Ability of Some Bacteria to Degrade BTEX and Hexadecane Under Oxic Conditions

David Adetitun, Olayemi, A. B., Kolawole O. M. and Babu Fathepure

Oklahoma State University
Department of Microbiology and Molecular Genetics
Subject Area: Biological Sciences

Petroleum contamination is caused accidentally but keep recurring due to the need for oil and gas in all segments of society and everyday life. Chemical degradation of these pollutants leaves cancer-causing compounds behind but microbial degradation does not. 21 bacteria were isolated from kerosene and gasoline artificially contaminated soil separately. This was done to determine the bacterium that will be able to thrive in the presence of the hydrocarbons. The ultimate goal of this work is to use bacteria to cleanup kerosene and gasoline-contaminated soil for agricultural purposes. The 21 bacteria were grown on media with kerosene and gasoline as carbon sources and they grew well when optical density, pH and total viable count were used as indicators. 5 bacterial species that showed better growth on kerosene and gasoline were selected for further studies. These 5 isolates were tested for their ability to degrade aromatic compounds such as benzene, toluene, ethylbenzene and xylene (BTEX). These isolates were also tested for their ability to grow on hexadecane as the sole carbon source. Degradation of BTEX was monitored using gas-chromatograph and utilization of hexadecane was measured by colony counts on plates. Molecular tools will be used to identify these isolates.

Seismic ground roll de-noising using the Redundant Lifting Scheme

Afshin Aghayan, Priyank Jaiswal

Oklahoma State University
School of Geology
Subject Area: Physical Sciences Technology

Separating linear coherent noise, such as ground roll from reflection waves, remains a key challenge in seismic data processing. By adapting the Redundant Lifting Scheme (RLS), which is wavelet transform method, to seismic data we show how the wavelet domain can be used to suppress ground roll. RLS operates on a trace-by-trace basis. It decomposes a trace into multiple wavelet-coefficients (WC) time series and consequently a single gather into a series of WC sub-gathers. The decomposition changes the relative magnitude of WC of various phases (reflection, head wave, ground roll, etc.) from one sub-gather to another without effecting their positions. In sub-gather(s) where the WC of undesired phases are significantly stronger than the desired phases, they can be surgically muted. Selective muting in carefully chosen sub-gathers attenuate undesired phases while having minimal effect on frequency spectra of the desired phases. Results show that the biggest advantage of the proposed RLS based de-noising method is that it has minimal effects on the lower end of signal frequency spectra. The proposed method could be as a valuable tool in a processor’s toolbox when data preconditioning for advanced processing such as waveform inversion, which benefits from low-frequencies, is desired.

Carbon Nanotube Based Bucky Paper Electrodes for Enzyme Electrocatalysis

Mayowa Akinwale, Roberto Montealegre, Charuksha Walgama and Sadagopan Krishnan

Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

Conductive nanomaterials are emerging as attractive platforms for various electrocatalytic applications. The superior electronic properties and large surface area of such nanomaterials gained significant attention in developing enzyme electrocatalytic and biosensing systems. In this study, we have prepared and characterized multiwalled carbon nanotube based “flexible” bucky papers for enzyme electrocatalysis. We have prepared bucky papers with different thicknesses ranging from 80 to 400 μM using the vacuum
filtration method. They are characterized by microscopy and electrochemistry for surface morphology and for electrochemical properties including conductivity and capacitance. These bucky papers are further immobilized with metalloproteins to perform direct oxygen reduction without any redox mediators. Our findings on this project will be presented.

Capillary Electrokinetic Chromatography of Neutral and Charged Species Using Functionalized Carbon Nanotubes Pseudo-Stationary Phases

Sarah Alharthi
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

Functionalized multiwalled carbon nanotubes (MWCNTs) exhibit unique chemical and physical properties that enhance separation in capillary electrokinetic chromatography (EKC). In this investigation, MWCNTs have been functionalized with hydroxyl, carboxylic and sulfonic groups and evaluated over a wide range of electrolyte composition with various neutral and charged species, e.g., alkylbenzenes, phenylalkyl alcohols, dansyl amino acids, barbiturates, urea herbicides and some aromatics. Functionalized CNTs have been characterized by spectroscopic methods. In all cases, the results on the functionalized MWCNTs were compared to those obtained on unmodified MWCNTs in the presence of SDS in the running electrolyte. The ratio of MWCNTs to SDS affected the investigated electrokinetic systems in terms of migration time window and resolution. Plots of log k’ of the same solutes on the various MWCNTs were used to evaluate the retention energetics and the hydrophobic phase ratios. While the various MWCNTs showed homoenergetic retention behaviors, they differed in terms of their hydrophobicity with the sulfonated ones being the least hydrophobic toward all solutes examined. The migration time window of the functionalized MWCNTs was quite wide allowing the separation of the various neutral and charged species with high selectivity and resolution, and yielded a plate count as high as 184,000 plates/m.

Characterizing the role of beef reducing activity to better understand premature browning

Oklahoma State University
Department of Animal Science
Subject Area: Whiteman Award Presentation

Premature browning (PMB) is a condition wherein meat will have a fully cooked brown color before reaching the USDA recommended cooking temperature to ensure elimination of pathogenic bacteria. It has been estimated that about 47% of ground beef is susceptible to PMB and it is a major food safety concern. The mechanism of premature browning is not clear. The objective was to characterize the role of reducing activity of ground beef in premature browning. Ground beef patties were packaged in high-oxygen (HiOX) or vacuum (VP), cooked to 65.5 or 71.1°C, and reducing activity was measured. The data were analyzed using the Mixed Procedure of SAS (n = 6 replications).

The results indicated that reducing activity of ground beef was dependent on temperature and packaging (P<0.05). Vacuum packaged patties had greater reducing activity and were less prone to PMB. Developing strategies to increase reducing activity can limit the incidence of premature browning.
What Bait Are You Using?: Bait Type Influences the Effectiveness of Trapping for Carrion Beetles

Theresa Andrew, W. Wyatt Hoback, Phillip G. Mulder, Andrine A. Shufran
Oklahoma State University
Department of Entomology and Plant Pathology
Subject Area: Biological Sciences

Carrion beetles (Coleoptera: Silphidae) utilize vertebrate carcasses for feeding and reproduction. These beetles find carcasses using chemoreceptors located on their antennae which detect volatiles released during decomposition. Surveyors for carrion beetles, including the federally endangered American burying beetle, *Nicrophorus americanus*, utilize various bait types ranging from whole laboratory rats to pieces of chicken that are rotted at warm temperatures for several days. Environmental variability is likely to compound differences among bait types leading to inconsistency of rotten bait which likely has substantial effects on survey outcomes. In this study, we compared capture rates for whole rotten baits against commercially available stink baits, a commercially available chemical, cadaverine, and other rotten animal products. Sampling occurred from July 7-23, 2015 near Oshkosh, NE, and 16,748 Silphid beetles were captured. From these results, rotten carrion was best, with chicken drumsticks and tuna fish capturing significantly more beetles than a whole rotten mouse. Captures utilizing artificial bait and chemical compounds were documented in lesser amounts. These results showcase the importance of standardized sampling methods for population estimate studies and conservation.

Structure-Function Studies of CupA Protein from NDH-13 Complex of *Synechocystis* sp. PCC6803

Juliana Artier, Steven C. Holland, Minquan Zhang, Robert L. Burnap
Oklahoma State University
Department of Microbiology and Molecular Genetics
Subject Area: Biological Sciences

Cyanobacteria are aquatic photosynthetic organisms that have evolved different mechanisms to thrive in diverse environments. In aquatic environments, inorganic carbon (C_i) is present as dissolved CO_2 and bicarbonate (HCO_3^-). *Synechocystis* sp. has five C_i concentrating systems responsible for increasing C_i concentration inside of the cell: three HCO_3^- transporters and two CO_2 uptake systems. High CO_2 concentrations are required for RuBisCO activity during carbon fixation in the photosynthetic Calvin cycle. Moreover, CO_2 uptake systems might avoid loss of internal CO_2 due to leakage of acquired C_i to the environment. These systems are specialized NDH-1 complexes, NDH-1_3 (NdhF3/NdhD3/CupA/CupS) and NDH-1_4 (NdhF4/NdhD4/CupB), which have very little known about their mechanism. Mutants lacking one of these proteins present impaired CO_2 uptake. We constructed knock out mutants of the whole operon and later complemented with an ectopic overexpressing system under RuBisCO promoter control. Physiological analysis of these mutants, by Chlorophyll fluorescence and O_2 evolution driven by bicarbonate, show a high C_i requirement feature, but the complementation strain seems to have a phenotype similar to wild-type. Future studies will be directed to analyze mutants with point mutations on His/Cys of CupA protein to evaluate its possible carbonic anhydrase activity. This study will help to elucidate structure-function relationships of these special NDH-1 systems.

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A Differential Single-Port 8T SRAM Bitcell for Variability Tolerance and Low Voltage Operation

Samira Ataei, James E. Stine
Oklahoma State University
School of Electrical and Computer Engineering
Subject Area: Physical Sciences Technology

A novel single-port, fully differential 8-transistor (8T) SRAM bitcell that is tolerant to process variations and suitable for low-power operation is proposed in this paper. At 500mV supply voltage, the proposed 8T bitcell achieves 44% and 46% improvement in read Static Noise Margin (SNM) and Write Noise Margin (WNM), respectively, compared to the 6-Transistor (6T) bitcell. This 8T bitcell shows process variation tolerance, which results in tight SNM and WNM distributions. It utilizes a differential operation, single read/write port and one wordline (WL), therefore, does not cause any changes in 6T SRAM architecture and can be used in current 6T memory compilers. The proposed 8T bitcell operates at a 500 mV supply voltage with 130 mV SNM and 220 mV WNM. Simulation results with an IBM cmos10lpe 65nm technology show this bitcell retains data at voltages down to 300 mV.

Uninformed-to-Informed Exploration in Real-World Environments

Allan Axelrod, Allan M. Axelrod, Girish V. Chowdhary
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

The explore-exploit dilemma, i.e., when it is best to explore (learn) or exploit (optimize) in the presence of uncertainty, is a problem of critical interest in many machine learning architectures, including Bandit and Reinforcement learning problems. Exploration policies can be classified as either uninformed or informed, where the latter uses information-theoretic samples to direct exploration. Machine learning and biology literature indicates that an informed policy leads to sample-efficient learning. However, an informed policy learns inefficiently for extended durations if it has insufficient prior information. Hence, we theoretically derive an exposure bound for qualifying guarantees on informed exploration in real-world datasets. Once the exposure bound satisfies some quality threshold, informed exploration approaches may then engage in sample-efficient learning. Until the exposure bound satisfies some quality threshold, uninformed exploration is our only feasible exploration policy. As a result, we have designed an uninformed-to-informed exploration policy which initializes using an uninformed exploration policy and then switches to informed exploration when the exposure bound satisfies some quality threshold. Our uninformed-to-informed exploration significantly outperforms a variety of other exploration policies in simulated and real-world dataset experiments.

Energy Requirements of Lactating Beef Cows in a Drylot System

Corbit Bayliff, Miles Redden, Jarod Cole, Adam McGee, Ryan Reuter, Gerald Horn, David Lalman
Oklahoma State University
Department of Animal Science
Subject Area: Whiteman Award Presentation

Population growth and alternative use of agricultural lands continues at an alarming rate, posing many challenges for meat-animal producers. Limited grazing land availability and excess feedyard capacity are among the factors that have stimulated interest in the expansion of confinement systems for beef production. The purpose of this research is to define cow and calf responses to a range of feed intakes and resulting energy provided to the cows. A total of 40 lactating beef cows were fed 114, 136, 156, 176, and 194 kcal NEm·(kg BW0.75)-1·hd-1·d-1 for 111 d until weaning. Steer calves were offered the same ration ad libitum along with milk. Monthly cow and calf BW, cow BCS and milk yield were regressed on date, and the mean
of the linear regression coefficients of animals within an energy intake was then regressed on energy intake. For each additional kcal NEm (kg BW\(^{0.75}\) y\(^{-1}\) · d\(^{-1}\) · d\(^{-1}\)) fed to cows, cows gained an additional 0.583 kg/100 d (P<0.01) or 0.015 BCS units/100 d (P<0.01). Calf weight gain also increased with increasing cow energy intake (P=0.013). In the range of these data, additional energy supplied to the cows resulted in linear increases in cow BW, BCS, milk yield, and calf BW.

**Chronic predation risk canalizes individual tadpole activity levels**

**Lynne Beaty, Barney Luttbeg**

Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Predation risk can have dramatic effects on ecological and evolutionary processes by inducing phenotypic changes (i.e., phenotypic plasticity) in prey. Prey responses to predation risk, however, are not infinitely plastic. Moreover, individuals often consistently differ in their behavioral responses to predation risk, resulting in the classification of distinct behavioral types. Since the widespread discovery of consistent individual differences and their potential adaptive value in buffering species against environmental fluctuations, many studies have sought to determine the proximate mechanisms underlying these differences. We tested the influence of experience with predation risk on the formation and maintenance of consistent behavioral differences between individual tadpoles. We reared Blanchard’s cricket frog (**Acris blanchardi**) tadpoles in the presence and absence of predation risk and repeatedly recorded their activity levels, morphology, and developmental stage. While we found no difference in mean activity levels nor evidence for behavioral types in tadpoles reared in either control or predator treatments, we did find that individual tadpoles reared in predation risk exhibited significantly more repeatable activity levels relative to control tadpoles. We discuss the implications of this behavioral canalization for predator-prey interactions and individual variation.

**Re-usability of Organic Sanitizers in Reducing Escherichia coli O157:H7 on Organic Leafy Greens**

**Justin Brooks, Divya Jaroni**

Oklahoma State University
Department of Animal Science
Subject Area: Whiteman Award Presentation

In recent years, organic leafy-greens have been implicated in foodborne illness outbreaks related to *Escherichia coli* O157:H7. Approved antimicrobials for organic produce are limited, resulting in investigations into natural alternatives. Plant-derived essential oils (EO) and organic acids have proven to be effective against *E. coli* O157:H7. Flume-tank washing of organic greens is a common practice where antimicrobial wash water is re-used multiple times. Therefore it is important to evaluate the re-usability of antimicrobials during this process. Oregano EO, cinnamon EO, carvacrol, cinnamaldehyde, and fulvic acid were evaluated for their reusability in washing organic leafy greens. The greens were inoculated with *E. coli* O157:H7. Each antimicrobial treatment was used five times to wash separate batches of inoculated leafy greens which were then stored at 4°C. Surviving *E. coli* O157:H7 were enumerated after each wash and also on days 0, 1, and 3 of leafy greens storage. Throughout five washes all selected antimicrobials showed significant (P < 0.05) reduction of *E. coli* O157:H7. Wash water resulting from the antimicrobial treatments did not show any growth of *E. coli* O157:H7. This study provides evidence that the tested antimicrobials could be re-used multiple times for washing organic leafy greens without losing their antimicrobial activity.
DFT Study of the Dissociative Adsorption of Chloro- and Dichlorobenzene on the Si(100) Surface

Eric Butson, Qing Zhu, Nicholas F. Materer
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

The dissociative adsorption of chlorobenzene and dichlorobenzene on Si(100) surface was modeled using density functional theory. A double and triple dimer cluster was used to represent the (100) face of silicon. Initial adsorption occurs by breaking one double bond on the phenyl ring and forming two new carbon-silicon bonds with the silicon dimer. For further dissociation to occur, the system must undergo a spin crossing process from the singlet electronic configuration to a higher energy triplet state. After this spin crossing event, the chlorine can then bond to the silicon surface. The possible mechanisms of dissociation are explored for both chlorobenzene and dichlorobenzene. The proposed mechanism suggest that chlorobenzene adsorbs on a dimer row, while dichlorobenzene adsorbs in between dimer rows. The minimum energy crossing point for the spin crossing is found by minimizing the energy gradients between the two electronic states. The probability of spin crossing at the minimum energy crossing point is calculated, and the activation energy for the process is determined. It is found that the activation energies for the spin crossings are small in comparison to the other steps in the proposed mechanisms.

Mechanism of yeast N-glycosylation: Structural characterization of Ost4p and its mutant

Bharat Chaudhary
Oklahoma State University
Department of Chemistry
Subject Area: Biological Sciences

N-linked glycosylation of proteins is an essential and highly conserved co-translational protein modification reaction that occurs in all eukaryotes. The enzyme that carries out this reaction is called oligosaccharyltransferase (OST). In this reaction, OST modifies the side chain of a specific Asparagine residue with a carbohydrate group in nascent proteins. Genetic defects cause a series of disorders that includes but not limited to mental retardation, developmental delay, hypoglycemia etc. Complete loss of N-glycosylation is lethal in all organisms. In yeast, OST consists of nine subunits. OST4p is the smallest subunit. Mutation of Valine (V) at position 23 to Aspartate (D) causes defects in N-glycosylation of proteins. To understand the structure, function and role of Ost4p in this reaction, we are characterizing Ost4p and its mutant by high-resolution solution NMR and circular dichroism (CD) studies. To this end, we have overexpressed, purified 15N, 13C-labeled Ost4p and the mutant OST4p (V23D), and reconstituted in membrane mimetic. The assignments of Ost4p using 3-dimensional NMR, and the preliminary structure calculated will be presented. The 2D {1H, 15N} HSQC spectrum of mutant OST4p (V23D) is significantly different from that of the wild-type suggesting that the mutant has a completely different conformation than the wild-type protein.

First-order superfluid to Mott-insulator phase transitions in spinor condensates

Oklahoma State University
Department of Physics
Subject Area: Physical Sciences Technology

We observe evidence of first-order superfluid to Mott-insulator quantum phase transitions in a lattice-confined antiferromagenic spinor Bose-Einstein condensate. The observed signatures include hysteresis effect and significant heatings across the phase transitions. The nature of the phase transitions is found to strongly depend on the ratio of the quadratic Zeeman energy to the spin-dependent interaction. Our
Common beans, cowpeas, and global nutrition security: Assessing alternative farm inputs and symbiotic soil microbes as the future of agriculture

Adam Cobb and Gail W.T. Wilson  
Oklahoma State University  
Department of Natural Resource Ecology and Management  
Subject Area: Biological Sciences

In addition to directly assisting plant uptake of nutrients and water, AM fungi help build organic carbon in the soil and reduce loss of soil fertility. In our first experiment, 4 common bean and cowpea genotypes were grown in local low nutrient soil with additions of worm compost or commercial fertilizers (along with mycorrhizal and non-mycorrhizal controls). The worm compost treatment resulted in productivity and nutritional quality (protein, minerals) similar to the commercial fertilizer treatment while significantly outperforming the non-amended control for all genotypes. One cowpea genotype supported increased AM fungal root colonization across all treatments. For our second study, we assessed the selected cowpea genotype grown with 10 different input treatments (combinations of biochar, worm compost, and fertilizers). Biochar had a significant effect – increasing total AM fungal root colonization as compared to other treatments. Additionally, blends of biochar and worm compost combined with reduced fertilizer rates produced similar amounts of biomass with similar tissue quality to the full fertilizer rate treatments. This indicates greater fertilizer use efficiency resulted from application of these alternative inputs. For the future of global sustainable agriculture, it is critical to optimize farm fertility inputs and the interaction of crops with mutualistic soil microbes.

