College of Arts and Science – FY 2012 Research Abstracts

BOTANY

Using Foxtail Millet as a Model to Improve drought resistance in Biofuels Grasses
Drought is the primary factor limiting agricultural productivity, and even small improvements in drought resistance will be useful for biofuels production, where C4 grasses such as switchgrass are advocated for lands that are marginal for food crop production. This project aims to identify and characterize genes responsible for water-use efficiency and other agronomic traits using the related model system of foxtail and green millet.
Sponsor: Oklahoma Center for Advancement of Science and Technology
PI/PDs: Andrew Doust, Janette Steets

Continuous Cultures of Algae: Basic Research Toward Biofuels
A viable algal biofuels industry would readily fit into traditional economic drivers and infrastructure in Oklahoma: energy and agriculture. It also has the potential to remediate water quality by consuming nutrients in wastewater, and to reduce net CO2 emissions by converting waste CO2 from fossil fuel combustion to biofuels that will displace future fossil fuel use. Henley's lab is studying the stability and physiological response of single- and mixed-species cultures of algae to variable temperature, salinity, and nutrients in the broader context of producing feedstock for biodiesel. First we are monitoring these biological variables to understand the complex physiological and community responses of mixed cultures of algae. Then we will attempt to regulate community biomass and species balance, productivity and lipid yields by intuitively manipulating culture conditions based on prior observational data.
Sponsor: Oklahoma Center for the Advancement of Science & Technology
PI/PD: William Henley

Resolving the Phylogeny of North American Milkweeds Through the Application of Massively Parallel Sequencing Technology
The resolution of systematic relationships among milkweed species will result in an enhanced understanding of their evolutionary history, and contribute to an improved classification of the genus. Furthermore, these results will provide a robust foundation for studies of milkweed floral diversity, pollination biology and biogeography. Milkweeds have served as a model system for the evolution of plant defenses against herbivory, and results from this research will contribute to a better understanding of how plants, including crops, co-evolve with their pests. The methods developed here achieve a savings in cost, time, and effort beyond any previously attained in phylogenetic research, and will be directly applicable to phylogenetic, population genomic and ecological genomic studies of animals, fungi and plants.
Sponsor: The National Science Foundation
PI/PDs: Mark Fishbein
Oregon State University: Aaron Liston, Richard Cronn

Phylogenomics of Anti-Insect Defenses in Milkweeds
Along with global climate change and soil erosion, herbivory by pests ranks as one of the major threats to global food security. Efforts to combat losses in crop productivity due to herbivory have long relied on pesticide application, which has raised concerns over impacts on human and

environmental health. Fortunately, evolutionary-based studies on the genetics of pest resistance have led to dramatic breakthroughs in the development of crops that forego the need for intensive pesticide application. The proposed research seeks to identify the genetic basis of milkweed traits previously identified as important adaptations to herbivory, providing genetic tools for crop improvement in Oklahoma and throughout the world.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PD: Mark Fishbein

The Role of Chloroplast Gene Expression in Plant Growth and Development
Chloroplasts play a central role in plant metabolism and in supporting the growth and differentiation of plant cells. Most chloroplast proteins are encoded by the nuclear genome and imported into the chloroplast. A few proteins are encoded by the chloroplast genome itself. Interfering with chloroplast gene function typically causes defects in photosynthesis. In *Arabidopsis*, disrupting chloroplast translation also results in embryo lethality. This contrasts with maize and *Brassica*, where albino seedlings are produced. This project will explore the molecular factors responsible for variations observed in the developmental consequences of interfering with chloroplast translation in *Arabidopsis* and related species.
Sponsor: The National Science Foundation
PI/PD: David Meinke

The Effects of Prescribed Burning on Epiphytic Bryophytes in the Ouachita National Forest of Oklahoma
This research will reveal the effects of fire on moss and liverworts in a fire-prone landscape in southeastern Oklahoma.
Sponsor: United States Forest Service
PI/PD: Michael Palmer