Reasons for Living Buffers the Relationship Between Perceived Burdensomeness and Suicide Ideation for Ethnic Minority People

Ashley Cole, LaRicka R. Wingate, Ph.D.  
Oklahoma State University  
Department of Psychology  
Subject Area: Social Sciences

Previous suicide research among ethnic minority members has largely focused on risk factors; however, it may be just as important to study resilience factors. Reasons for living is a resilience factor that emphasizes human strength and well-being, and it has been found to be negatively related to suicide ideation. Perceived burdensomeness, defined as perceptions of being a burden on others, is an interpersonal component and risk factor from the Interpersonal Theory of Suicide. This study examined whether reasons for living would buffer the relationship between perceived burdensomeness and suicide ideation in a sample of ethnic minority members. Participants included 74 college students who self-identified as ethnic minority members, including African American/Black (29.3%), American Indian (24.0%), Hispanic/Latino (17.3%), Asian/Asian American (14.7%), Biracial (8.0%), and Other (6.7). Participants’ ages ranged from 18 to 32 (M = 19.12), and were majority female (77.3%), and heterosexual (94.7%). They completed online measures of reasons for living, perceived burdensomeness and suicide ideation. Results indicated that the moderation model was significant. This finding suggests that ethnic minority people who are able to identify reasons for living may be less vulnerable to thoughts of suicide even if they experience perceptions of being a burden.
Gentrification, Social Disorganization, & Delinquency
Stanley Collins, Stanley J Collins
Oklahoma State University
Department of Sociology
Subject Area: Social Sciences

Gentrification, the dramatic shift in the demographic composition of urban neighborhoods toward better-educated, more affluent, and typically younger residents and middle- to upper-income households, has become a hot-button word in both policy and academic discussions. Those on the policy end of the spectrum largely see the process as a benefit, as it has been shown to increase the tax base, improve the physical condition of urban communities, and reduce urban sprawl, amongst other things. Conversely, those in academic circles have been largely skeptical of the process, challenging its ability to do the aforementioned things and identifying negative impacts on existing urban neighborhoods. Missing from the story of disorganization and gentrification is the narrative of youth that are reared in these communities, and what affects these processes have on their development and potential delinquent outcomes. To address this gap in the research, the goal of this study is to test the relative impact gentrification has on youth using data from the Project of Human Development in Chicago Neighborhoods (PHDCN).

A Fiberless Adenovirus Gene Vector for Delivering the GFP Reporter Gene
Anna Condacse
Oklahoma State University
Department of Chemical Engineering
Subject Area: Biomedical Sciences

Adenovirus is widely used as a vector for gene therapy and vaccine delivery due to its ability to achieve high transduction efficiency and high levels of gene expression. An adenovirus vector that lacks the virus fiber protein had previously been engineered. When complexed with polymers, the fiberless adenovirus produces nanoparticles capable of delivering genes with reduced immunogenicity and flexible cell targeting. In this study, a homologous recombination technique is used to produce a fiberless adenovirus which packages a reporter gene for green fluorescent protein (GFP). The incorporated GFP will allow for quantitative analysis of the vector’s infectivity to the targeted cells, as well as the study of the cellular trafficking and nuclear entry of the vectors. The GFP is first cloned into a shuttle vector. The resultant plasmid is linearized by restriction endonuclease, Pmel, and then is cotransformed into DH10B electrocompetent cells with an adenoviral backbone plasmid. The linearized recombinants that are selected for kanamycin resistance are then transfected into HEK293 cells to produce the fiberless adenovirus packaging the GFP. The vector is tracked via fluorescence microscopy and flow cytometry. Through this analysis, the limiting steps can be identified and provide insight to how the vector can be improved.

Montmorency Tart Cherry Prevents Gut Mucosal Immune Changes Associated with Ovarian Hormone Deficiency
Erica Crockett, Jennifer L. Graef, Ping Ouyang, Stephen L. Clarke, Edralin A. Lucas, Brenda J. Smith
Oklahoma State University
Department of Nutritional Sciences
Subject Area: Biomedical Sciences

Postmenopausal women are at risk for diseases linked to dysregulated immunity. Foods rich in phenolic compounds (e.g., tart cherries) provide a means of countering the effects of estrogen deficiency due to their immunomodulating properties and proximity to gut-associated lymphoid tissues (GALT). This study investigated the effects of cherry consumption on gut mucosal immunity in an animal model of estrogen deficiency. Five-month-old C57BL/6 female mice (n=10/group) were sham-operated (Sham) or ovariectomized (OVX) and assigned to a dietary group consisting of control or control diet supplemented
with tart cherry powder (5% w/w). Following 28 days of treatment, the colonic lamina propria was isolated and RT-PCR was performed to assess the abundance of inflammatory mediators. Gene expression of interferon (IFN)-γ was upregulated with OVX (P<0.05), and cherry supplementation restored IFN-γ expression to that of SHAM. Tumor necrosis factor (TNF)-α tended to be increased (P=0.0526) in the OVX group compared to the SHAM group, and cherry supplementation normalized this response. The OVX-induced suppression (P<0.05) of interleukin (IL)-10 was restored in the cherry group compared to the SHAM. These data show that estrogen deficiency promotes a pro-inflammatory environment within GALT and the consumption of tart cherries provides a means of countering these responses.

Toxicity of Pyraclostrobin Fungicides to Terrestrial Amphibians

Joseph Cusac, William H. Mimbs IV, Shane A. Morrison, Jason B. Belden, Loren M. Smith, Scott T. McMurry

Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Previous studies suggest that pyraclostrobin-based fungicides (e.g., Headline® fungicide, BASF) are toxic to amphibians at environmentally relevant concentrations. These studies mimicked worst – case direct exposures, but amphibians may also be exposed to fungicides through previously sprayed soil and consuming contaminated prey. Further, it is unknown how toxicity compares among multiple species of amphibian. We investigated the toxicity of Headline® and Headline AMP® fungicides to *Acris Blanchardi* via direct overspray, and measured body residues of fungicide active ingredients. Additionally, we investigated the toxicity of Headline AMP® to juvenile *Anaxyrus Cognatus* through direct spray, through previously sprayed soils (from Texas and Nebraska, USA), and by dietary exposure. Direct overspray with Headline® and Headline AMP® was toxic to *A. Blanchardi* (LC₅₀ = 2.1 and 1.7 μg a.i./cm², respectively), but body residues of fungicide active ingredients were generally low. Exposures of *A. Cognatus* to Headline AMP® via direct spray and previously treated TX and NE soils caused significant toxicity (LC₅₀ = 2.4, 3.34 and 3.61 μg a.i./cm², respectively), but at environmentally unrealistic concentrations. Dietary exposure to the fungicide did not cause observable toxicity. Therefore, routine application of Headline® and Headline AMP® may be a threat to some cropland amphibians, depending on the exposure scenario.

Optimization of the Interaction Between a Novel Drug Delivery System and Human Primary Lung Epithelial Cells

Rachel Davis

Oklahoma State University
Department of Chemical Engineering
Subject Area: Biomedical Sciences

Nanoparticle technology has become an area of high interest in the biomedical research community, with an emphasis on drug delivery to various areas of the body, including the lung. Though work has been done to investigate the ability of nanoparticles to deliver drug effectively, little work has been done to investigate any negative effects these particles might have in the lung, especially in conjunction with lung infections. The objective of this study is to investigate the effect of poly(lactic-co-glycolic acid) (PLGA) nanoparticles on the increased susceptibility of human primary small airway epithelial cells (SAECs) to a mildly virulent influenza A virus strain (strain H3N2). SAECs were grown on Transwell inserts and treated 1) simultaneously with PLGA nanoparticles and H3N2; 2) with PLGA nanoparticles, followed by H3N2; 3) with only PLGA nanoparticles; and 4) with only H3N2. Naïve SAECs were used as a negative control group. Analyses include the permeability of the SAEC layer by transepithelial electrical resistance; viability of the SAECs through a fluorescent assay that measures the metabolic activity, viral binding to the SAECs by immunofluorescence and microscopy; and the expression of pro-inflammatory markers such as IL-6 and TNF-α, by ELISA. Work on this project is still ongoing.
The Influence of Urbanization on Monarch-Parasite Interactions

Kelsey Deal, Kristen Baum
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Urbanization affects ecosystems around the world, leading to habitat loss, fragmentation, and degradation. Altered landscapes can influence the interactions between host organisms and their parasites by changing the distribution and abundance of habitat resources. Monarch butterflies (Danaus plexippus) rely exclusively on milkweeds as a host plant, and can be infected with several parasites, providing an opportunity to evaluate these interactions. The objectives of this study were to compare parasitism rates to landscape context and host plant density. Experimental plots were established at garden sites around Stillwater, Oklahoma and sites were monitored for monarch larvae at least once a week during the fall (mid-August through October) of 2015. To quantify parasitism rates, 4th and 5th instar monarch caterpillars were collected and reared individually in the lab. Late instar monarch caterpillars occurred at more than 84.6% of our sites, and either OE or tachinid fly parasitism was observed at 90.9% of these sites. The percentage of urban land cover types at each site influenced the overall parasitism rate. Examining how additional landscape characteristics and environmental factors influence monarch-milkweed-parasite interactions will provide insights into the contribution of urban areas to supporting the monarch population, with important implications for urban wildlife ecology and conservation.

Creation of an Advanced Three-dimensional Tissue Model for the Generation of Mast Cells from Progenitor Cells

Mina Derakhshan, Rudra Bhowmick, Heather Gappa-Fahlenkamp
Oklahoma State University
Department of Chemical Engineering
Subject Area: Biomedical Sciences

Allergy is the overreaction of the immune system to foreign substances. Release of preformed mediators and expression of diverse molecules have placed mast cells (MCs) among the foremost inducers of allergic responses. Due to difficulties in isolation of MCs from human tissue, the objective of this work is to generate mature MCs within an in vitro tissue model that provides an in vivo-like environment. MC progenitors, isolated from human peripheral blood, and human primary fibroblasts were cultured in a collagen matrix to represent the connective tissue. In order to mimic the basal lamina and capillary wall, the matrix was coated with fibronectin and human primary endothelial cells, respectively. Samples were incubated for seven weeks to allow for differentiation of progenitors. The progenitor-derived cells demonstrated MC characteristics, including typical MC morphology and expression of cytoplasmic granules, as determined by metachromatic staining and immunocytochemistry. Also, the generated cells expressed MC phenotypic markers, c-kit and FcεRI. After FcεRI activation by myeloma IgE and anti-IgE antibodies, the generated MCs released their histamine content, showing typical MC functional phenotype in an immediate-type allergenic response. Our tissue model will be used to determine the major immune response events that are difficult to study in vivo.

The role of neuroticism within the Emotional Cascade Model of Borderline Personality Disorder

Hilary Deshong, Stephanie N. Mullins-Sweatt, Ph.D.
Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

The Emotional Cascade Model of Borderline Personality Disorder (BPD) suggests that emotional and behavioral dysregulation (e.g., alcohol misuse, binge eating) found in BPD is maintained through rumination
The purpose of the current study is to assess how trait neuroticism relates to varying types of rumination and maladaptive behaviors. It was hypothesized that high levels of neuroticism would predict higher levels of rumination (e.g., anger, sadness, interpersonal) and higher levels of maladaptive behaviors (e.g., having a one night stand, harming oneself). The current study predicts that neuroticism will positively relate to all maladaptive behaviors and to all rumination measures. Additionally, neuroticism, rumination, and maladaptive behaviors will be significantly related to the total score of BPD. A moderation analysis will be used to assess whether neuroticism moderates the relationship between rumination and maladaptive behaviors. The current study may provide evidence that individuals high in neuroticism are likely to engage in more maladaptive behaviors, regardless of how much they are ruminating. These results may indicate that the general personality trait neuroticism plays a role in how/if rumination leads one to engage in maladaptive behaviors.

Pattern Recognition Studies of Serum N-Linked Glycans obtained by MALDI-IMS-MS Profiling

Tao Ding
Oklahoma State University
Department of Chemistry
Subject Area: Biomedical Sciences

This research focused on identification and validation of altering N-linked glycan circulating biomarkers collected from MALDI-IMS-MS and analyzed by pattern recognition techniques for in-vitro diagnoses to screen population at risk for esophageal adenocarcinoma (EAC). 58 serum samples from patients diagnosed with Barrett’s esophagus (BE), high-grade dysplasia (HGD), EAC and from normal controls (NC) were analyzed by MALDI-IMS-MS. The training set consisted of 90 spectra from known phenotypes and the validation set was comprised of 26 blinds. Nine N-linked glycans generated by MALDI-IMS-MS were investigated as potential cancer biomarkers. A classifier developed using principle component analysis allowed for the correct phenotype prediction of 20 of the 26 blinds. To improve prediction accuracy, preprocessing of the mass spectral data using the Symlet 6 wavelet was undertaken and wavelet coefficients selected by a genetic algorithm for pattern recognition analysis was able to correctly classify 25 of the 26 blinds. A cross-correlation library searching algorithm was also used to analyze this data set, and the top hit was correct for 23 of the 26 blinds. These studies and many more not described here confirm that this set of mass spectra contain a wealth of information relevant to differentiating the various disease states associated with esophageal cancer.

Analyses of Petrophysical Properties of Carbonate Rocks Subjected to the Injection of hydraulic fracking wastewater

Pouyan Ebrahimi, Javier Vilcaez
Oklahoma State University
School of Geology
Subject Area: Physical Sciences Technology

The Arbuckle formation, located in the State of Oklahoma, is mainly composed of dolomite and carbonate minerals. Some highly porous regions in the Arbuckle formation are used to dispose hydraulic fracking wastewater (HFW) produced from hydrocarbon production operations.

High reactivity of carbonate and dolomite minerals arises the question of whether or not petrophysical properties of the Arbuckle formation such as porosity and permeability are being changed due to the dissolution and precipitation of minerals induced by injection of HFW. Predicting degree of these changes will provide us with the opportunity to design optimum injection schemes and assess chemical and physical fates of the injected HFW.

The main goal of this research is to explore the impact of HFW injection on petrophysical and chemical properties of the Arbuckle formation by core flood experiments and other laboratory measurements such as
XRD, Micro-CT scan (micro-CT), Porosimeter, and so on. In addition, this research will help us to predict the chemical and physical fates of the injected HFW using numerical computational methods.

**Fractal Graph Analysis and Sector Dimensioning**

*Todd Edmonds, Mario Borunda*

Oklahoma State University  
Department of Physics  
Subject Area: Physical Sciences Technology

Abundance of interest in the stock market has resulted in a plethora of research avenues to analyze, speculate and predict its movement. Quantitative research in recent years has surged to become staple in stock and sector analysis. Through fractal decomposition and overlay, computer analysis can show the behavior of specific stocks, sectors, and other openly traded financial instruments in relation to conditions of the world economy as they evolve.

The purpose of this research avenue is to identify a fractal dimensioning method to accurately describe the stock exchange and its subsidiaries to create ratios and other representative measures to better hedge and handle risk.

**An evaluation of tornado siren coverage in Stillwater, Oklahoma: Optimal GIS methods for a spatially explicit interpretation**

*Emily Ellis, Adam Mathews*

Oklahoma State University  
Department of Geography  
Subject Area: Social Sciences

Severe weather occurrences, especially tornadoes, are costly to communities in terms of loss of life and property damage. Cities located within Tornado Alley are especially at risk of being affected by tornadic activity and thus have a pressing need for a warning system. The use of strategically-placed outdoor tornado sirens is a common approach to notify residents of approaching severe weather. However, it remains difficult to ensure complete coverage (i.e. every resident within an audible distance of a siren) of such a system within a city. This study uses two distinct GIS-based methodological approaches using U.S. Census population data and siren locations to assess the extent city residents are safeguarded by the existing tornado siren network in Stillwater, Oklahoma. The first approach utilizes spatially unaltered (aggregated) census data whereas the second approach proposes a disaggregation technique incorporating building polygons to improve the spatial detail. The first approach revealed that 26% of city residents are not covered by the siren network, whereas the second approach estimated that only 4% are not covered. The second approach provided a more precise account of Stillwater’s vulnerable population due to its spatially explicit nature.

**Effect of aspect ratio of gold nanorods on cellular uptake**

*Deshani Fernando, Yolanda Vasquez*

Oklahoma State University  
Department of Chemistry  
Subject Area: Biomedical Sciences

Nano-sized materials have been increasingly used in the medical field to improve the target efficiency of drugs. Among many nano-sized materials, gold nanorods (Au NRs) have received broad attention due to their tunable surface plasmonic resonances that provide ways to manipulate electromagnetic field at nanoscale depending on the aspect ratio of the Au NRs. These properties make them highly attractive candidates for biomedical applications such as drug and gene delivery, biological imaging and cancer treatment. However, an understanding of the interactions between Au NRs and biological systems is of
significant interest. Therefore, in this study Au NRs of different aspect ratios (AR) varying from 2.5 to 11 is prepared using the growth-directing surfactant, cetyltrimethylammonium bromide (CTAB). Cellular uptake studies of CTAB-capped nanorods with HeLa cells, revealed an extremely large uptake for AR 11. This was further confirmed by the uptake studies done with mPEG coated Au NRs. The number of NRs taken up per cell, for the different aspect ratios, is quantified by ICP. TEM analysis also revealed the presence of gold nanorods in late-endosomes and cellular plasma. Zeta potential analysis and FTIR analysis was used to characterize the Au NR to understand the surface properties.

The Relationship Between Auxin Production Capacity by Rhizobacteria and Wheat Biomass

Alimamy Fornah, Michael Anderson

Oklahoma State University
Department of Plant and Soil Sciences
Subject Area: Biological Sciences

The plant hormone auxin is known to be involved in growth responses in plants. Bacteria also produce auxin for some unknown reason. In this work we seek to better understand the role of auxin produced by rhizobacteria on plant growth. A total of 4320 individual bacteria were isolated and auxin concentration was measured using a spectrophotometer at 540 nm. In a separate experiment using 576 randomly selected rhizobacteria auxin production capacity and cell growth in culture was measured over a 4 day period at 540 nm and 595 nm spectrophotometrically, respectively. There was a high correlation ($R^2 = 0.94$) between cell growth and auxin production capacity in both large and small growing colonies indicating a strong relationship between bacteria cell growth and auxin production. Examining the correlation between auxin production capacity and biomass productivity was in most cases negative and non-significant, except for large colony bacteria in the endorhizosphere of the Teller fine sandy loam soils, which was negative and significant ($p$ value $\leq 0.0148$). Large colonies from both soils produced (33%) significantly higher average auxin concentrations ($p$ value $\leq 0.005$) than small colonies. The result suggests that auxin production capacity by bacteria is not related to plant growth promotion.

The Ecology of Coyotes (Canis latrans) in Relation to Energy Development & Prescribed Burns

Shelby Fraser, Dr. Fuhlendorf, Dr. Fairbanks, Dr. Elmore

Oklahoma State University
Department of Natural Resource Ecology and Management
Subject Area: Biological Sciences

Due to the extirpation of many large, native carnivores the coyote has become one of the most widespread and successful predators in North America. They are now considered apex predators in many ecosystems. For this reason, it is important to understand how they respond to natural and anthropogenic disturbances. For this study, ten coyotes were captured, fitted with GPS collars, and monitored for 18 months. By using GIS data from The Nature Conservancy and GPS data from the collars we are assessing how coyote movements and use of habitat are affected by energy development and prescribed fires in the Tallgrass Prairie Preserve (TPP). Based on preliminary data, it is clear coyotes select for vegetation type, and have significantly smaller home ranges in the TPP than in other similar studies. They also appear alter their activity patterns based on anthropogenic pressures. Coyotes are generalist predators and have successfully adapted to increasing human expansion, so it is likely that the coyotes in this study may not alter their behavior after natural and anthropogenic disturbances.
The role of worry on the habituation of the startle response to neutral stimuli

Kristen Frosio, William V. Lechner, Evan J. White, Adam C. Mills, Danielle L. Taylor, Matt R. Judah, & DeMond M. Grant

Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Pathological worry is central to Generalized Anxiety Disorder (Barlow, 2000). Recent literature suggests that worry is employed to maintain sustained negative emotions in order to avoid negative shifts in arousal (Newman & Llera, 2011). Though startle reflex has generated a lot of interest in its linear relationship with emotional valence, little research has examined whether negative affective states can predict startle habituation. It was hypothesized that worry would be associated with slower rates of habituation. It also was hypothesized that this relationship would remain while controlling for related symptoms.

Forty-four participants high and low in pathological worry as measured by the Penn State Worry Questionnaire (PSWQ: Meyer et al., 1990) completed four blocks of 12 trials involving a startle stimulus paired with emotionally valenced stimuli. The first 12 trials in block 1 were used to examine the rate of change in habituation.