Collaborative Research: Cyber-enabled Innovative Research in Integrated Geoinformatics and Ecoinformatics
I will update a database on Floras from North America, and create a user-friendly web-based application allowing the public to access plant biodiversity data. These data will be used to inform management of biodiversity and to test key ecological hypotheses.
Sponsor: National Science Foundation
PI/PD: Michael Palmer

Genetic Analysis and Comparison of Host Defense against Aphids in Barley, Sorghum, and Wheat
The objectives of this research are to analyze genetic factors that control expression of resistance in wheat, barley, and sorghum to aphids and to compare defensive responses of the different host plants. Molecular markers will be used to identify genetic regions associated with aphid resistance. Identification of the conserved resistance mechanisms will facilitate map-based gene isolation by using syntenic intervals across cereal species. It is expected that this research will generate information to help identify genetic components responsible for aphid resistance, revealing the similarities of resistance mechanisms as well as diversity of host defenses between the cereal species.
Sponsor: United States Department of Agriculture, Agriculture Research Service
PI/PDs: Yinghua Huang, Janette Steets

CHEMISTRY

Development of a Robust Field Technique to Quantify the Air-Void Distribution in Fresh Concrete

Concrete can suffer frost damage when subjected to moisture and freezing temperatures. Frost-durable concrete can be produced if a specialized surfactant is added during mixing to stabilize microscopic air-voids. To investigate this process the research team is using a micro computed tomography scanner (□CT) to observe the in-situ 3D air-void system in fresh concrete. This new technique allows the research team to non-destructively examine the response of the air voids to pressure. Research is also being performed to determine the underlying chemistry that yields stable air-void /cement interfaces and the best approaches for air-entrainment.
Sponsor: Oklahoma Transportation Center/United States Department of Transportation
PI/PDs: Allen Apblett
School of Civil and Environmental Engineering: Tyler Ley

Suppression of ASR through Aggregate Coatings

Many highways, runways, parking lots and bridges are suffering from premature deterioration due to alkali silica reaction (ASR) that takes place between the alkalis contributed primarily by the cement and a reactive form of silica from specific silicon-containing rocks or minerals in the aggregates utilized in concrete production. This produces an alkali/silica gel that, in the presence of sufficient moisture, will expand and produce stresses that damage the concrete. The research has the aim of developing cost-effective pretreatment processes for problematic aggregates that will eliminate the alkali silicate reaction.
Sponsor: Oklahoma Transportation Center/United States Department of Transportation
PI/PDs: Allen Apblett, Nicholas Materer
School of Civil and Environmental Engineering: Tyler Ley

Expected Life of Silane Water Repellant Treatments on Bridge Decks

The Oklahoma Department of Transportation (ODOT) commonly uses a silane or siloxane chemical sealer on new bridge decks to reduce the penetration of external chemicals and help extend the life of the bridge. Currently, it is unknown how long these sealers are effective, and if these sealers can be reapplied to continue to help protect the concrete. The research team will evaluate the effectiveness of silane coatings of bridge decks at different ages through laboratory and non- destructive field techniques to determine their effective life. Methods to reapply the silanes to mature concrete will also be investigated.
Sponsor: Oklahoma Department of Transportation
PI/PDs: Allen Apblett, Nicholas Materer
School of Civil and Environmental Engineering: Tyler Ley

Sensor Technology for Cargo Transportation Safety

The proposed research will result in several devices that will markedly increase the safety of transportation of hazardous materials that consist of volatile, strongly oxidizing chemicals. The compounds that will be targeted for sensing constitute a significant risk to the public, transportation workers, and emergency responders. Many of these materials have been involved in numerous transportation-related catastrophes so that methods to identify leaks before they become serious, or, when an accident does happen are highly warranted. These sensors will be an extremely simple colorimetric detectors that can be viewed a distance to see if any oxidant is leaking.