Results indicated a significant negative correlation between worry and habituation ($r = -.41$), such that as worry increased, the rate of habituation decreased. When controlling for depressive and social anxiety symptoms, worry significantly predicted rate of habituation ($\beta = -.48$, $p = .005$). Depressive and social anxiety symptoms were not predictive of habituation rates.

Phylogenetic Incongruence in Begonia L.

Daniel Fuller, Mark Hughes, Peter Moonlight

Oklahoma State University
Department of Botany
Subject Area: Biological Sciences

The increased availability of DNA sequences has revolutionized the field of molecular phylogenetics. However, the increase in available data also increases the opportunity for statistically significant incongruence to affect multigenic phylogenies. The source of incongruence between phylogenies can vary from sampling error to systematic error to different evolutionary histories. *Begonia* is a mega-diverse genus of approximately 1800 species most of which are narrow endemics. Originating in Africa, *Begonia* has since dispersed throughout the tropics and undergone several rapid radiations making it an ideal study group for evolutionary botany. A previous framework phylogenetic study of *Begonia* has shown significant levels of incongruence between the mitochondrial and chloroplast datasets. Using Bayesian Inference methods, phylogenies of *Begonia* mitochondrial and chloroplast DNA were created using representative species from all major clades covering the entire pantropical range. The resulting phylogenies were compared and instances of well supported incongruence noted.

Simulation and Modeling of Metabolic Profiles in Drug Discovery

Carrie German, Dr. Sundar Madihally

Oklahoma State University
Department of Chemical Engineering
Subject Area: Biomedical Sciences

Discovering new therapeutic agents requires detailed analyses of efficiency and safety. Due to the liver’s vital role in drug metabolism, liver cells are grown outside the body, termed *in vitro*, for less invasive and less costly analysis. A number of cell lines and culturing systems are available for *in vitro* testing; however, systems capable of providing reproducible and reliable results similar to clinical data have yet to be discovered. As a result of inaccurate laboratory results, a high percentage of newly developed medical
treatments fail to pass clinical trials due to acute liver toxicity. My dissertation research focuses on filling in knowledge gaps in the current understanding of drug metabolism and the effect the surrounding environment can have on cell shape and function. I am using a two pronged approach involving computational fluid dynamics programming to increase understanding of molecular transport/distribution and reaction mechanisms in liver cell cultures, and experimentation to examine environmental effects such as dimensionality and number of cell types. The combination of these two approaches can be compared with clinical data for validation. Implementation of simulation and environmental optimization in the early phases of drug discovery will aide in decreasing costs and improving patient safety.

**Feasibility of Household Solar Panel and Wind Turbine**

Ahmad Ghaith, Francis Epplin, Robert Frazier  
Oklahoma State University  
Department of Agricultural Economics  
Subject Area: Physical Sciences Technology

Oklahoma households that purchase electricity from investor owned utilities, and install solar panels or a wind turbine system after 2015, are assessed additional fees, ostensibly to compensate for the infrastructure costs to send excess electricity safely from the household systems back to the grid. However, there is no compensation for excess electricity. The objective of the research is to determine the feasibility of solar panels and wind turbine systems for households in each of five locations and to determine the consequences of the surcharge. Twenty years of hourly weather data were obtained from five Oklahoma Mesonet locations. These data were used to determine average hourly solar radiation and wind speed for each month and location. Expected electricity output was determined for four commercially available systems. Simulated electricity consumption for each of the five locations was obtained from the Department of Energy. Differences between household requirements and production were computed to determine purchases from the grid. Net present value was computed for each alternative system for each grid rate structure available to Oklahoma households. None of the budgeted renewable systems are feasible at any of the locations. The average annual cost of the Oklahoma surcharge system is computed.

**Parental Knowledge Predicts Adolescent Delinquency, or Does It? An Examination of the Sleep Displacement Loophole**

Zachary Giano, Michael Merten, Tia Claybrook  
Oklahoma State University  
College of Human Sciences  
Subject Area: Social Sciences

Numerous studies have looked at parental knowledge as a predictor of adolescent delinquency. Less is understood however, regarding the specific context in which these risk factors are manifested. Sleeping in a place other than an individual’s primary residence can create a displaced sleeping arrangement. A gap exists in the literature regarding adolescents staying overnight at more than one place per week. We examined whether higher levels of sleep displacement in 91 adolescents in Tulsa were related to behavioral risk factors (e.g. substance abuse, antisocial behavior, etc…) when examined concomitantly.

Correlation analyses revealed that sleep displacement was positively associated with adolescent antisocial behavior ($r = .278$, $p < .05$), adolescent antisocial behavior with substance abuse ($r = .303$, $p < .01$), substance abuse ($r = .255$, $p < .05$) and anger regulation ($r = .254$, $p < .05$).

Since sleep displacement was not associated with parental knowledge, results suggest that although parents may know the whereabouts of their adolescents, the specific context and engagement of their activities may be unknown, and thus a potential risk factor if sleep displacement becomes habitual on a weekly cycle. This implies that parental knowledge may not be an accurate predictor of adolescent delinquency.
Ethno-Symbolism and Government Discourse in Azerbaijan

Brian Gilson
Oklahoma State University
Department of Geography
Subject Area: Social Sciences

Governmental discourses of national identity are interrogated for historical and contemporary meaning. Six symbolic resources are analyzed using methods of discourse analysis through a lens of ethno-symbolism. The official seal of Azerbaijan, the national flag, the national anthem, the official seal of the Baku 2015 European Games, a Soviet-era tourist map, and the romance novel *Ali and Nino* are analyzed for the historical and contemporary identity claims that are encoded within. In particular, the representations of national identity that are contained, as well as the subtle and not so subtle claims, relationships, and allegiances that are being communicated are studied. A cultural history is constructed from an analysis of the chosen symbols that serves to inform contemporary Azerbaijani identity. The way in which national identity in Azerbaijan is constructed through discourse and the historical basis of that construction is assessed and compared against the claims of ethno-symbolism. It is found that modern constructions of national identity in Azerbaijan are drawn from pre-modern ethno-territorial identities and that the paradigm of ethno-symbolism offers an accurate lens through which to understand Azerbaijani national identity.

How do prey choose to forage and invest in defense with imperfect information about predation risk?

Scott Goeppner, Barney Luttbeg
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Prey have to make foraging and growth decisions despite only having imperfect information about the presence of predators. We used a dynamic state variable model to examine how these decisions are shaped by imperfect information. As expected, when predators were absent prey maximized their foraging and did not invest in defense. When predators were present, prey reduced their foraging, regardless of the actual predation risk. They invested largely in defense at early time steps, but, at lower levels of predation risk, began to invest in reproduction as they approached terminal time. Next, we used forward simulations to determine how individual’s choices and fitness were impacted when their perceptions of predation were imperfect. We found that in general prey should tend to overestimate predation risk, but when actual levels of predation risk are low there may be less selection for overestimating risk. This result suggests that the fitness impacts of over or underestimating predation risks change as the actual predation risk changes. Finally, we expanded our model to see individuals should optimally build their perception of predation risk, using information from their parents and environment.

Quantification of Gas Evolution Rates for Subsea Seperator Applications

Tyler Goldsmith
Oklahoma State University
Department of Chemical Engineering
Subject Area: Physical Sciences Technology

Gas-liquid separators are essential components to the upstream energy industry. Before separating a solution into liquid and gas phases, it is critical for gas dissolved in liquid to evolve out of solution to prevent gas carry-under events later down the line. Therefore, it is important to understand gas evolution rates to troubleshoot gas-liquid separator design. Little is known how solids in solution (i.e. sands or waxes in crude oils) effect gas evolution rates. The focus of this project is to explore the effect that the introduction of solids to a system has on gas evolution. A methodology is being developed to quantify gas evolution rates of a gas-liquid system that includes solid particles. A liquid will be supersaturated with
compressed air. The system will then be agitated to initiate gas evolution. Pressure traces will be recorded and then used to derive a gas evolution half-life. Trials will be conducted with varying pressures, types of solids (50 micron glass beads and varying plastic microspheres), and concentration of solids. Work on the project is still ongoing.

Geographic variation in sexual dimorphism on the elemental level

Jared Goos, William Eskew, Rickey D. Cothran, Punidan D. Jeyasingh
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Sexual dimorphism of organisms is responsible for some of the most striking examples of intraspecific variation in nature. Examining how sexual dimorphism may vary in different ecological contexts is important to our understanding of population diversification. Most studies examining intraspecific variation in sexual dimorphism have done so in the context of morphological traits. All organismal traits, however, have unique demands of elemental resources derived from the environment. The supply of these elemental resources varies both spatially and temporally, potentially driving local adaptation within species. In this study, we examined sexual dimorphism in elemental composition of *Hyalella* amphipods in 19 geographically separated springs throughout Oklahoma. Using recent technological advancements in elemental analyses, we characterized the variation in elemental sexual dimorphism of each population and correlated that variation to the variation in environmental element supply. Our results indicated that a) spatial variation in elemental supply is evident in our sites b) elemental sexual dimorphism varies between populations and c) elemental sexual dimorphism is correlated with spatial variation in elemental supply. Together, our results are among the first to link spatial variation in elemental supply with intraspecific variation across populations, and highlight the importance of examining potential ecological drivers of intraspecific variation.

The Role of General and Maladaptive Personality on Interpersonal Romance

Ashley Hadwiger, Dr. Stephanie Sweatt & Neil Meyer
Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Personality traits can be used to describe a person’s characteristic manner of thinking, feeling, behaving, and relating to others. Traits can also be used to describe maladaptive patterns of personality, particularly within the context of interpersonal relationships. The current study sought to examine the influence of general and maladaptive personality traits on interpersonal romance, specifically within romantic conflict and romantic satisfaction. It was hypothesized that maladaptive and general personality would be significantly correlated with each other and with measures of romantic conflict and satisfaction, but that maladaptive personality would be more strongly associated with romantic conflict and satisfaction than general personality. Undergraduates (N = 283, 74.1% female) ranging from 18 to 59 years of age (M = 19.72, SD = 3.026) completed all measures online. General personality showed moderate to strong correlations with romantic conflict and satisfaction while maladaptive personality traits showed weaker correlations. Additionally, overall maladaptive personality functioning was positively correlated with the general personality traits of Neuroticism and negatively correlated with Agreeableness and Conscientiousness.
Neighborhood Characteristics and Adolescent Coping Strategies

Ashley Harvey, Tia Claybrook, Zach Giano, Sally Eagleton, Michael Merten PhD
Oklahoma State University
Department of Human Development and Family Science

Subject Area: Social Sciences

Neighborhood characteristics are increasingly salient to researchers in many areas of human sciences. Other contextual factors are linked to adolescent outcomes, just as emotional eating has been linked to stress and anxiety. The current study examines the relationships between neighborhood characteristics and emotional eating behaviors in adolescents. First, a regression was run with the composite neighborhood violence score as a continuous variable against the emotional eating behavior measure. The model was significant ($F = 4.27, p < .01, R^2 = .14$). Next, four different neighborhood vectors were created as a categorical variable, with 1 being the least violent and 4 the most. An ANOVA analysis revealed significant group mean differences ($F = 4.96, p < .01$), with each group increasing in emotional eating as the severity of neighborhood vectors increased. As results from the current study indicate, examination of neighborhood characteristics may be crucial to researching emotional eating behaviors in adolescents. Implications from this study include: use of neighborhood characteristics as an additional measure to control for adolescent behaviors, awareness of influences on coping mechanisms, and further research may explore specific neighborhood characteristics related to emotional eating.

Predicting affect in real time: Examining the role of general personality and maladaptive dependency

Ashley Helle, Hilary L. DeShong, Gregory J. Lengel, Neil A. Meyer, DeMond M. Grant, Stephanie N. Mullins-Sweatt
Oklahoma State University
Department of Psychology

Subject Area: Social Sciences

Dependent personality disorder is characterized in DSM-5 as the excessive need to be cared for by others, which leads to separation fears, clinginess, submissiveness, and interpersonal difficulties. There has been debate regarding personality traits that best explain dependency characteristics from a dimensional perspective. This study examined the association between the Five Factor Dependency Inventory (FFDI) maladaptive personality traits, general personality traits, and changes in mood over time. Specifically, we examined the unique prediction of positive and negative mood using personality traits associated with maladaptive dependency. Undergraduate students ($N = 104$) participated in the ecological momentary assessment study. Participants completed self-report measures of personality and maladaptive dependency traits and then reported on mood three times daily for one week using an iPod Touch/iPhone. Results will include hierarchical linear modeling to examine the relationships among variables and changes over time. It is hypothesized that the neuroticism and agreeableness will predict positive and negative affect over the span of one week, and furthermore, maladaptive dependency traits will predict changes in affect above and beyond the general personality traits. This study will inform the literature related to dependent personality traits and the impact these maladaptive personality traits may have on affect in daily life.

Comparison of mitochondrial function between sulfide tolerant and non-tolerant Poecilia mexicana during hydrogen sulfide exposure

Chathurika Ruchirani Henpita P G, Jennifer H. Shaw
Oklahoma State University
Department of Integrative Biology

Subject Area: Biological Sciences

Hydrogen sulfide ($H_2S$) is a toxic gas that inhibits cellular respiration at mitochondrial cytochrome c oxidase and is lethal at high doses. However, low concentrations of $H_2S$ are produced by cells as a normal byproduct.
of cysteine metabolism and are responsible for maintaining critical physiological processes involved in blood pressure, angiogenesis, and mitigating oxidative and inflammatory stress. Interestingly, the mitochondria serve not only as the target of H2S toxicity, but also as the site for enzymatic detoxification of H2S. Abnormal elevation of cellular H2S is correlated with vascular, metabolic and neurological disease, therefore understanding the regulation of cellular H2S concentration is important. Lab-reared *Poecilia mexicana* is an ideal model to study H2S because these fish species are derived from two populations, sulfide tolerant and non-tolerant, due to the presence or absence of H2S in their habitat. We hypothesized that sulfide tolerant fish would exhibit a lower oxygen consumption rate (OCR) relative to the non-tolerant population following H2S exposure. We found that sulfide tolerant mitochondria exhibit a reduced rate of oxygen consumption following control and H2S treatment relative to the non-tolerant population, suggesting that their ancestral exposure to H2S has driven modifications at the level of mitochondrial function.

**Changes in electron flow resulting from alterations in carbon metabolism in the cyanobacterium Synechocystis sp. PCC 6803.**

Steven Holland, Juliana Artier, Neil Miller, Melissa Cano, Junpeng Yu, Maria Ghirardi, Robert L. Burnap

Oklahoma State University  
Department of Microbiology and Molecular Genetics  
Subject Area: Biological Sciences

Cyanobacteria are photosynthetic organisms of huge ecological and biotechnological importance. In order to assimilate carbon into their central metabolism, cyanobacteria require energy rich ATP and NADPH molecules to power the Calvin-Benson-Bashamm cycle. The light reactions of photosynthesis produce these molecules in a series of reactions starting with the removal of electrons from water and ending with their donation to NADP⁺, a process termed linear electron flow. Many photosynthetic organisms employ mechanisms that ensure the proper ratio of ATP and NADPH are produced. These are collectively referred to as cyclic electron flow and act in concert with linear electron flow. Most photosynthetic organisms use ATP and NADPH to store electrons on carbon molecules in the form of starch (long-chain sugar molecules). In this way, carbon metabolism and photosynthetic electron flow are linked.

We analyzed two mutants of the cyanobacterium *Synechocystis* sp. PCC 6803 with alterations in their carbon metabolism. The Δ*glgC* mutant is unable to form starch, while the JU547 mutant has been engineered to produce ethylene. In each mutant, a sink of electrons and carbon has been either closed or added, respectively. The aim of this work was to examine changes in electron flow and carbon acquisition resulting from these alterations.

**Extreme Weather and Bird Populations**

Nicolas Jaffe, Tim O’Connell, Mona Papeş

Oklahoma State University  
Department of Natural Resource Ecology and Management  
Subject Area: Biological Sciences

Extreme weather events are among the most impactful aspects of climate change and are projected to increase in frequency in many regions of the world. Research studies across disciplines have linked extreme weather to numerous natural processes and species, yet their ecological roles are not fully understood. Avian species are widely recognized as indicators of climate change due to their sensitivity and responsiveness. Though the effects of weather extremes have been well documented in case studies with birds, few are conducted at broad spatial and temporal scales and fewer yet address more complex issues such as variability across species, functional groups, and ecoregions. Oklahoma is uniquely suited to address these questions. The state is known for its extreme weather patterns, features diverse ecoregions, and is home to over 200 species of breeding birds. Examining how weather extremes influence bird abundance helps assess the vulnerability of populations. Furthermore the need to conduct such studies at a relevant scale for
conservation is paramount as many successful management strategies are implemented at state and regional scales.

**Controlled Differentiation of Human Mesenchymal Stem Cells on Surfaces Patterned with Micropillars**

Hasani Jayasinghe, YOLANDA VASQUEZ  
Oklahoma State University  
Department of Chemistry  
Subject Area: Physical Sciences Technology

Human mesenchymal stem cells (hMSCs), isolated from bone marrow, adipose tissue, and most connective tissues, are primary cells which are capable of developing into multiple tissues such as bone (osteogenic), cartilage (chondrogenic), and adipose tissue. Interestingly, the morphology, functions, and differentiation of hMSCs can be controlled, *in vitro*, by various properties including the surface topography, stiffness, and functional groups of the adherent surface. Due to the tunability of their functions and differentiation patterns, hMSCs have become attractive sources for tissue engineering and regenerative medicine. Hence *in vitro* differentiation of hMSCs has been extensively studied; however, the regulation achieved by altering only the topography of the adherent surface is still under investigation. Here, in this study we have explored the effect of microscale pillars on directing the human mesenchymal stem cells towards a specific differentiation pathway. We have fabricated epoxy substrates and poly(2-hydroxylethyl methacrylate) based hydrogels patterned with microscale pillars of different heights. Human mesenchymal stem cells are cultured on the patterned epoxy and hydrogel substrates and their differentiation potential towards adipogenic, osteogenic, and chondrogenic lineages has been evaluated.

**Hydroacoustic Sampling in Shallow Reservoirs**

Garrett Johnson, Dan Shoup, Kevin Boswell  
Oklahoma State University  
Department of Natural Resource Ecology and Management  
Subject Area: Biological Sciences

Shad (*Dorosoma* spp.) are important prey species in southern reservoirs. Current sampling methods for assessing shad abundance are time consuming and imprecise. Hydroacoustic fish sampling, common in marine fisheries but only recently used in freshwater fisheries, may be useful for sampling shad populations. Traditional hydroacoustic sampling uses vertical beaming, which is less efficient in shallow freshwater systems because it only samples a small volume relative to deeper marine habitats. Horizontal beaming allows a greater sample volume in shallow reservoir habitats, but less precisely estimates fish size because fish orientation is unknown (and the reflecting surface area of a fish varies greatly with orientation in the horizontal aspect). To account for this, we propose to combine traditional hydroacoustics with an ARIS® imaging sonar to measure fish orientation, allowing better estimates of fish size from target-strength data. ARIS® sonar also has the potential to identify fish to species based on length-width ratios and swimming sinuosity. We will validate the accuracy of these methods for sampling gizzard shad using a 15 x 15 x 5 m net enclosure that is stocked with a known number and size structure of gizzard shad.
N-Acryloxy Succinimide-Co-Ethylene Glycol Dimethacrylate Organic Monolithic Columns for Post Immobilization of Various Ligands for HPLC

Murthy Jonnada, Ziad El Rassi
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

An organic monolith was introduced for the post immobilization of various ligands for bio-affinity and interactive chromatography. This novel monolith is “universal” since it allows the tailor made of various monolithic stationary phases. It was generated by the co-polymerization of N-acryloxsuccinimide (NAS) and ethylene glycol dimethacrylate (EDMA). Through its surface N-hydroxysuccinimide functional groups, the NAS-EDMA monolith allowed the immobilization of n-alkyl amine ligands or proteins via reaction with the primary amines forming stable amide linkages. The utility of NAS-EDMA monolith was assessed in two different immobilizations of proteins. In one immobilization process, 5 different lectins with different affinity to glycoconjugates were immobilized onto the NAS-EDMA monolith, and the 5 resulting lectin columns were arranged in tandem to capture sub-glycoproteomes from healthy and breast cancer sera. The captured glycoproteins were identified by LC-MS/MS analysis, and their differential expression in cancer versus healthy sera was determined. In a second approach, a micro-immobilized enzyme reactor consisting of NAS-EDMA monolith with immobilized trypsin was prepared, coupled on line with an octadecyl silica (ODS) column and its performance was tested with the tryptic map of cytochrome C. In addition, the NAS-EDMA monolith with attached n-octadecyl chain proved very useful in protein separations by micro-HPLC.

Effect of silane on viscoelastic behavior of epoxy under hygrothermal conditions

Libin Kaleeluvilayil Babu, Libin K. Babu, Dr. Raman P. Singh
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

This study examines impact of (3 – Glycidyloxypropyl) trimethoxysilane coupling agent on epoxy resin by matrix modification. Different weight percentages of silane are added to neat resin to investigate how silane’s reaction with epoxy changes important properties of the material before and after moisture absorption. Nanoindentation was employed to evaluate mechanical properties taking into account viscoelastic nature of the material being studied. Water degradation of samples were conducted both at room temperature and 50 °C to gain insight into changes caused by absorption of water. It was observed that silane degraded various properties of neat resin such as elastic modulus, hardness and creep resistance. Differential scanning calorimetry (DSC) results indicated that glass transition temperature (Tg) of the material was also lowered. However, the most interesting observation was that for 2 wt. % silane samples which were subjected to 50 °C water degradation there was increase in creep resistance as well as glass transition temperature. Fourier transform infrared spectroscopy (FTIR) was used to analyze chemical interaction which could have been attributed as the reason behind possible increase in cross linking of epoxy under sub boiling water degradation environment.

Visualizing User Interaction for designing better User Interfaces

Ashwin Kannan
Oklahoma State University
Department of Computer Science
Subject Area: Physical Sciences Technology

Not Received
Using Molecular Dynamics Simulations to Unravel the Structure and Nano-scale Tail Segregation in 1-Alkyl-3-Methyl Imidazolium Octyl Sulfate Ionic Liquid Homologous Series

Utkarsh Kapoor, Jindal K. Shah
Oklahoma State University
School of Chemical Engineering
Subject Area: Physical Sciences Technology

Ionic liquids (ILs) are novel chemical substances composed entirely of ions. Unlike common salts ILs can be synthesized to exist as liquid under ambient conditions. Conventional ILs exhibit rather poor solubility for nonpolar substances such as alkanes commonly obtained from crude oil. One strategy, to enhance the solubility of nonpolar compounds, is to increase the nonpolar content, by increasing the alkyl chain length, in either the cation or the anion. Thus, it is possible to tune size and shape of these domains by judiciously selecting alkyl chain lengths in an effort to design ionic liquids for selecting absorbing a given alkane. In this presentation, we report the results of mesoscopic segregation of polar and nonpolar domains obtained from the molecular dynamics simulation study carried out on ILs containing alkyl chain on both cation and anion Radial distribution functions, spatial distribution functions and structure factors were computed to interpret the morphology of polar and non-polar domains present. The results indicate that it is possible to tune the tail-tail aggregation by varying the alkyl chain length. Further quantification of the nonpolar region was carried out by computing the aggregate size and shape from domain analysis.


Srijana Karki
Oklahoma State University
Department of Sociology
Subject Area: Social Sciences

This study examines social capital of married women attending secondary education in Kathmandu, Nepal. Using in-depth interviews with 25 women who had completed their secondary education, or who were still pursuing their secondary education in Utprerana Women Secondary School, the study assesses various influences and changes in social capital as women started their education. Some of the social capital that helped women to continue their secondary education were living in a nuclear family, having a supportive husband, supportive children and their personal aspirations for the education. The factors that were creating obstacles for women attending secondary education were constant opposition from extended families, friends and neighbors, and pressure to complete domestic responsibilities. The school provided women with some personal space away from their domestic responsibilities. All the women in the study valued their relationship with their classmates and teachers. Women’s participation in social activities reduced as they started attending secondary education. Women attended only those social activities which they thought was absolutely necessary to attend.

Polymer photodegradation: autocatalytic under sunlight

Sriharsha Karumuri, A. Kaan Kalkan
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

Yellowing of plastics under sunlight is the most common sign of their degradation, which is propelled by a series of photochemical reactions — oxidation, dissociation, crosslinking, and chain scission. In the present work, we overcome these limitations by analyzing the discoloration of epoxy thermoset thin films (~ 650 nm) under UV exposure by optical absorption spectroscopy. To reveal the mechanistic steps of degradation, a fundamental kinetic model has been formulated that encompasses the kinetics of these 4 photochemical
The model exhibits an excellent agreement with the data systematically recorded by UV-Vis as well as FTIR spectroscopies. Our analysis establishes that the polymer PD is autocatalytic under sunlight, as new C═O sites are generated by UVA excited C═O moieties (i.e., n→π* transitions) through creation of singlet oxygen (1O2) due to excited energy transfer to ground state triplet oxygen (3O2). These electronically excited C═O moieties also undergo dissociation creating free radical sites, which undergo either crosslinking or chain scission. It is also demonstrated that the rate of PD is increased either by incorporation intrinsic C═O sites or non-C═O sensitizers. Additionally, the kinetics model is employed to elucidate the propagation of PD reactions along the thickness that are difficult to acquire experimentally.

Organic monolithic column for post immobilization of various ligands for CEC

Shantpriya Khadka, Ziad El Rassi
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

An organic monolith for post immobilization of interactive ligands for use in CEC was prepared by the co-polymerization of hydroxyethylmethacrylate (HEMA) and pentaerythritol triacrylate (PETA). The HEMA-PETA monolith thus prepared was then post modified with hydroxypropyl-β-cyclodextrin (HP-β-CD), glycerol and non-polar alkyl ligands for chiral, hydrophilic and reversed phase CEC, respectively. Two different approaches were implemented in the surface modification of this HEMA-PETA monolith. In one approach, acid catalyzed ring opening was performed to link HP-β-CD, glycerol as well as 1, 2-epoxyalkanes of varying alkyl chain length of n = 10, 12, 14, 16 and 18 with the free hydroxyl functional groups on the surface of the HEMA-PETA monolith. In a second approach, octadecyl isocyanate was reacted with the surface hydroxyl functional groups of the HEMA-PETA yielding a stable covalent urethane bond. In all cases, the surface modified HEMA-PETA monoliths exhibited strong cathodal EOF. The HP-β-CD column was tested with ± warfarin, ±hexobarbital, DL- phenylalanine while the glycerol column was evaluated with neutral polar amides and nucleosides. The nonpolar alkylated surfaces were studied under reversed phase mobile phase composition with alkylbenzenes, polyaromatic hydrocarbons, phenol derivatives, and toluene derivatives. The separations thus achieved were highly efficient and reproducible.

Controlling the Release of Doxycycline Using Multiaxial Electrospun Hybrid Fibers

Abdurizzagh Khalif, Sundararajan V. Madihally
Oklahoma State University
Department of Chemical Engineering
Subject Area: Biomedical Sciences

Many approaches are used to protect the therapeutic agents in the harsh microenvironments. A novel approach is loading the therapeutic agent in a micro and nanosize fibers and form a matrix. Electrospinning provides an effective method for fabrication of micro and nanosize fibers. Also, recent advances allow the formation of multiple layers that can be utilized in regulating drug release. However, forming the matrix using biocompatible materials which are also mechanical strong have not been attempted. We first explored the fabrication of hybrid Polycaprolactone (PCL)/Gelatin (GT) electrospun fibers. Blending natural and synthetic polymers provides a new biomaterial with appropriate biocompatibility and improved mechanical, physical and chemical properties which is beneficial for cell adhesion and degradation rate. Doxycycline (Dox) is an antibiotic, used in the treatment of bacterial infections in the body. We evaluated the release characteristics of Dox. Fibers fabricated from single, coaxial and triaxial spinneret were compared and characterized for their morphology and release profile. Results showed that the fabricated PCL/GT can be tuned to release Dox because of their unique fabrication process.
Teacher and Child Predictors of Pre-Kindergarten Children’s Classroom Engagement

Ashley Kimble, Isaac Washburn Laura Hubbs-Tait
Oklahoma State University
Department of Human Development and Family Science
Subject Area: Social Sciences

The purpose of this study was to examine characteristics of children, teachers, and classrooms that predict two types of classroom engagement: disengagement and elaborate child-adult interaction. Participants were 940 prekindergarten children and their teachers from 245 classrooms, drawn from the National Center for Early Development and Learning Multistate Study of Pre-Kindergarten, 2001-2003. Measures were observed child engagement and classroom quality, teacher report of teacher-child relationships and child behavior, and parent-reported demographics. Results of multilevel models reveal significant predictors of child disengagement: Latino ethnicity, boys, lower maternal education, higher teacher-child conflict, lower teacher education, higher teacher/child ratio, non-Head Start classrooms, and lower teacher productivity. Significant predictors of elaborated interaction were higher teacher-child closeness, greater teacher-child conflict, lower teacher/child ratio, Head Start, and more teacher sensitivity. Random effects models for teacher-child conflict were significant for both disengagement and elaborated interaction. Findings outline the effects of teacher and child characteristics and emphasize the importance of teacher-child relationships. Elaborated interactions seem to be driven by both closeness and conflict suggesting both positive and negative emotional tones. Significant random effects for teacher-child conflict on both types of engagement indicate variation in the effect across classrooms and a need to explore potential moderators of this relationship.

CarP, a putative beta propeller protein, plays role in Pseudomonas aeruginosa response to calcium

Michelle King, Marianna Patrauchan
Oklahoma State University
Department of Microbiology and Molecular Genetics
Subject Area: Biological Sciences

Pseudomonas aeruginosa is an opportunistic pathogen that causes severe acute and chronic infections in humans. It has been shown that calcium (Ca\(^{2+}\)) induces pyocyanin, antibiotic resistance, and swarming motility in P. aeruginosa. We showed that CarP, a previously uncharacterized protein, plays a role in Ca\(^{2+}\) induced phenotypes and is required for survival at increased Ca\(^{2+}\) concentrations. We also showed that the expression of carP is up-regulated by a Ca\(^{2+}\) induced two-component system. Bioinformatic analysis enabled prediction that CarP is a 5 bladed \(\beta\)-propeller that has a Ca\(^{2+}\) binding site in the opening of the propeller. Even though it’s clear that CarP plays a role in \(\text{Ca}^{2+}\) induced physiology, the mechanism is not clear. To study what factors commonly associated with a host environment regulate the expression of carP, we will use a reporter construct with carP promoter cloned upstream of the lux operon, which will allow measuring promoter activity based on the luminescence produced by the lux system. In addition to different Ca\(^{2+}\) concentrations, presence of H\(_2\)O\(_2\), CO\(_2\) we will test the effect of antibiotics commonly used to treat Pseudomonas infections. These data will enlighten us on the potential role CarP can play in regulating P aeruginosa response to Ca\(^{2+}\).
Application of Microfluidics for Monodispersed Droplets Production

Subarna Kole, Prem Bikkina
Oklahoma State University
School of Chemical Engineering
Subject Area: Physical Sciences Technology

Emulsification and demulsification processes have a wide range of applications in various fields such as food and agricultural, cosmetics, pharmaceutical, and petroleum industries. For some applications, creating stable emulsions may be a primary requirement where as for the other applications, separation of emulsions into its constituent fluid phases would be critical. So, it is essential to understand the underlying physicochemical aspects to effectively control these processes. Droplet size is one of the critical factors that influence the emulsion stability. This presentation focuses on the application of a custom designed microfluidics facility for emulsion formation. The experimental facility has a unique capability to produce controlled mono-dispersed oil-in-water and water-in oil emulsions. The experimental results indicating the effects of organic phase, aqueous phase salinity, salt type, surfactant type, total flow rate, and water-cut on the droplet size will be discussed.

Regulation of phosphodiesterase activity by phosphorylation in Dictyostelium after cAMP signaling

Nick Kuburich, Nirakar Adhikari, Jeff Hadwiger
Oklahoma State University
Department of Microbiology and Molecular Genetics
Subject Area: Biological Sciences

Many eukaryotic signaling pathways use cAMP as a secondary messenger to evoke specific responses to different external stimuli. Localized levels of cAMP can be controlled by phosphodiesterases, which are sometimes regulated by phosphorylation. Dictyostelium discoideum offers an excellent system to study the regulation of phosphodiesterases as it contains relatively few cAMP-specific phosphodiesterases compared to mammals. The cAMP-specific phosphodiesterase, RegA, regulates important steps in Dictyostelium development and is negatively regulated by the MAP kinase, ERK2. This inactivation occurs periodically by external cAMP pluses. This results in a cell-signaling pathway that activates ERK2. Mammalian studies have suggested that cAMP-dependent protein kinase, PKA, can also regulate the phosphodiesterase activity. This putative regulation of PKA on the activity of RegA has not been fully investigated in Dictyostelium. Mass spectrometry is being used to detect potential phosphorylation sites on RegA. Two sites of interest have been identified, including a PKA phosphorylation site. Site directed mutagenesis is being used to replace the residues at these sites and a MAPK site to mimic or prevent a phosphorylation event. The phenotypes of cells carrying these mutations will be analyzed through developmental analysis. RegA will be analyzed during multiple time points with phosphospecific antibodies to determine its regulation.

Nonlinear and Inertant Acoustic Metamaterials and their Device Implications

Prateek Kulkarni, James M. Manimala
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

Acoustic Metamaterials (AM) are a class of artificial materials that derive their unique dynamic properties not just from material constituents but more so from engineered configurations. Tailoring their engineered configuration imparts unusual wave manipulation capabilities that bring about novel applications. We introduce nonlinear as well as inertant elements in AM with locally resonant configurations in order to investigate their device implications. Using an effective-mass model, approximate analytical solutions are derived for the amplitude-dependent dispersion curve shifts owing to the presence of cubic nonlinearities. Numerical verifications show that an amplitude-activated direction-bias in the propagation characteristics is
achieved depending on direction of propagation in the AM. Introducing inerters are shown to modify the
dispersion characteristics of the AM, especially in the ultra-low frequency range without static mass
penalties. It was found that the local resonance bandgaps in such inertant AM with tuned parameters can be
widened to the extent of obtaining almost complete wave attenuation across all frequencies. While an
entirely passive direction-biased waveguide for mechanical waves would be a promising step towards a full-fledged mechanical analog of the electronic diode, harnessing the unique response of inerters could enable
acoustic wave inhibiting structures.

Manipulation of cold atoms: random walks on an optical lattice
Wakun Lam, Sandro Wimberger, Gil Summy
Oklahoma State University
Department of Physics
Subject Area: Physical Sciences Technology
We show an approach to manipulate the trail of cold atoms in an optical lattice, in which the lattice depth and/or phase are randomly chosen in certain statistical distribution. We observe by simulation as well as experiment that the atoms are driven away from their initial locations in momentum space faster than the normal diffusive process. We consider this power-law distribution of the driven atoms is an evidence of random walk in quantum systems. Hence, our study provides a fashion to steer the random walk of particles, which may be a good tool in speeding up the traditional algorithm in a manner of quantum computation.

Bird Response to Fires in the Cross Timbers
Caitlin Laughlin, Timothy J. O’Connell, Steven W. Hallgren
Oklahoma State University
Department of Natural Resource Ecology and Management
Subject Area: Biological Sciences
Land cover type in the grassland-forest ecotone known as the Cross Timbers is dictated by fire frequency. The fire regime in these forests has been dominated by low-severity dormant season fires, which change understory structure and composition. Birds respond strongly to differences in canopy cover, but the effect of understory change is less understood.

Our objective was to examine how differences in cover impact the bird communities of Okmulgee Wildlife Management Area (OWMA) in Oklahoma. Dominated by post oak (*Quercus stellata*), OWMA was selected for its 28 years of prescribed fire, with 14 units ranging from 4.3 to 0 fires per decade. We visited points in each unit twice for two six-minute avian point counts and to collect basic compositional and structural information.

We discuss the role of canopy cover and horizontal cover on bird community composition. We found that Carolina Wren (*Thryothorus ludovicianus*) abundance responds strongly to increases in understory cover, while Eastern Wood-Peewee (*Contopus virens*) responded negatively, and Indigo Bunting (*Passerina cyanea*) abundances did not show a response. How these species respond differently to fire frequency provides insight into how our forests resources can be managed to provide for both wildlife habitat and fire control in fire-prone Oklahoma.
An Examination of the Role of Working Memory Demands on Objectively Measured Motor Activity in Adult Adhd, Gad, and Healthy Control Groups

Sarah Lea
Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Attention-deficit/hyperactivity disorder (ADHD) is a complex neurocognitive disorder characterized by problems with attention, hyperactivity, and impulsivity. Excessive motor activity such as restlessness and fidgeting are not pathognomonic symptoms of ADHD, and are often associated with other problems of psychopathology (American Psychiatric Association, 2013 Tryon, 2009). For example, the diagnostic criteria of Generalized Anxiety Disorder (GAD) includes restlessness as a distinguishing symptom of the disorder (American Psychiatric Association, 2013). Furthermore, previous research indicates WM deficits in storage and rehearsal components directly affect ruminations or anticipatory processing associated with anxiety disorders (Derakshan & Eysenck, 1998). The topographical similarity of excessive motor activity seen in both ADHD and anxiety disorders, as well as similar WM deficits, may indicate a common relationship between WM deficits and increased motor activity across psychopathology. However, to date, no studies have examined the possible relationship between WM deficits and objectively measured motor activity associated with anxiety. Consequently, the current study aims to examine objectively measured motor activity associated with the WM system in adults with ADHD, adults with GAD, and healthy control (HC) adults.

The Impact of Alcohol Use on Waterpipe Smoking Behaviors and Carbon Monoxide Exposure: A Pilot Investigation

Eleanor Leavens, Emma I. Brett, Thad R. Leffingwell, Julie Croff, Theodore L. Wagener
Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

The co-occurrence of alcohol use and waterpipe (WP) smoking is quite common among young adults. It is estimated that WP smokers are more than twice as likely to use alcohol and frequently consume alcohol immediately before or during a WP smoking session. However, it is unclear what impact alcohol has on WP smoking patterns and resultant exposure to tobacco-related toxicants. The current study is a first step in addressing this research gap. Patrons from two WP lounges (one served alcohol the other did not) located in a South Central Metropolitan area were invited to participate in the study. Participants meeting inclusion criteria (≥ 18 years old, intending to smoke WP) were invited to complete a brief questionnaire, as well as carbon monoxide (CO) and breath alcohol content (BrAC) testing before entering and upon exiting the WP lounge. Eighty participants completed the study. The majority of participants self-reported drinking prior to visiting the WP lounge and drinking while at the WP lounge. An associated between alcohol consumption and greater toxicant exposure was observed. This pilot study begins to address the lack of research on the impact of alcohol on WP smoking behaviors and resultant toxicant exposure.

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Improved Tornado Warning via Atmospheric Monitoring of Infrasound

Madison Likins
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

Infrasonic sound can be emitted from various sources, such as tornadoes, earthquakes, propane torches, and others. This infrasonic signature acts as a pressure wave as it moves through the atmosphere. As the wave propagates, its characteristics are likely to change due to certain weather conditions. The purpose of this research is to develop a model for infrasonic attenuation and validate the model with experimental data. The first step is to develop a simple model that numerically estimates the change in an acoustic signal as it propagates through the atmosphere at a specific condition. A few different scenarios will be run to determine how a signal changes depending on weather conditions. An experiment was conducted to achieve baseline data on the attenuation of infrasound; data was recorded using special microphones. Results show that the microphones used in the experiment are not sensitive enough to detect infrasound due to large amounts of wind noise. The results from the experiment affirm the need for new microphones so that more meaningful data can be collected. The current Matlab code models the one-dimensional wave equation and will be further developed to include the affects of weather conditions on the attenuation of an infrasonic source.

Maternal Negative Affect: Moderator & Mediator of Using Power Assertion for Toddler Noncompliance

Hua Lin, Robert Larzelere
Oklahoma State University
Department of Human Development and Family Science
Subject Area: Humanities

This study examined whether mothers’ negative affect moderated or mediated the association between toddler noncompliance severity and the use of power-assertive disciplinary responses. Mothers (N = 105) of toddlers were interviewed to report turn-by-turn details of two of their most difficult discipline episodes, two potentially problematic episodes, and an observed episode. Mothers’ negative affect included initial negative affect and maximum negative affect (on a 5-point scale), and whether they got more upset during the episode. Child non-compliance was categorized as un-skilled (defiance, tantrum, hitting), mid-skilled (passive noncompliance, simple refusal), or skilled (negotiation, whining). Maternal disciplinary practices were categorized as non-power-assertive and power assertive. The results showed that mothers got more upset on longer discipline episodes. Whether mothers got more upset and their maximum negative affect both increased the positive relation between toddler noncompliance severity and whether mothers used power assertion. Mothers’ maximum negative affect also mediated the relation between child noncompliance severity and whether mothers used power assertion. Mother’s initial negative affect was neither a mediator nor a moderator. The results indicate that getting more upset may escalate possibilities of mother’s using power assertion more than otherwise indicated by their toddler’s noncompliance severity.

Interactive Effects of Phosphorus and Iron Contribute to Altered Life History Traits in Daphnia

Patrick Lind, Puni Jeyasingh
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Phosphorus (P) is an important element in biology, having been linked to a wide variety of life history traits such as growth and reproduction. Recent work has shown that P limitation can produce as much as a 16-fold increase in iron (Fe) content in the keystone grazer, Daphnia. This indicates that P and Fe are linked, and synergistically affect growth and reproduction. How Fe limitation influences life history has not been
thoroughly investigated, particularly in freshwater systems. In this study, we explored the interactive effects of Fe and P limitation on a suite of life history traits across several *Daphnia* species. A 2x2 factorial experiment of P and Fe supply, revealed that interactions between P and Fe produce significant changes in life history among *Daphnia* species, principally in early growth rate and number of juveniles produced. These results indicate that *Daphnia* Fe demand will decrease as P supply increases, with potentially important ecological implications, with the ever increasing runoff of P into lakes.

**The sequence of behaviors-What does mother-child interaction tell us about disciplinary tactics?**

**Chao Liu, Robert Larzelere**

*Oklahoma State University*

*Department of Human Development and Family Science*

*Subject Area: Social Sciences*

Disciplinary practice remains to be a hot topic not only among popular press but also in academic research. Current parenting perspectives can be generally divided into two schools of thought: positive parenting and parent management training. Whereas positive parenting opposes any practice of firm discipline such as power assertion, parent management training advocates the mild use of it. One potential weakness of both perspectives lies in their ignorance of different disciplinary situations such as the type of noncompliance exhibited by the child. This study thus aims to address this deficiency by videotaping and coding the sequential interactions of 102 mothers and toddlers: child compliance or noncompliance–mother’s disciplinary tactic–child reaction. Distinctions were made among parent-oriented noncompliance (negotiation and whining), parent-avoiding noncompliance (simple refusal and passive noncompliance), and parent-opposing noncompliance (defiance, hitting, and tantrums). Results showed that the effectiveness of disciplinary tactics was dependent upon the disciplinary situation–with parent-oriented noncompliance, positive parenting led to higher level of children’s compliance whereas parent management training resulted in lower level of children’s compliance. However, under the situation of parent-opposing noncompliance, positive parenting was associated with more parent-avoiding noncompliance while parent management training correlated with lower level of parent-avoiding noncompliance.

**In vitro Glycosylation of Membrane Proteins using N-glycosyltransferase**

**Leshani Liyanage, Gabriel A. Cook**

*Oklahoma State University*

*Department of Chemistry*

*Subject Area: Physical Sciences Technology*

The majority of proteins in nature are glycoproteins, proteins that contain covalently linked oligosaccharides. The attachment of the sugar moiety can influence the physiochemical and biological properties of proteins by affecting their folding, modulating interactions with other biomolecules and modifying their functions in cellular level. We want to study these effects since a number of these proteins are involved in human disease. Our strategy is to use N-glycosyltransferase (NGT), an enzyme that recognizes the consensus sequence NXS/T of the protein and catalyzes the glycan attachment to the asparagine residue of the sequence, to perform *in vitro* glycosylation of membrane proteins allowing us to evaluate the effects of this modification on protein structure, dynamics and its function. By using a simplified membrane protein with a glycosylation site, we have developed an effective model for determining whether membrane proteins can be glycosylated using this enzyme in a membrane-like environment. Glycosylation of these samples is performed using the synthesized peptide, *E.coli* expressed NGT from *Actinobacillus pleuropneumoniae*, and a uridine diphosphate glucose molecule as the sugar substrate. Mass spectrometry and gel electrophoresis have been used for the detection of glycosyltransferase activity leading the way for NMR to be performed for characterizing the reaction adducts.
Investigation into the Effect of Aliovalent Doping on the Phase Transformation and Thermal Expansion Properties of La$_{1-x}$R$_x$NbO$_{4-\delta}$; R=Ca, Ba, Sr

Dan Lowry, Pankaj Sarin
Oklahoma State University
School of Materials Science and Engineering
Subject Area: Physical Sciences Technology

Improvements in the proton conduction properties of LaNbO$_4$ have been achieved through the creation of oxygen vacancies in the crystal lattice by aliovalent doping. Understanding how phase stability and thermal expansion behavior is influenced through the inclusion of these aliovalent dopants in the crystal structure is essential to further develop this system for SOFC electrolyte application. In this study, powder samples of La$_{1-x}$R$_x$NbO$_{4-\delta}$ (where R=Ca, Ba, or Sr) were synthesized by the steric-entrapment method and studied using in situ high temperature diffraction up to 1200°C in air as well as specific heat measurements by differential scanning calorimetry. The in situ HTXRD datasets were analyzed to determine the effect of the dopant ions on the crystal structure and to characterize the thermal expansion behavior as a function of temperature. Changes in lattice parameters, phase transformation response, and thermal expansion will be discussed as a function of both dopant and temperature.

Tuning of the inverse opals to make photonic crystals with high periodicity

Ujith Madduma-Bandarage, Yolanda Vasquez
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

Inverse opals are ideal candidates for photonic applications where specific wavelengths of light are diffracted by Bragg’s diffraction of the crystal. Periodicity of the material is important to control the range of diffracted wavelengths resulting an intense stop band with a narrow bandwidth. Highly periodic Inverse opals are prepared by co-assembly technique, in which, colloids such as poly(methyl methacrylate) (PMMA) are vertically deposited in the presence of sol-gel precursors such as tetraethyl orthosilicate (TEOS). Once the PMMA template is removed by calcination, the matrix material -hydrolyzed TEOS- is further condensed to form a silica network. It is found that the periodicity of voids in this material depends on the factors such as colloidal concentration, TEOS concentration, and hydrolysis rate of TEOS. We have analyzed the effect of the above factors using a spectrophotometer in transmission mode and image analysis techniques such as thresholding and Fast Fourier Transformation. We have found that there are critical colloidal concentration and TEOS concentration that give better inverse opals with minimal defects and higher periodicity. The spectrophotometric analysis has revealed that the particular films have stop bands with a significantly high intensity. The volume fraction of the voids confirmed the better crystallinity of the material.

Size up your opponent: Opponent size affects reproductive output in a lizard, Anolis sagrei

Jessica Magaña, Matthew B. Lovern
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Territorial species compete over resources, resulting in differential access to resources related to social status. Some territorial species adjust their behavior and physiology in response to brief social interactions that indicate access to resources. Previous work showed that 10 min interactions between female lizards altered individuals’ reproductive investment: winners produced heavier hatchlings than losers, independent of lizard size. This experiment tested the effect of long-term experience (7 weeks) on paired female lizards and compared the effects of an opponent of similar or dissimilar size. We tested two alternate hypotheses:
(1) bully hypothesis: mismatched pairs will show greater disruption of reproductive output as the larger lizard harasses the smaller lizard or restricts access to resources; (2) rivals hypothesis: matched pairs will show greater disruption of reproductive output as lizards devote greater energy to aggression in an uncertain dominance hierarchy. Matched pairs laid fewer eggs than mismatched pairs, supporting the rivals hypothesis; however, mismatched pairs had greater variation in hatching mass than matched pairs, supporting the bully hypothesis. Lizards may emphasize different reproductive traits based on their social circumstances.

The Regulation of Glucose Transport is Altered During Diabetes-Induced Atrial Fibrillation

Zahra Maria, Allison Campolo, Brenda Smith, Benjamin Scherlag, Veronique Lacombe
Oklahoma State University
Physiological Sciences
Subject Area: Biomedical Sciences

The heart is one of the main organs to utilize glucose; however, little is known about glucose metabolism in the atria. Glucose transport into the cell via Glucose Transporters (GLUTs) is the rate-limiting step of glucose utilization. Although GLUT4 is the major isoform, GLUT8 has emerged as a novel cardiac isoform. We hypothesized, GLUT-4 and -8 translocation to the atrial cell surface will be insulin regulated and impaired during type-2 diabetes (T2Dx)-induced atrial fibrillation (AF). AF was induced in the atria of both healthy and long-term-high-fat-diet (HFD)-induced T2Dx rodents by transesophageal atrial pacing. After 6 months on a HFD, mice were obese and hyperglycemic, and developed insulin resistance compared to mice on a control diet. Our results showed an increased susceptibility and propensity of both AF and atrial tachycardia in the T2Dx animals (P<0.05). In the T2Dx atria, active cell surface and total GLUT-4 and -8 content was also down-regulated under basal condition (P<0.05). In conclusion, our data suggest that: 1) GLUT-4 and -8 trafficking is altered in the T2Dx atria 2) T2Dx increases the vulnerability to atrial fibrillation. Alterations in atrial glucose transport may induce perturbations in energy production and provide a metabolic substrate for atrial fibrillation during diabetes.

Longitudinal heterogeneity gradient drives zooplankton metacommunity structure and biodiversity in a large dune system

William Mausbach, Andy Dzialowski
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Few studies have observed patterns in metacommunity structure and biodiversity across multiple natural metacommunities, and those that have, have focused on terrestrial or permanent aquatic systems. Here, we used a longitudinal climate-induced heterogeneity gradient to determine how environmental heterogeneity influences metacommunity structure and biodiversity in the temporary pools of the Nebraska Sandhills, Nebraska. Due to an east-west climate gradient, the temporary pools transition from freshwater in the temperate eastern Sandhills to hypersaline in the semi-arid western Sandhills. We collected zooplankton and measured environmental variables from 30 temporary pools across three regions of the Sandhills (east, central, and west). We found that metacommunity structure transitioned from a randomly structured metacommunity in the eastern region to a highly structured Clementsian metacommunity in the western region. Alpha and gamma diversity decreased from east to west in both freshwater and saline pools. We found that salinity had a negative effect on saline pool alpha diversity, and that as saline pools became more prevalent freshwater alpha diversity decreased. Our findings suggest that the relative influence of local and regional processes on metacommunity structure and biodiversity increase as metacommunities become more heterogeneous.
Systematics and Evolution in the New World Milkweed Vines

Angela Mcdonnell, Mark Fishbein
Oklahoma State University
Department of Botany
Subject Area: Biological Sciences

Milkweed subtribe Gonolobinae is diverse (475 spp.) and originated in the Neotropics, but has diversified in seasonally dry grasslands, savannas, and desert scrub habitats of subtropical and temperate North America, making it an ideal group for studying the origin of temperate grassland flora. However, classification and an understanding of evolution within the American milkweed vines have been difficult to clarify due to extensive morphological variation within the group. To address this problem, we use a combination of DNA sequences from single copy nuclear genes and chloroplast regions as well as next generation sequencing data to investigate the evolutionary relationships within the group. Evolutionary relationships within a broadly-sampled subtribe are presented and implications for classification are discussed.

The Impact of Recreational Therapy on Functional Independence among Individuals Participating In Inpatient Rehabilitation

Michelle Miller, Melissa Zahl
Oklahoma State University
School of Applied Health and Educational Psychology
Subject Area: Biomedical Sciences

The objective of this retrospective medical chart review was to evaluate the relationship between change in FIM scores and recreational therapy, controlling for age and admission FIM scores. Patients with a neuromuscular diagnosis (N = 1034) participating in inpatient rehabilitation were included. Three hierarchical regression analyses were conducted 1) overall FIM score, 2) motor FIM score, and 3) cognition FIM score while controlling for age and admission FIM scores. Regression model 1: 12.9% of the variance (R^2=.129, F(3,690)=34.060, p<.000) was explained by the independent variables, age and admission score were statistically significant to the prediction, p.<.000. Regression model 2: 7.9% of the variance (R^2=.079, F(3,690)= 19.653, p<.000) was explained; age and admission motor subscale score were significant. Regression model 3: 45.8% of the variance in the dependent variable included three independent variables admission cognitive scores, age, and TR treatment units (R^2=.458, F(3, 690)= 194.742, p<0.000), all were significant. This research indicates that recreational therapy independent of age and admission FIM score contributes a small percentage to changes in FIM scores, specifically looking at the cognition subscale. It should be noted, that the smallest of changes in variances may be meaningful to patients with a neuromuscular diagnosis in rehabilitation.

Ecosystem-level effects and soil alterations following woody species encroachment onto tallgrass prairie

Laura Mino, Gail Wilson
Oklahoma State University
Department of Natural Resource Ecology and Management
Subject Area: Biological Sciences

Currently, it is estimated that as little as 1% of the historical range of Great Plains grasslands remains intact. One of the greatest current threats to these ecosystems worldwide is woody species expanding (or encroaching) into native grasslands. While many studies have documented aboveground consequences of encroachment, little research exists on belowground ecosystem-level effects, such as alterations in arbuscular mycorrhizal fungal abundance, following woody plant establishment. Mycorrhizal interactions have previously been shown to play critical roles in native plant species dominance and positively contribute to soil function of grassland ecosystems. Woody species expanding their native ranges may competitively engage with dominant grasses for mycorrhizal associations but these potential competitive interactions have
not yet been determined. Our study assesses abiotic and biotic soil characteristics of native tallgrass prairie and adjacent areas with established stands of the following encroaching woody species: *Cornus drummondii*, *Gleditsia triacanthos*, *Juniperus virginiana*, and *Rhus aromatica*. Our results indicate establishment of these encroaching species may result in species-specific alterations in abiotic and biotic soil characteristics. These ecosystem-level alterations may serve as mechanisms facilitating the rapid conversion of grasslands to woodlands, and may pose substantial challenges to grassland restoration.

**Synthesis of Polysaccharides grafted Polyhedral oligomeric silesquioxanes based nanocomposites for high performance applications**

**Muthu Subramanian Mohan, Kunal Mishra, Ranji Vaidyanathan**

Oklahoma State University  
School of Materials Science and Engineering  
Subject Area: Physical Sciences Technology

A system of the preparation of polymer grafted nanoparticles as a filler for epoxy composites is focused herein for 1) the improvement in interlaminar properties and 2) to enhance the biodegradability potential in the field of nanocomposites by using a natural polymer as matrix. The aerospace and automobile structures are often susceptible to low velocity impact and hence they are highly prone to delamination. To serve this cause, nanomaterials are used in the composites which impart various toughening mechanisms to avoid delaminations. But one of the most persisting problems with the nanofillers is its poor ability to disperse in the composites matrix. To overcome this problem we focused on the grafting the nanofillers with natural polymer for its superior dispersion in the matrix. In our system, Glycidyl Polyhedral oligomeric silesquioxanes (GPOSS) nanoparticles grafted with amylopectin polysaccharide is chosen as model nanofiller for the epoxy composites. Both amylopectin and GPOSS was covalently grafted by the reaction between hydroxyl groups of amylopectin and epoxy groups of GPOSS. The performance of Amylopectin grafted GPOSS as nanofiller in epoxy composites is evaluated using DCB test.

**Using Student Behavior as an Indicator of Engagement**

**Michael Moore, Cara Stephens, Donald French**

Oklahoma State University  
Department of Integrative Biology  
Subject Area: Education

What makes the flipped classroom successful? Does the choice of active learning strategies used in class matter? We used scan sampling to record student’s attention in a flipped, introductory-science classroom at a public university. We collected data on four different activities: Verso (discussion board), group activities, class discussion, and clickers in five-minute intervals over fifteen minute periods. Prior research in traditional lecture classrooms shows that students have a fifteen-minute attention span. Student’s behaviors were recorded and categorized as either on task or off task. We found that in most cases there was no statistical difference across the time points, meaning the activity maintained their attention consistently. When comparing the first five minutes of each of the four activities, we found, using a post hoc comparison, that off-task behavior during Verso accounted for the significant difference at the 5 minute time point. When looking at each activity individually, we found a significant difference in student behavior across fifteen minutes during group activity. A post-hoc comparison indicated that the difference occurred at the 15 minute time point. In this session we present details of these observations, discuss several hypotheses for the differences, and compare these results to results from a lecture class.
Impaired Working Memory Performance Among Worriers: Insights from Event-Related Potentials

Mariah Nacke, Evan White, M.S., Danielle Taylor, B.A., Kristen Frosio, B.A., Marissa Foore, & DeMond Grant, Ph.D.

Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Generalized anxiety disorder (GAD) is characterized by chronic worry, which is associated with hypervigilance to threatening stimuli (Andor, Gerlach, & Rist, 2008) and increased attention to external cues, thus affecting performance on cognitive tasks. A measure for rapid attention resource allocation to specific stimuli is the Late Positive Potential (LPP), an Event-Related Potential (ERP) component that indexes the amount of attentional resources devoted to processing an event (Cuthbert et al., 2000). Thus, in the current study the LPP was used to index attention to threatening distractors. It is hypothesized that increased attention to distracting images (i.e., greater LPP amplitude) will be related to lower working memory performance. Thirty-eight participants from a large Midwestern university completed a working memory task with intermittent distractor images. Regression analysis indicated that worry and LPP amplitude to distractors did interact to significantly predict working memory performance. This supported the hypothesized relationship between high worry, attention to distractors and working memory performance. Future research is needed to further delineate the nature of these relationships in an effort to document the mechanisms of worry's impact on cognitive processes.

Biphasic Reactor Modeling and Simulation: Hydrogenation of p-Hydroxybenzaldehyde


Oklahoma State University
Department of Chemical Engineering
Subject Area: Physical Sciences Technology

A thorough understanding of biphasic reactors, where reaction and phase distributions simultaneously take place, can be obtained by modelling and simulations. Hydrogenation of p-hydroxy benzaldehyde in water-decalin mixture which is used in upgrading biofuels from fast pyrolysis was used as a case study. An algorithm for the modeling of biphasic catalytic reactors describing both reaction kinetics and phase separation was implemented. The reaction-phase distribution was mathematically represented by the Langmuir-Hinshelwood isotherm and NRTL thermodynamic model. ASPEN PLUS and Visual Basic for Application were used to implement the model and simulate this biphasic reaction process and phase separation. Experimental data on the p-hydroxybenzaldehyde hydrogenation reaction were used in developing the kinetic model and performing the process simulation. Further, case studies were conducted to examine the accuracy of the phase behavior predictions provided by the non-random, two-liquid (NRTL) activity coefficient model. The results indicate that modeling biphasic reactors as kinetically constrained equilibrium systems simulates the process with reasonable accuracy. Further, for systems lacking binary equilibrium data, a priori NRTL model binary parameters predictions based on quantitative structure–property relationship parameter generalization and UNIQUAC Functional Group Activity Coefficient can be alternatively used depending on availability.
Estimation of Agricultural Total Factor Productivity in Zambia

John Ngombe, John N. Ng’ombe, Kelvin Mulungu

Oklahoma State University
Department of Agricultural Economics
Subject Area: Social Sciences

In response to falling agricultural productivity levels in Sub-Saharan Africa, most governments have substantially invested in the promotion of better technologies that result in agricultural productivity gains. For Zambia, previous research has reported a decline in agricultural productivity and operation of smallholder farmers below their frontier. But no empirical study has been undertaken to determine the agricultural total factor productivity (ATFP) that would help policy makers and government to understand how to improve the agricultural sector’s efficiency. This study estimates the ATFP using time-series World Development Indicators’ data from 1971-2013 by employing the Roe, Smith and Choi (2014) model. Our results indicate that Zambia’s ATFP has remained volatile but averaged around -0.004 from 1971 to 1991 and 1992 to 2013 while agricultural output growth was 2.4 % and 1.9% in respective periods. We further find more positive ATFP values during market liberalization and post-privatization period of public agricultural institutions and more negative values in a drought-prone period, something that entails need for policies that would make agriculture more resilient.

A Quantum Random Walk with Bose-Einstein Condensate

Jiating Ni, Wakun Lam, Siamak Dadrasmarani, Jerry Clark, Gil Summy

Oklahoma State University
Department of Physics
Subject Area: Physical Sciences Technology

We experimentally implement a quantum random walk in momentum space by exposing a Bose-Einstein condensate (BEC) to a time-periodic optical lattice. The quantum diffusive behavior of the BEC is controlled by a “coin-tossing” process realized by superposed internal states with certain relative phase. We observe that the momenta of BEC diffuse in a fast manner comparing to the classical random walk. This provides us a tool to control the profile of momentum distribution which is useful in many applications of quantum computing.

Gold Phosphide Reactions

Toni Nigro, Dr. Yolanda Vasquez, Deshani Fernando

Oklahoma State University
College of Arts and Sciences
Subject Area: Biological Sciences

Many metal phosphides are important components in electric devices as semiconductors, photochemical devices, and as catalysts. The challenge that has brought on interest in forming Au2P3 is using gold nano rods and reacting them with a phosphorous source to ultimately produce Au2P3 and control the size and shape of the product. We’ve utilized a thermodecomposition technique to form the metal phosphide nano rods all while altering the ratios of our phosphorous source, Tri-n-octylphosphate (TOP), and the length of time the reactions have been performed. Our results have been promising in the formation of Au2P3, however we have found that controlling the morphology of the rods has been difficult and has shown some interesting shapes and sizes. We hope to take what we have seen in the morphology and perform further experiments in order to see what the intermediate forms are as Au2P3 nano rods are forming.
Mango Supplementation Prevents Gut Microbial Dysbiosis and Modulates Short Chain Fatty Acid Production Independent of Body Weight Reduction in C57BL/6 Mice Fed a High Fat Diet

Babajide Ojo, Guadalupe Davila El-Rassi, Penelope Perkins-Veazie, Stephen Clarke, Brenda J. Smith, Edralin A Lucas

Oklahoma State University
Department of Nutritional Sciences
Subject Area: Biological Sciences

Some dietary components are known to prevent high fat-induced gut dysbiosis. We investigated the effects of freeze-dried mango pulp on 1) cecal microbial population, 2) body composition, glucose homeostasis and plasma lipids, and 3) short-chain fatty acid (SCFA) production and gut inflammatory markers. Six week-old male C57BL/6 mice were randomly assigned to four dietary treatment groups: control (AIN-93M, 10% kcal from fat), high-fat (HF, 60% kcal from fat), and HF+1% or 10% mango (w/w) for 12 weeks. Gut microbial changes were determined by 16S rDNA sequencing of cecal samples. Body composition, plasma glucose and lipids, cecal and fecal short-chain fatty acids (SCFA), and mRNA abundance of inflammatory markers in the ileum and colonic lamina propria were assessed. HF feeding significantly reduced the beneficial bacteria (i.e., Bifidobacteria and Akkermansia species) compared to control while mango dose-dependently prevented this reduction without a decrease in body weight or fasting blood glucose. Elevated plasma triglyceride in the HF group was abolished with mango supplementation. A dose-dependent increase in fecal and cecal acetic and butyric acid was observed with mango supplementation compared to HF group. Furthermore, mango supplementation increased ileal and colonic IL-10 gene expression compared to the HF group indicating modulation of gut inflammation.

Nonvolatile Main Memory Aware Garbage Collection in High-Level Language Virtual Machine

Chen Pan, Mimi Xie, Chengmo Yang, Zili Shao, Jingtong Hu

Oklahoma State University
School of Electrical and Computer Engineering
Subject Area: Physical Sciences Technology

Non-volatile memories (NVMs) such as Phase Change Memory (PCM) have been considered as promising candidates of next generation main memory for embedded systems due to their attractive features. These features include low power, high density, and better scalability. However, most existing NVMs suffer from two drawbacks, namely, limited write endurance and expensive write operation in terms of both time and energy. These problems are worsen when modern high-level languages employ virtual machine with garbage collector that generates a large amount of extra writes on non-volatile main memory. To tackle this challenge, this paper proposes three techniques: Living Objects Remapping (LORE), Dead Object Stamping (DOS), and Smart Wiping with Maximum Likelihood Estimation (SMILE) to reduce the unnecessary writes when garbage collector handles objects. The experimental results show that the proposed techniques not only significantly reduce the writes during each garbage collection cycle but also greatly improve the performance of virtual machine.

Accurate prediction of cyclohexane-to-water distribution coefficients with molecular simulations on the Cowboy High Performance Supercomputer

Shanaka Paranahewage, Dr. Christopher Fennell

Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

Accurate prediction of distribution coefficients of small molecules between different chemical environments is critical for the development and efficacy assessment of new drug candidates. Unfortunately, inaccurate atom type parameters can result systematic biases in estimations of distribution coefficients from molecular dynamic simulations. We have tested three different scaling methods of force field parameters to determine
the distribution coefficients between cyclohexane and water for a set of 30 small molecules, spanning a broad swath of chemical interest, using detailed molecular simulations. We found that the solvent dielectric quality and condensed phase polarization of the ligand plays a critical role inaccurate estimation of these values and the removal of systematic biases in simulation parameters. Based on the study set results and procedure developed, we have estimated cyclohexane-to-water distribution coefficients for 53 ligands as part of the SAMPL5 prediction.

Choice-Impulsivity in Children and Adolescents with Attention-Deficit/Hyperactivity Disorder (ADHD): A Meta-Analytic Review

Connor Patros, R. Matt Alderson, Lisa J. Kasper, Stephanie J. Tarle, Sarah E. Lea, Kristen L. Hudec

Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Impulsive behavior is a core DSM-5 diagnostic feature of attention-deficit/hyperactivity disorder (ADHD) that is associated with several pejorative outcomes. Impulsivity is multidimensional, consisting of two subconstructs: rapid-response impulsivity and reward-delay impulsivity (i.e., choice-impulsivity). While previous research has extensively examined the presence and implications of rapid-response impulsivity in children with ADHD, reviews of choice-impulsive behavior have been both sparse and relatively circumscribed. This review used meta-analytic methods to comprehensively examine between-group differences in choice-impulsivity among children and adolescents with and without ADHD. Twenty-eight tasks (from 26 studies), consisting of 4,320 total children (ADHD = 2,360, TD = 1,960), provided sufficient information to compute an overall between-group effect size for choice-impulsivity performance. Results revealed a medium-magnitude between-group effect size ($g = .47$), suggesting children and adolescents with ADHD exhibited moderately increased impulsive decision-making compared to TD children and adolescents. Further, relative to the TD group, children and adolescents with ADHD exhibited similar patterns of impulsive decision-making across delay discounting and delay of gratification tasks. However, the use of single-informant diagnostic procedures relative to multiple informants yielded larger between-group effects, and a similar pattern was observed across samples that excluded females relative to samples that included females.

Field evaluation of the ZeroFly® Storage Bag as a barrier to insect pest infestation

Sulochana Paudyal, George P. Opit, Enoch A. Osekre, James K. Danso, Naomi Manu, and E. P. Nsiah

Oklahoma State University
Department of Entomology and Plant Pathology
Subject Area: Biological Sciences

The deltamethrin-incorporated polypropylene (PP) bag, ZeroFly® Storage Bag, is a tool used to reduce losses by stored-product insects. ZeroFly bags filled with untreated maize were compared with PP bags filled with Betallic-treated maize and PP bags filled with untreated maize (control). The experiment was conducted from February to August 2015, at four different locations of Ghana. Moisture content, number of live and dead insects, insect damaged kernels (IDK), and maize weight loss data were collected monthly. ZeroFly bags and Betallic treatment significantly reduced insect damage compared to control treatment. ZeroFly bags were able to keep IDK level below 5% till June, but the levels increased to 10.2% in August. In the control, IDK increased significantly over time and reached 32% after 6 month. The ZeroFly bag was effective against *Sitophilus*, *Tribolium*, and *Cryptolestes* species for 4 month. Weight loss of $\leq 3.68\%$ was recorded in ZeroFly bags whereas, $11.88\%$ loss in PP bags at August. Among three treatments, Betallic was more effective in terms of suppressing insect populations, reducing IDK, and minimizing weight loss. Result shows ZeroFly bags are effective for 4 month, but could also protect grains for longer if insect-free grains are used to fill bags.
Structure of hexadecyltrimethoxysilane on silica

M.A. Helanka Perera, J. Perera and Frank D. Blum
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

The structural assemblies of hexadecyltrimethoxysilane (HDTMS) on silica particles were studied by temperature–modulated differential scanning calorimetry (TMDSC), thermogravimetric analysis (TGA), and Fourier transform infrared spectroscopy (FTIR). HDTMS molecules adsorbed at very small adsorbed amounts (< 0.8 mg/m²) molecules were directly bound to the silica surface as isolated molecules and their aggregates were more likely to be amorphous. These molecules were found to have very small enthalpies for both melting and crystallization of HDTMS hydrocarbon chains. The enthalpies were found to increase linearly with adsorbed amounts. With increasing adsorbed amount of HDTMS (> 0.8 mg/m²) melting and crystallization enthalpies started to increase exponentially and reached the bulk HDTMS enthalpy for samples with more than 15 mg/m². The increased enthalpies for samples with more than 0.8 mg/m² during transitions indicate that HDTMS molecules underwent structural changes, from surface to bulk.

Simulation of Infrared Attenuated Total Reflection Spectra of Automotive Paints

Undugodage Don Nuwan Perera, Barry K. Lavine, Koichi Nishikida
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

Modern forensic laboratories are using attenuated total reflection (ATR) spectroscopy for infrared (IR) analysis of automotive paints. Although ATR is a widely used sampling technique in IR spectroscopy the IR spectrum of an automotive paint sample obtained by ATR exhibits distortions compared to its transmission counterpart, e.g., band broadening and lower relative intensities and skewed peaks at higher wavenumbers. This hinders library searching as infrared libraries are comprised of transmission spectra. In the study, IR search prefilters have been developed from transmission spectra in the Paint Data Query (PDQ) library that were transformed into ATR spectra using an ATR simulation algorithm for the purpose of identifying the assembly plant of the vehicle involved in a hit-and-run accident from an ATR spectrum of an unknown paint sample. Both simulated and experimental ATR spectra were preprocessed using the discrete wavelet transform and wavelet coefficients characteristic of the assembly plant of the automotive vehicle were identified using a genetic algorithm (GA) for pattern recognition analysis. Even in challenging trials where the paint samples evaluated were all from the same manufacturer (General Motors) within a limited production year range (2000-2006), the respective assembly plant of the vehicle was correctly identified.

A comparative analysis of microRNAs in Flaveria species of C₃, C₃-C₄ intermediate and C₄ photosynthesis

Robert Pokoo, Ramanjulu Sunkar
Oklahoma State University
Department of Biochemistry and Molecular Biology
Subject Area: Biological Sciences

Photosynthesis is a chief metabolic process through which plants synthesize carbohydrates in the presence of sunlight using atmospheric carbon dioxide and water. Flaveria genus belongs to the family Asteraceae and its species differ greatly in their mode of photosynthesis as some are C₃, some others are C₄ and even some others are C₃-C₄ intermediates. This makes Flaveria a valuable model system to investigate at the molecular level, how C₄ type has evolved from ancestral C₃ type. MicroRNAs (miRNAs) are a group of small non-coding RNAs that negatively regulate expression of their target genes at the posttranscriptional level. This miRNA-mediated gene regulation is critical for almost all biological processes of plant life cycle.
However, so far, the role of miRNAs in the evolution of C₄ photosynthesis from its ancestral C₃ type is unknown. To address whether or not miRNAs have a role in this process, we have sequenced and analyzed miRNAs in the leaves of Flaveria trinervia (C₄), Flaveria bidentis (C₄), Flaveria ramosissima (C₃-C₄) and Flaveria robusta (C₃). The analyses revealed significant differences for various conserved miRNAs. By sequencing degradome libraries, potential target genes regulated by these miRNAs have also been identified in these different Flaveria species.

Screening of winter wheat DH population for highest photosynthetic capacity under normal and heat stressed conditions

Pratishtha Poudel, V.G. Kakani
Oklahoma State University
Department of Plant and Soil Sciences
Subject Area: Biological Sciences

Photosynthesis is the major factor responsible for assimilates for grain formation in Wheat. Factors like atmospheric CO₂ concentration and temperature, and soil moisture conditions affect the process of photosynthesis. However, photosynthesis varies from genotype to genotype depending on growing conditions. The objective of this study was to investigate winter wheat genotypes variation in photosynthesis under normal and heat stressed conditions. A total of 100 genotypes from double haploid population developed by Wheat Improvement Team at Oklahoma State University were studied using the Controlled Environmental Research Laboratory at OSU. A set of genotypes was maintained under controlled conditions (22/16 °C) throughout the experiment and another set was subjected to heat stress (32/26 °C) starting at 65 days after sowing. Data on photosynthesis and stomatal conductance was recorded twice at 3 day interval after stress treatment using LI-6400 (Licor Inc., NE, USA). The results show differences between genotypes and in interaction with temperature treatments. The findings of this research will be useful to identify genotypes with highest photosynthetic capacity for use in future breeding programs.

The effect of Ca²⁺ on the production of virulence factor, rhamnolipid, in a human pathogen Pseudomonas aeruginosa

Tyler Pound, Michelle King, Marianna A. Patrauchan
Oklahoma State University
College of Arts and Sciences
Subject Area: Biological Sciences

Pseudomonas aeruginosa is a gram-negative, opportunistic pathogen that is known to infect open wounds, burns, and the lungs of Cystic Fibrosis patients. Calcium (Ca²⁺) has been known to induce production of several P. aeruginosa virulence factors including pyocyanin and alginate. It also enhances swarming motility, which is required for biofilm formation. In order to swarm, cells need to produce and secrete rhamnolipid, a biosurfactant that aids cells in moving across a semisolid surface. This requirement together with the fact that elevated Ca²⁺ increases swarming motility suggested that calcium may also induce biosynthesis of rhamnolipid. To quantify rhamnolipid production, we used Orcinol Assay, commonly utilized for detecting extracted rhamnose production. P. aeruginosa cells were grown in the presence of 5 mM Ca²⁺ or without adding Ca²⁺. Rhamnolipid was extracted and quantified. We are currently quantifying total cellular protein, which will be used to normalize rhamnolipid data. Following this analysis, we will test the effect of Ca²⁺ on the activity of the rhlA promoter using gfp-fusion. rhlA is a gene that is crucial for rhamnolipid production. Fluorescence will be measured in elevated Ca²⁺ to determine if the transcription of the rhlA gene is induced by Ca²⁺.
Pretreatment of plant biomass using fungi and bacteria

Sway Pradhan, Babu Fathepure
Oklahoma State University
Department of Microbiology and Molecular Genetics
Subject Area: Biological Sciences

Delignification is a critical step in the bioconversion of lignocellulosic biomass into useful monomers. Fungi and bacteria both have evolved pathways to degrade lignin. However, only little efforts have been made to study them together as integrated microbial system. The major focus of this research is to study lignin degradation using Pseudomonas sp. YS-1p and Phanerochaete chrysosporium when inoculated as individual cultures as well as in co-cultures with varying ratios of fungi to bacteria on mineral salts medium supplemented with plant biomass. Two different plant biomass were used, including sugarcane bagasse and switchgrass. Flasks were inoculated with P. chrysosporium (F) and strain YS-1p (B) at various ratios including 1:0 (F:B), 1:1 (F:B), 1:10 (F:B), 1:50 (F:B) and 0:1 (F:B). Culture samples were withdrawn periodically to assay for lignin peroxidase (Lip) and Dye decolorizing-peroxidase (DyP) and also to monitor population dynamics of the microorganisms used. Our preliminary results show that lignin degrading enzyme activity depended on the type of plant biomass used. Monitoring of microbial population dynamics during the course of plant biomass degradation showed that strain YS-1p grew best in the presence of P. chrysosporium suggesting that bacteria might have benefitted from degradation products of fungus.

From virgins to fathers: Hormonal correlates of the onset of paternal behavior in Algerian mice Mus spretus

Dineesha Premathilake, Melissa Dandy, Polly Campbell
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Paternal care is rare among mammals because males tend to show sexual competition rather than caring for the young. It is an interesting thing to study the factors that affect the onset of paternal behavior. Paternal care is mostly associated with a monogamous mating system. The Algerian mouse Mus spretus has a monogamous mating system. It has been found that fathers show paternal behavior towards their own pups. But the behavior of virgin males towards pups is unknown. To study the onset of paternal behavior virgin males, fathers and experienced fathers (n=15) were exposed to 3-5 day old unfamiliar pups. Males were scored for latency to first contact, number of contacts, latency to attack and retrieve. Repeated measures of ANOVA was used to test for a difference in latency to first contact and number of contacts at different stages of paternal experience. There was no significant difference in these behaviors. However, the percent of males that retrieved pups was higher in experienced males than in virgins and fathers, and the percent of males that attacked pups was lower in experienced males than in virgins and fathers. Further, the effect of prolactin for this behavioral change will be studied.

Economic Contrast of Independent and Competitive Water Extraction Under Limited Water supply

Karthik Ramaswamy, Art Stoecker
Oklahoma State University
Department of Agricultural Economics
Subject Area: Social Sciences

The study provides the net benefits from crop choice, irrigation system and size of land when well extractions are competitive and non-competitive under limited water supply. In most southern parts of the Great Plains, Ogallala aquifer recharge rates are almost negligible, which makes the water supply a finite resource. Existing irrigated corn production gives greater return per acre, but, declining water levels results in reduced yields and increasing pumping cost. Recent research and variety trials have shown that 190
bushels of corn needs 22 acre-inches while sorghum takes 9.4 acre-inches to produce 150 bushels. For each well capacity, frequency to irrigate a quarter-section and gross rate applied using center pivot and subsurface irrigation systems are incorporated into an EPIC simulation to calibrate the expected inputs and outputs. Using Cooper-Jacob approximation, competitive and non-competitive possible well extraction rates are decided for the remaining saturated thickness after superimposing the influence of surrounding well drawdowns. Actual drawdown, net return and water use are used to quantify the parameters in the programming model, where irrigation purchases take the integer values. A Mixed Integer Programming (MIP) was developed to derive the maximum net benefits for competitive and non-competitive extractions rates from the remaining groundwater supply.

**Preparation and Characterization of Polar Silica Stationary Phases for Hydrophilic Interaction Liquid Chromatography**

Renuka Rathnasekara, Ziad El Rassi  
Oklahoma State University  
Department of Chemistry  
Subject Area: Physical Sciences Technology

Hydrophilic interaction chromatography (HILIC) which uses a polar (hydrophilic) stationary phase with an organic-rich hydro-organic mobile phase in order to separate polar analytes has gained an increasing interest among separation scientists over the past few decades. Three novel silica based HILIC stationary phases have been synthesized by covalent attachment of different polar functionalities to bare silica micro particles. In all cases, the basic silica support was coated with an epoxy active layer via the reaction of silica with \( \gamma \)-glycidoxypropyl trimethoxysilane. Thereafter, the activated epoxy silica thus obtained was covered with a layer of either tris(hydroxymethyl)aminomethane (TRIS) or sorbitol (SOR) yielding the singly layered silica stationary phase. The TRIS-silica was further coated with a layer of chondroitin sulfate A (CSA) yielding the multi-layered hydrophilic silica stationary phase referred to as CSA-TRIS-silica sorbent. An extensive chromatographic characterization was conducted to assess the extent of each coating step in achieving the singly and multilayered polar coating of the silica microparticles. This included the effect of mobile phase composition, e.g., ACN, buffer and pH on retention factor, selectivity, efficiency and peak resolution. As expected each coating yielded unique retention pattern and selectivity towards the polar and slightly polar solutes tested.

**The removal of arsenic species from fruit juice and other aqueous samples using iron oxyhydroxides**

Travis Reed, Allen Apblett  
Oklahoma State University  
Department of Chemistry  
Subject Area: Physical Sciences Technology

Contamination of arsenic species have been found in various natural water systems and widely sold foodstuffs. These contaminants can have ill effects on human health, especially, on the very young. Arsenic contamination in juice has been given quite a bit of attention and even causing an action limit of 10 ppb to be put into place by the FDA to match that for potable water set by the EPA. The development of materials that can be used for removal of arsenic from these products is of importance to help allow for safer drinking for communities world-wide. Nanocrystalline iron and zinc oxyhydroxides and their solid solutions have been shown to uptake arsenic from various aqueous real life samples. These materials have the benefit being easy to synthesize by the low temperature decomposition of the metal pyruvic acid oxime salts leading to the only by-products being small volatile organic fragments and the metal oxide. This study will discuss the treatment of arsenic contaminated samples and fruit juice by iron/zinc oxyhydroxides.
Low-Frequency Acoustic Noise Mitigation Characteristics of Metamaterials-Inspired Vibro-Impact Structures

Anuj Rekhy, James Manimala
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

Acoustic absorbers like foams, fiberglass or liners conventionally used in aerospace structures have limited effectiveness to mitigate low-frequency (LF) noise below ~400 Hz, a significant contributor to environmental noise pollution, unwanted structural responses, enhanced acoustic signature and reduction in quality of performance. Drawing inspiration from metamaterials, which are manmade materials that derive their unique dynamic behavior not just from material constituents but more so from engineered configurations, we investigate tuned mass-loaded membrane type vibro-impact attachments on a baseline structure to make it more effective as a LF acoustic barrier. Incident LF waves are shown to be up-converted via impact to higher modes in the backing structure. Up to 36 dB of transmission loss increase is obtained within a tunable LF frequency bandwidth of about 200 Hz owing to the mechanism of anti-resonance while vibro-impact driven up-conversion enables subsequent dissipation in conventional absorbers. Experimental proof-of-concept and correlations to simulations are utilized to optimize the vibro-impact mechanism using parametric studies. Structurally integrated concepts for operational environments are also explored. Successful transition to applications could enable new mission capabilities for aerospace and military vehicles and help create quieter built environments.

Customizing a Bioprinter for Printing Cell-laden Hydrogels

Kevin Roehm, Sundar V. Madihally
Oklahoma State University
Department of Chemical Engineering
Subject Area: Biomedical Sciences

Tissue engineering focuses on producing tissues and organs outside of the body to meet the demand for transplantable tissue. Bioprinting, 3D printing of cells or cells encapsulated in carrier inks, is unique in tissue engineering: the spatial location of multiple cell types incorporated into a printed tissue can be controlled. Hydrogels are one carrier ink used for bioprinting. However, current hydrogel inks need damaging crosslinking agents (ultraviolet, pH or chemical) to gel (transition from liquid to solid). In contrast, gelatin-chitosan hydrogels gel when the temperature is raised from room temperature to body temperature (37°C). Initially entrapped air and particulates caused clogging and a custom print head was required to accept sterile syringes. We addressed these issues by removing entrapped air and particulates by centrifugation, working with an industrial partner to modify a printer to accept syringes, and creating custom code to instruct the printer. Acellular printing was achieved. Then cells, pre-stained with a fluorescent dye, were mixed with the hydrogel solution, printed onto an agarose substrate under sterile conditions, and examined under a fluorescent microscope. We are determining the effect of printer settings on cell viability, stresses experienced by cells, sterility of the printing process, and stability of printed constructs.

Opportunity Identification in Social Entrepreneurship: An Empirical Study

Paul Sanchez-Ruiz, Paul Sanchez-Ruiz, Craig Watters
Oklahoma State University
School of Entrepreneurship
Subject Area: Social Sciences

This empirical study concerns the opportunity recognition process in a context of extreme poverty conditions. One problem in the extant social entrepreneurship literature is that it is too focus on discover external factors that facilitate the creation of businesses. This problem is even more pronounced in undeserved areas of social entrepreneurship. Therefore, the purpose of our study was twofold. First, to
document – on a holistic view – how young entrepreneurs living in extreme poverty conditions identify opportunities. Second, to understand what are the opportunities that young entrepreneurs select in order to potentially start a business. Thus, through the lens of the behavioral theory of the firm, we paid attention to the attributes of opportunities – prevalence, relevance, urgency, accessibility, and radicalness. These attributes influence the opportunity recognition process of young entrepreneurs living in underserved areas. Our findings indicate how young entrepreneurs discover opportunities and what opportunities young entrepreneurs select to start a business in underserved communities. We hope that our study will stimulate research on the area of opportunity recognition in social entrepreneurship. We believe the role of social entrepreneurship in the economy of any country is vital, but more importantly, empowers entrepreneurs to reduce the unequal economically gaps in their countries.

Personality influences anti-predator response in snails

Lauren Schmidt, Christopher G. Goodchild, Sarah E. DuRant
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Animals have many strategies to protect themselves against predators, such as avoidance and refuge-seeking behaviors. Animal personality, which is defined as a set of consistent behaviors, is a framework that has been used to categorize individuals as being "shy" or "bold". There are ecological costs and benefits to different personality types (e.g., predation risk, access to resources), and it is possible that personality determines which antipredator strategy an animal will use. Our objectives were (1) to determine whether snails exhibit repeatable behaviors that can be classified as personality and (2) to determine the ecological significance of personality in coping with predators. We initially determined personality (i.e., shy vs. bold) by measuring latency to emerge. We then exposed both personality types to predator and no-predator environments. Throughout the experiment we took weekly measurements of emergence time and avoidance behavior, and at the end we measured shell crush resistance. Our data suggest that latency to emerge is repeatable and indicative of a personality type. Additionally, we found that, in the presence of a predator, "shy" snails will invest greater resources in their shell, whereas "bold" snails will exhibit avoidance behaviors. These results suggest that defense strategies are linked to personality type.

The Effect of Two Back Squat Intensities on Vertical Jump Height in Resistance-Trained Females

Jessica Schnaiter, Ryan M. Thiele, Douglas B. Smith, Eric C. Conchola
Oklahoma State University
School of Applied Health and Educational Psychology
Subject Area: Education

Previous authors have observed deficits in vertical jump height (VJH) following free-weight back squats; however, few have investigated these findings comparing two different protocols. PURPOSE: Investigate the effects of two free-weight back squat protocols on VJH (inches) in resistance-trained females. METHODS: Seventeen resistance-trained females (age=21.6±1.1years), completed a familiarization trial in which a one-repetition maximum (1-RM) was determined for the back squat, followed by two randomly assigned days of testing, separated by 4-7 days. Protocols consisted of five sets of eight repetitions at 80% 1-RM or five sets of sixteen repetitions at 40% 1-RM of back squats. Vertical jumps (VJs) were performed before (Pre), after (Post0), five (Post5), ten (Post10), fifteen (Post15), and twenty (Post20) minutes following completion of back-squats. A two-way repeated-measures analysis of variance (ANOVA) (intensity [40% vs. 80%] × time [Pre vs.Post0 vs.Post5 vs.Post10 vs.Post15 vs.Post20]) was used to analyze VJH. RESULTS: There was no significant intensity × time interaction (P=0.833), however, a main effect for time was observed at Post0, Post15, and Post20 (P=0.0001-0.009). CONCLUSION: These findings show similar results to previous studies that have tested VJ measures following back squat protocols, in which inconsistent recovery patterns may exist.
Strength and Comprehensiveness of Mandated School District Wellness Policies in Relation to Health-Related Student Fitness Measured by Fitnessgram®

Dean Seidman
Oklahoma State University
Department of Nutritional Sciences
Subject Area: Biomedical Sciences

School wellness policies (SWP) are federally mandated documents developed by school districts with the objective of addressing nutrition and physical activity. Following implementation of SWPs, health outcomes of students such as obesity and fitness, have been of interest. This study sought to see if there is a connection between the strength and comprehensiveness of SWPs and physical fitness in students, as measured by Fitnessgram®. 747 students were obtained from 27 districts receiving funding from PEP grants to conduct Fitnessgram® testing and review SWPs. Strength (\(\bar{x}=24.13\)) and comprehensives (\(\bar{x}=48.91\)) scores from Oklahoma districts that were evaluated were lower than national averages. Regression analysis showed there was no relationship between fitness and strength (p=0.18) or comprehensiveness (p=0.182), however gender and fitness was significantly correlated (p=0.04). Correlation analysis further confirmed that there was no relationship between district mean fitness and strength (r=0.14, p=0.48) or comprehensiveness (r=0.14, p=0.48). Although physical fitness can be related to childhood obesity, results from this study suggest SWPs in Oklahoma are not strong or comprehensive enough to facilitate change in student fitness. School districts should consider enhancing opportunities for physical activity and physical education not only in the school, but also among the home and community environments.

Alteration in vadose zone moisture and water level with juniper encroachment in a grassland: the use of time-lapse electrical resistivity imaging and monitoring wells

Bharat Sharma Acharya, Todd Halihan, Chris B Zou
Oklahoma State University
Department of Natural Resource Ecology and Management
Subject Area: Biological Sciences

Information on soil moisture and its spatio-temporal variability along the vadose zone profile is important to detect the existence and assess the magnitude of deep drainage and flow pathways under different vegetation. Time-lapse electrical resistivity imaging (ERI), a geophysical method, was used to monitor vadose zone moisture and infer deep drainage in tallgrass prairie and a prairie heavily encroached by a juniper species (Juniperus virigiana) in the south-central Great Plains, US. Time-lapse electrical resistivity imaging (ERI) indicate (a) vegetation induced vertical soil moisture profiling, (b) increased spatial-temporal variability in root zone conductivity under juniper-encroached catchment compared with grassland catchment, (c) two-layered moisture migration profiles and (d) lower percentage of change in conductivity in top 3 m and higher below 3 m soil depth across vegetation. Similarly, two groundwater monitoring wells of 3 m depth were drilled in a hydraulically conductive location as indicated by electrical resistivity imaging in the experimental catchments. Results indicate higher water level under the grassland and reduced water level under juniper encroachment in a perched aquifer. Thus, spatio-temporal variability in vadose zone moisture and water level can be used for broader understanding of subsurface hydrology for land-use and groundwater management.
Quantitative genetics of phosphorus use in Daphnia

Ryan Sherman, Kristina Baker, Larry Weider, Puni Jeyasingh
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

It has been previously demonstrated that there is differential expression of genes under varied phosphorus (P) supplies between ancient and modern Daphnia pulicaria genotypes. This demonstrates that P limitation invokes widespread regulatory changes in Daphnia. Thus, regulatory changes may be important in adaptive responses as environmental P supply changes in lakes (i.e. eutrophication). Quantitative trait loci (QTL) mapping is a robust method to identify genomic regions underlying P-use. Mapping these QTLs will be accomplished by constructing mapping populations of F2 recombinant lines that allow one to identify regions of the genome containing putative QTLs for the phenotypic trait of interest (P-use). An F2 mapping population was created by crossing resurrected Daphnia pulicaria genotypes from older (~60-yr-old) and recent (~5-yr-old) sediment layers in South Center Lake, MN. F2 genotypes exhibit substantial variation in P use, and responses to changes in P supply. These genotypes are being sequenced to identify loci underlying differences in P use.

Biochemical Mechanisms of Insecticide Tolerance

Adam Simpson, Puni Jeyasingh, Jason Belden
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

Previous research has demonstrated that Daphnia pulicaria genotypes hatched from resting eggs—isolated from lake sediments varying in age—exhibit differential tolerance (median effect concentration – EC50) to the common-use insecticide, chlorpyrifos. Ancient (~700-yr-old) genotypes were more sensitive to this chemical, when compared to genotypes hatched from more recent sediment layers (~40-yr-old). To elucidate the mechanisms underlying this striking observation, we conducted a series of assays with the three most tolerant and three most sensitive genotypes. Tolerance to chlorpyrifos could occur through differences in: 1) uptake, 2) biotransformation/bioactivation, and/or 3) active sites of relevant enzymes (e.g., cholinesterase). An uptake study conducted using radio-labeled chlorpyrifos yielded no significant differences among genotypes. Furthermore, an enzyme activity assay indicated no significant differences in cholinesterase sensitivity to chlorpyrifos. However, acute toxicity tests with the toxic metabolite, chlorpyrifos-oxon, significantly reduced the variation in EC50 between tolerant and sensitive genotypes by ~3-fold. This variation was decreased further after the co-application of a metabolic inhibitor, piperonyl butoxide. These data suggest that bioactivation and detoxification of chlorpyrifos play an important role in determining tolerance to chlorpyrifos in this population. More generally, this work illuminates the mechanisms by which non-target taxa adapt to man-made chemicals.

Behavioral Theory and Family Identity: Conceptualizing their Role in Reducing Household Food Waste

Aditya Udai Singh
Oklahoma State University
Spears School of business
Subject Area: Social Sciences

Sustainability and climate change are major concerns the world over. They have prompted governments to take a close look at lifestyles and policies that affect waste generation and excessive greenhouse gas emissions. Within this domain, the issue of food waste and its harmful effects on the environment is one that is starting to receive attention. In the US, about 31-40% of food that is produced is wasted at some point in the production and distribution supply chain, with most waste resulting from the household. Although
existing research has attempted to explain wasteful behaviour at the individual level, little is known about how the dynamics of the household and the daily interactions of members within it results in food being wasted.

This research seeks to investigate this family dynamic through the framework of a family’s identity and look at how the sacrifice of the “individual goal” in favour of the collective “family goal” affects food being wasted. The results would further our understanding on intervention aimed at affecting behaviour change, and would be novel with its focus on affecting the behaviour of members in a collective group or a household rather than simply focusing on the behaviour of an individual.

Zero Refractive index at Terahertz frequencies

Leena Singh  
Oklahoma State University  
School of Electrical and Computer Engineering  
Subject Area: Physical Sciences Technology

Metamaterials have created a new dimension to engineering material with desired refractive indexes. The artificially designed material could achieve properties which never existed in natural materials. This has created an opportunity, to build new devices that were once impossible to imagine. By tailoring the electric and magnetic response of the material towards incident electromagnetic waves, the effective refractive index can be varied from negative to zero, or even to higher positive values. Metamaterials are proven to be especially valuable in the terahertz (THz) regime, where most naturally existing materials exhibit weak EM wave response. There have been tremendous amount of work done in designing negative and high positive refractive indexed THz materials. However, there have been no materials designed to exhibit near zero refractive index in the THz regime. Here, we demonstrate a free-standing, thin film metal-dielectric checkboard structure, exhibiting near zero refractive index of 0.187 at 2.76 THz. This was achieved by designing a structure where both electric permittivity and magnetic permeability approach near to zero simultaneously, resulting in near-zero index of refraction. The capability to engineer near-zero refractive index THz metamaterials would allow the fabrication of new devices such as beam collimators, zero-phase delay lines and transformation lenses at THz frequencies.

The Representation of Women in the Irish Citizen, 1912-1920

Emily Smith  
Oklahoma State University  
Department of History  
Subject Area: Humanities

This paper discusses the representation of women in the Irish Citizen, a suffrage organ which ran from 1912 to 1920. The paper was edited by James and Mary Cousins and Frank and Hannah Sheehy-Skeffington, and was first released as a weekly paper; in 1916, it became a monthly and continued in that form until it ceased publication. Though the paper's primary focus was on suffrage, a number of other issues relevant to women were covered as well. These included such topics as equal pay for equal work, a variety of social issues, and the role of women in Ireland's new government, among other themes. Because women themselves feature so prominently in the discussion of these issues, an examination of the way in which these issues were discussed will lead to a more complete understanding of how women themselves were represented within the newspaper. Often, this representation was deliberate; the goal of the paper was the enfranchisement of women, and as a result, it sought to paint women in the best possible light. Understanding how this was done provides valuable insight into the ways media can be used to shape a culture's perceptions of a marginalized group.
Selection of Rashba Coupling in a Topological System with Quantum Point Contacts

Paul Smith, M. F. Borunda
Oklahoma State University
Department of Physics
Subject Area: Physical Sciences Technology

We investigate the design of a topological insulator for use as an electronic transistor. A theoretical and computational study was performed on a two-dimensional electron gas system, the interface between GaAs and AlGaAs. By etching this interface, a topological system can be created, one that only allows electrons to travel along the edges of the transistor at the interface. The gating for the transistor requires the etching of two Quantum Point Contacts, points where electrons can transfer between the two conducting edge states. To create interference between spin states, a magnetic field is added perpendicular to the transistor. By calculating the transmission and reflection coefficients of the electronic states in this system, the optimal characteristics for the design of the transistor are determined. From these characteristics, the electronic properties of the transistor are computed, so that the usefulness of such a transistor for electronic applications can be evaluated. The interference in the transistor is found to preferentially select electrons based on their spin, enabling the separation of spin-up and spin-down electrons from each other. This separation of spin states is ideal for a spintronic transistor. This research is a key step towards the development of spintronic electronics.

Strengthening of reinforced concrete beams with corroded reinforcement using mineral based composites

Murugappan Subbu
Oklahoma State University
School of Civil and Environmental Engineering
Subject Area: Physical Sciences Technology

The aim of the study is to strengthen the damaged reinforced concrete (RC) beams with corroded reinforcement using glass fibre sheets (GRP) and mineral based composites (MBC - cement & metakaolin). This project investigates the viability of using externally bonded GRP with MBC to rehabilitate corroded RC beams. With corroded rebars, four RC beams B1, B2, B3 and B4 were casted, strengthened and repaired externally. Control beam B1 was cast without repair of corrosion and without any strengthening. B2 was cast without repair of corrosion but strengthened externally with GRP using MBC. In B3, rebar coating was applied and strengthening was carried out. Procedure in B4 was similar to B3 except epoxy was used as bonding agent. Four point bending test were carried out and results were compared. Flexural behaviour of beams showed that these techniques are promising solution for corroded RC members apart from eliminating the demerits of epoxy.

Antiferromagnetic Spinor Bose-Einstein Condensates in a Triangular Optical Lattice

Tao Tang, Zihe Chen, Lichao Zhao, Yingmei Liu
Oklahoma State University
Department of Physics
Subject Area: Physical Sciences Technology

We present an experimental study on antiferromagnetic spinor Bose-Einstein condensates confined by three-dimensional triangular optical lattices. Our data demonstrate that both first-order and second-order superfluid to Mott-insulator quantum phase transitions are realized in our system. The superfluid to Mott-insulator phase transition is found to occur at a larger lattice depth, when we change the lattice geometry from a triangular lattice to a cubic lattice. There is a qualitative agreement between our data and the mean-field theory.
A new solid-state NMR method reveals the influence of chain structure and thermal history on the crystal-amorphous interface within polyethylenes

Arifuzzaman Tapash, Paul J. DesLauriers, Jeffery L. White
Oklahoma State University
Department of Chemistry
Subject Area: Physical Sciences Technology

A simple solid-state NMR method is presented here to quantitatively determine the distribution of solid polyethylene (PE) chain segments in different morphological regions. The rigid chains in the crystalline phase with all-trans chain conformations, the non-crystalline trans-gauche chains, all-trans chains with higher mobility, and non-crystalline chains with limited mobility fractions were reliably quantified using the developed method. A wide range of well-characterized polyethylene samples were studied, which reveals that the amount of crystal-amorphous interface region increases with the chain length of linear metallocene-PEs. Topologically different polyethylene that have certain amounts of short-chain branches (SCB), long-chain branches (LCB), and LCB’s that contain SCB’s exhibit unique morphological behavior relative to the linear PE’s of similar Mw. The method also reveals the variations in morphology due to different thermal histories. Thermally quenched polyethylene was found to have higher interface content than that of the annealed or untreated PEs. Phase composition results obtained by this simple experiment are quantitative, reliable and reproducible. The results suggest a route to large-scale design and control of interfacial morphology in polyethylenes and related properties.

Working Memory and Behavioral Inhibition in Attention-Deficit/Hyperactivity Disorder: A Re-examination of Competing Core Processes

Stephanie Tarle, R. Matt Alderson, Connor H. G. Patros
Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Working memory and behavioral inhibition have been identified as potential underlying deficits of attention-deficit/hyperactivity disorder (ADHD) in competing models of the disorder. The stop-signal (SS) paradigm is often reified as a measure of behavioral inhibition across ADHD research. However, the choice reaction time component of the SS task likely places demands on working memory processes, consequently confounding the paradigm as a pure measure of inhibition. Therefore, the current study examined the relationship between multiple inhibition tasks to test the functional working memory model of ADHD. Forty-six boys, between 8 to 12 years old, with and without ADHD, were administered working memory (phonological and visuospatial tasks) and behavioral inhibition (go/no-go and SS) tasks. Bias-corrected bootstrapped mediation analyses indicated that working memory accounted for the relationship between group membership (ADHD and typically developing children) and both measures of inhibition. These findings suggest that studies using the SS paradigm may be confounded by controlled-focused attention associated with the choice-reaction time element of the stop-signal task. Therefore, this study suggests working memory overlaps or is upstream of behavioral inhibition. Additional research that utilizes alternative measures of behavioral inhibition is needed to determine the extent of the overlap in children with the disorder.

Self-focused attention affects early neural indicators of selective attention

Danielle Taylor, Mills, A.C., Frosio, K.E., Judah, M.R., White, E.J., & Grant, D.M.
Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Cognitive theories suggest that attentional biases play a key role in Social Anxiety Disorder (SAD; Clark & Wells, 1995). These biases include vigilance for external threat and self-focused attention. Research has
used event-related potentials (ERPs), neural measures with high temporal resolution, to examine external biases. Because self-focus has been found to impair executive processes, more research is needed to evaluate this attentional bias. The current study examined two ERPs for false heart-rate cues during a cognitive task, the anterior P2, which increases for selective attention (Potts, 2004), and the stimulus-preceding negativity (SPN) which is associated with preparation for an upcoming response or stimulus (Brunia, Van Boxtel, & Böcker, 2012). We hypothesized that socially anxious individuals would have increased P2 amplitudes for false heart rate cues compared to those with low social anxiety, and knowledge of heart rate would result in reduced SPN amplitude.

Results revealed that P2 amplitude was more positive and the SPN was less negative for self-focus cues. There was also a relationship between P2 amplitude and performance for only high SA individuals, indicating increased attention due to self-focus that resulted in decreased goal driven activity and decreased maintenance of task-goals.

Early Users’ Views on the Greenseeder® Hand Planter: Implications for Improvement and Widespread Diffusion

Lisa K. Taylor, Assoumane A. Maiga, Ph.D., William R. Raun, Ph.D., M. Craig Edwards, Ph.D., Marshall A. Baker, Ph.D., Joshua J. Ringer, Ph.D.
Oklahoma State University
Department of Agricultural Education
Subject Area: Social Sciences

By 2025, the global demand for maize (Zea mays L.) is expected to double, dictating the need to become the highest producing cereal crop (Ray, Mueller, West, & Foley, 2013). Use of new technologies to increase food production has become essential so as to ensure food security and alleviate hunger. The Greenseeder® Hand Planter was developed by researchers at Oklahoma State University to assist in overcoming this global challenge. The study’s purpose was to describe perceptions of early users of the Greenseeder® Hand Planter. An online questionnaire was sent to participants in 30 countries, including those in Africa, Asia, Central America, Europe, South America, and the United States. A large majority (83.3%) of respondents indicated they would definitely or probably continue using the hand planter. Two-thirds of the respondents perceived the hand planter was somewhat better than other planting techniques. Participants reported that the hand planter presented relative advantages (Rogers, 2003) compared to other traditional planting tools, i.e., was more convenient; easier to use in some soils; reduced their workloads; and it provided more time to do other farming activities. Two-thirds of the respondents indicated they would definitely recommend the tool to other farmers.

Oral-motor learning and structure of practice

Roha Mariam Thomas, Ramesh Kaipa
Oklahoma State University
Department of Psychology
Subject Area: Social Sciences

Principles of Motor Learning (PMLs) refer to a set of guided principles that facilitate motor learning. However, it remains unknown if PMLs facilitate oral-motor learning. The practice variables that have received considerable attention in speech motor learning literature are constant, random, and blocked practice. The aim of this study was to evaluate the role of constant, blocked, and random practice conditions in learning an oral motor task using electromyography (EMG) as an outcome measure. Thirty participants were randomly allocated to one of the three groups (random, constant, blocked) and were required to learn an oral motor task. The first three days the participants practiced a target and distractor pattern and the last day the participants had to reproduce the patterns without visual feedback. An EMG wireless sensor was placed on the surface of the right orbicularis oris to measure the muscle potential. The absolute error (%) was measured were subjected to a mixed model ANOVA using SPSS to determine the amount of learning. The results suggested there was no difference in the participants’ learning across the three practice
Characterization of a Pulsating Drill bit Blaster
Nicholas Thorp, Geir Hareland, Brain Elbing
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

The drill bit studied in this paper aims to maximize drilling rate by creating drilling fluid pulsation which could lead to lower drill string friction, more efficient removal of cuttings underneath the bit and increased nozzle fluid pressure and velocity. An analytical model was created to predict the influence of various aspects of the bit design, operating conditions and fluid properties on the bit pressure characteristics. The effect of several design changes and different operating conditions on the frequency and amplitude of fluid pulsation was studied in large-scale above ground testing. The results indicate that internal tool design has a significant effect on the pulsation frequency and amplitude which can be accurately modeled as a function of flowrate and geometry. Application of this technology in future designs could allow the bit pressure oscillation frequency and amplitude to be optimized with regard to the lithology of the formations being drilled. This could lead to faster, more efficient drilling which could cut drilling costs and lead to a larger number of oil and natural gas plays being profitable.

Development of a reference infrasonic sensing system for integration with UAS
Arnesha Threatt, Dr. Brian Elbing
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

Numerous geophysical and anthropogenic events emit infrasonic frequencies (<20 Hz), including volcanoes, hurricanes, wind turbines and tornadoes. These sounds, which cannot be heard by the human ear, can be detected from large distances (in excess of 100 miles) due to low frequency acoustic signals having a very low decay rate in the atmosphere. Thus infrasound could be used for long-range, passive monitoring and detection of these events. An array of microphones separated by known distances can be used to locate a given source, which is known as acoustic localization. However, acoustic localization with infrasound is particularly challenging due to contamination from other signals and sensitivity to wind noise. Consequently, to develop the appropriate filters for the long-range monitoring there needs to be close range measurements of the source signals. Thus there is work currently to integrate an infrasonic microphone with an unmanned aerial system (UAS) so that close range measurements can be acquired. This presentation will present work to establish a trusted infrasonic source and reference microphone, which will be used to determine the UAS mounted microphone’s ability to accurately acquire measurements.

Vibrational Spectroscopy of Single Quantum Dots
Cagri Topal, A. Kaan Kalkan
Oklahoma State University
Department of Mechanical and Aerospace Engineering
Subject Area: Physical Sciences Technology

Quantum dots (Qdots) have been extensively studied due to their unique properties, arising from quantum size effects. Among many analytical techniques, vibrational spectroscopy has been proven to be a powerful tool to explore the phonon modes and the structure of Qdots. The present work studies the vibrational spectra of single thiol-capped CdTe Qdots by Surface-enhanced Raman Scattering (SERS). One challenge in
Raman spectroscopy of Qdots is the intense fluorescence background which masks the Raman signal. Our nanoAg-on-Ge SERS substrates enable us to overcome this problem by quenching the fluorescence by resonance energy transfer (RET). Furthermore, by studying single Qdots, we eliminate the heterogenous broadening. This feature is particularly advantageous in studying Qdots, since their optical properties are highly sensitive to variations in the size, core-shell structure and surface chemistry. In the present study, time series SERS spectra of single CdTe Qdots are captured at 40 ms intervals in the form of sudden spectral jumps sustaining less than a second. These spectral jumps are characteristic of the surface thiols, thiol-core interface, as well as the CdTe core. We have captured three distinct types of spectral jumps, which we attribute to different chemisorption of the thiols at facets of different crystal directions.

Differentiation of Fat Stem Cells into Cardiac Cells in a 3-D Environment

Christian Tormos, Dr. Sundar Madihally
Oklahoma State University
School of Chemical Engineering
Subject Area: Biomedical Sciences

Heart diseases are among the top causes of death every year. Current treatment options to repopulate the acellular tissue rely on cell therapies using injectable hydrogels. Although these treatments are promising, the largest obstacles still to overcome is viability of the implanted cells. We hypothesized that the addition of nutrients and oxygen releasing particles will improve the cell viability. In addition, we added stimulants known to aid in the differentiation of stem cells to heart cells. To investigate the survival of these cells, we utilized human fat stem cells, seeded them in a chitosan-gelatin hydrogel that has mechanical properties similar to cardiac tissue and cultured them for 21 days. At the end of the experiment the amount of dead and live cells was determined. Further, we analyzed these cells and investigated whether these cells had differentiated into heart cells. The chitosan-gelatin hydrogel was able to sustain culture for 21 days. The addition of oxygen releasing particles seemed to have a small negative effect on the survival of cells. However, these particles makes the hydrogel stronger and therefore this small negative effect can be overlooked. Differentiation of fat stem cells into heart cells was achieved in a 2D environment.

Flow Assurance Issues in the Oil and Gas Industry: Hydrates and Wax

Solving challenges of the on-line incremental model parameterization (IMPOL) technique
Vidhya Venugopal, Dr. R. Russ Rhinehart
Oklahoma State University
Department of Chemical Engineering
Subject Area: Physical Sciences Technology

Not Received

The Effects of AquaSmart Coated Sand Products on Growth and Water Use of Greenhouse-Grown Ornamentals and Nutrient Leaching in Greenhouse Media

Magdalena Vinson, Janet C. Cole, Justin Q. Moss
Oklahoma State University
Department of Horticulture and Landscape Architecture
Subject Area: Biological Sciences

Water usage is one of the primary continuing costs for new and established greenhouse operations. One way in which growers have been working to reduce water costs is by using wetting agents and hydrophilic polymers. These products help increase the water-holding capacity of the media, and can allow for less
frequent irrigation while maintaining desired growth rates. AquaSmart Enterprises, LLC markets a super-absorbent, coated sand product to the greenhouse ornamentals industry with the statement that the product can increase water-holding capacity and reduce water use in container substrate. The objectives of this study were to evaluate the effects of AquaSmart polymer coated sand products on growth and water use of greenhouse-grown ornamentals and nutrient leaching in greenhouse media. Six common ornamental species were tested using three application rates of AquaSmart and a nontreated control to compare water use and growth rates within species. The nutrient study used the same product application rates, and generated nutrient release curves for each rate. Additionally, dry-down studies were conducted to determine the effects of slow-release and liquid fertilizers on water absorption rates of AquaSmart.

Pattern Recognition Assisted Infrared Library Searching of Automotive Paints for Forensic Analysis

Collin White, Barry K. Lavine, Matthew Allen

Oklahoma State University
Department of Chemistry

Subject Area: Physical Sciences Technology

Pattern recognition techniques were developed to search infrared spectral libraries of the paint data query (PDQ) database to identify an unknown vehicle from a paint chip left at a crime scene. The library search system contains two interrelated components: search prefilters from individual or multiple automotive paint layers, and a cross-correlation library searching algorithm. To develop these search prefilters, the IR spectra were wavelet transformed and wavelet coefficients characteristic of the vehicle’s assembly plant were identified using a genetic algorithm. A library search algorithm is then used to cross-correlate the unknown with each spectrum in the truncated library identified by the search prefilters, and the top 5 hits were identified by the algorithm. Even in challenging trials where the samples were all the same make (e.g., Chrysler or General Motors) within a limited production year range (2000-2006), the model of the vehicle could be identified from the IR spectrum of the paint sample.

Domain Specific Effects of Working Memory on Threat Detection

Evan White, Kristen E. Frosio, Danielle L. Taylor, Matt R. Judah, Adam C. Mills, DeMond M. Grant

Oklahoma State University
Department of Psychology

Subject Area: Social Sciences

Empirical studies suggest that worry precludes threat processing and biases attentional processes for threatening stimuli. The mechanisms for how worry affects threat processing are presently unknown. A recent theory suggests one mechanism for the negative effects of worry on neural indicators of attention may be working memory load. The goal of the current study was to document the influence of working memory load and worry on attention allocation during processing of threatening images. It was hypothesized that worry and working memory load will decrease attention allocation during preparation and processing of threat.

Working memory load reduced neural preparation for an upcoming image compared to baseline preparation. This was true for both visual and verbal working memory loads. Results indicated that both the visual and verbal working memory tasks resulted in a reduction of attention allocation to the processing of images across stimulus types compared to the baseline task for individuals in the low worry group. The current study extends the literature by documenting the influence of working memory load on the preparation for upcoming stimuli and adding further support to the growing body of literature documenting the decrement in attention to processing stimuli when working memory demands are present.
Macronutrient effects on spider growth

Will Wiggins, Shawn Wilder
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

A large body size is important for many reasons, including increases in viable eggs, more competitive sperm, and increased success in male-male combat. However, building a large body is costly and may require particular amounts and ratios of nutrients. For many animals, especially carnivores on which less is known of their nutritional ecology, the balance of nutrients at which animals maximize growth and body size remains unknown. We manipulated the quantity and nutrient content of flies as prey to test how the lipid and protein content of prey affected the growth of spiders. We measured the body size of 400 first generation lab born jumping spiders, *Phidippus audax*, raised on 21 different diet treatments ranging from high protein to high lipid across several prey quantities. The ratio of lipid to protein in prey had the largest effect on spider growth in the high prey abundance treatments. Overall, spiders weighed more and had larger body size (i.e., legs, carapace) on diets that were more lipid-biased. Our results suggest that spiders require lipid rich prey for maximal growth.

Contrasting influence of nighttime illumination on American burying beetle and roundneck sexton beetle capture rates

Jillian Wormington, Kyle Risser, Wyatt Hoback, Kristopher Giles, Carmen Greenwood, Barney Luttbeg
Oklahoma State University
Department of Integrative Biology
Subject Area: Biological Sciences

The nocturnal American burying beetle (*Nicrophorus americanus*), once widely distributed in the eastern United States, is currently listed as endangered by the U.S. Fish and Wildlife Service. The factors driving this decline remain largely unknown. Curiously, a closely related and ecologically similar burying beetle, the roundneck sexton beetle (*Nicrophorus orbicollis*), remains abundant and widespread. We use two sets of trapping data from Nebraska and Oklahoma U.S.A. to examine the effects of moon phase and weather on capture rates to test the hypothesis that the American burying beetle is more sensitive to changes in ambient light and other field conditions than the roundneck sexton beetle. We found that moonlight levels predicted American burying beetle counts at both sites; as nights got brighter, capture rates declined. However, in Oklahoma but not Nebraska, fewer American burying beetles were caught on cloudy nights, perhaps due to amplification of skyglow from the nearby city of McAlester. In contrast, the number of roundneck sexton beetles captured was associated with moonlight, but either positively or not to the degree of American burying beetles. This relative indifference to illumination levels could contribute to the success of roundneck sexton beetles in brighter locations where American burying beetles have disappeared.

Nonvolatile Processors on Energy Harvesting Powered Embedded Systems

Mimi Xie
Oklahoma State University
School of Electrical and Computer Engineering
Subject Area: Physical Sciences Technology

Energy harvesting devices generate electric energy from their surroundings using direct energy conversion techniques. Examples of power sources include kinetic, electromagnetic radiation (including light and RF), and thermal energy. The obtained energy can be used to recharge a capacitor or, in some cases, to directly power the electronics. However, there is an intrinsic drawback with harvested energy. They are all unstable. With an unstable power supply, the processor execution will be interrupted frequently. Frequent turning-off and booting-up will place an extra burden on a limited power budget. What is worse, in some cases, large
tasks can never get finished since the intermediate results cannot be saved. To address this problem, non-volatile processors (NVP) have been proposed to enable instant on/off for these devices. In NVP, a non-volatile FRAM is attached to the processor’s volatile registers. Every time there is a power outage, the processor’s state will be saved to the NV FRAM, which is known as checkpointing. Then the next time the power comes back on, the processor’s state is copied back to the volatile registers and program execution resumes. In this way, we can make sure the program execution is “accumulative” and resistant to frequent power outage.

Investigation of hydrate formation and prevention measures in oil-dominated system

Ashwin Kumar Yegya Raman, Deepika Venkataramani, Clint P.Aichele
Oklahoma State University
School of Chemical Engineering
Subject Area: Physical Sciences Technology

Flow assurance is one of the major technical problems facing the petroleum industry. Several millions of dollars have been spent in mitigating pipeline blockages. Despite extensive studies over decades, the mechanisms by which hydrates are formed and the prevention measures are not completely understood which is attributed to the complex nature of hydrates. Cyclopentane hydrates are studied in model oil systems using surfactant and solid particles, which act as stabilizing agents. Droplet size distribution and hydrate formation are examined at various water fractions using different kinds of stabilizing agents. Bench top experiments are performed to explore the hydrate formation conditions and their morphology. Rheological behavior of hydrate forming emulsions is studied using different kinds of stabilizing agent. In addition, anti-agglomerants and kinetic hydrate inhibitors will be used to study the prevention measures of hydrates. An Olympus BX53 polarized optical microscope with shear cell and temperature control (-50°C to 450°C) stage is used to quantify droplet size distribution, and hydrate crystals morphology. Characterization of hydrate forming emulsions, prevention measures and a fundamental understanding of their rheological behavior would provide us a better understanding of hydrate formation and mitigation mechanisms.

Regulation of the tight junction protein occludin in ovarian theca cells of cattle

Lingna Zhang, Leon J Spicer
Oklahoma State University
Department of Animal Science
Subject Area: Whiteman Award Presentation

Tight junctions (TJ) are cell-cell contact structures that provide cell layers with barrier function and regulate cell growth. The role of TJ in ovarian follicle development has not been investigated yet. Therefore, experiments were conducted to evaluate the gene expression and the hormonal regulation of occludin (OCLN), a classic membrane component of TJ, in ovarian theca cells (TC) of cattle. Quantitative RT-PCR was used to measure gene expression of OCLN in freshly collected granulosa cells (GC) and TC of small (1-5 mm) and large (8-21 mm) follicles, as well as in cultured large-follicle theca cells (LGTC) treated with various hormones and growth factors. In freshly collected GC and TC, small follicles had greater (P< 0.05) OCLN mRNA abundance than large follicles. In both large and small follicles, TC had greater (P < 0.05) mRNA abundance than GC. In cultured LGTC, insulin-like growth factor 1 (IGF1), tumor necrosis factor α (TNFα), dihydrotestosterone (DHT) and progesterone (P4) significantly increased OCLN mRNA abundance, while fibroblast growth factor 9 (FGF9) and epidermal growth factor (EGF) decreased (P< 0.05) OCLN mRNA abundance. Also, luteinizing hormone (LH) attenuated the IGF1-induced OCLN expression. In conclusion, OCLN mRNA expression decreases during follicular development and is hormonally regulated in cattle.