Sponsor: Oklahoma Department of Transportation
PI/PDs: Allen Apblett, Nicholas Materer

Removing Radiostrontium from Milk
The research will develop the strontium-removing calcium tungstate into a form that is optimized for use in columns that can rapidly remove strontium from milk and to demonstrate that the product is less expensive and has higher selectivity and capacity for strontium than the best resins currently available for this purpose. The product could be used at dairies or factories to remove strontium from milk, powdered milk, and baby formula or it could be packaged in the form of a cartridge that consumers could immerse in a bottle to treat the milk themselves.
Sponsor: Economic Development Generating Excellence Program
PI/PD: Allen Apblett

Impact on Polisher Performance by Filming Amines
The objective of this research project is to identify the effects of filming amines on the performance characteristics of ion exchange resins. The degradation mechanisms will be identified that result in loss of capacity, increased fouling, ease and efficiency of regenerability, and reduction in mass transfer coefficient.
Sponsor: Electric Power Research Institute
PI/PDs: Allen Apblett
School of Chemical Engineering: Gary Foutch

Explosive-Containing Porous Materials as Non-Detonable Training and Testing Aids
XploSafe, LLC has materials that host the dangerous explosive HMTD in a fashion that negates explosive hazards while ensuring the maintenance of a normal vapor pressure of HMTD. To expand this work to other explosives, the surfaces of the host material need to be chemically modified to control the molecular interactions between the host material and the explosive. By systematically varying the chemistry of the pores, guided by computational studies, the effective vapor pressure of various explosives, including TNT, RDX and TATP, within the pores can be adjusted to safely mimic the real material.
Sponsor: Oklahoma Center for Advancement of Science and Technology (subcontract from XploSafe, LLC)
PI/PDs: Allen Apblett, Nick Materer

Sensor for Hydrogen Peroxide and Peroxide-Based Explosives
The overall goal of this research project is to develop real-time an explosive sensors that are highly selective and sensitive for peroxide-based improvised explosives and the hydrogen peroxide that is used to manufacture them.
Sponsor: Oklahoma Center for Advancement of Science and Technology
PI/PDs: Allen Apblett, Nick Materer

Suppression of ASR through Aggregate Coatings
Many highways, runways, parking lots and bridges are suffering from premature deterioration due to alkali silica reaction (ASR) that takes place between the alkalis contributed primarily by the cement and a reactive form of silica from specific silicon-containing rocks or minerals in the aggregates utilized in concrete production. This produces an alkali/silica gel that, in the presence of sufficient moisture, will expand and produce stresses that damage the concrete. With time, the expansion of the gel generates internal pressure that can lead to cracking of the concrete

that provides pathways for ingress of deleterious materials such as water, sulfates and chlorides to the interior of the concrete matrix. This can then lead to serious durability issues such as freeze/thaw damage, sulfate attack, or corrosion of steel or rebar. Several mitigation options for ASR exist, including the use of low-alkali cements, mineral additives, or chemical additives. All of these increase the cost of concrete: for example, the addition of lithium nitrate causes an expense of $ 20 per cubic yard of concrete. All of these methods have another commonality – they apply the treatment globally at great expense, while the root of the ASR problem is localized surface phenomenon at the aggregate-cement interface. Therefore, the proposed solutions to the problem of ASR that will be developed in this investigation will target this interface with the aim of developing cost-effective pretreatment processes for problematic aggregates that will eliminate the alkali silicate reaction.
Sponsor: Oklahoma Transportation Center/United States Department of Transportation
PI/PDs: Allen Apblett, Nicholas Materer
College of Civil Engineering: Tyler Ley

Next Generation Composite Materials for Aerospace and Exploration Systems
New epoxy composite systems using functionalized fillers have been synthesized for aerospace fuel-tank applications. These systems have shown a 9 °C improvement in glass transition temperature, 40% improvement in storage modulus, and 70% improvement in gas barrier properties with 1% loading with glycidyl POSS.
Sponsor: NASA
PI/PDs: Raman Singh, Kevin Ausman

Nano-modified Composite Tanks for Natural Gas and Fuels
New epoxy composite systems using clay fillers have been synthesized for natural gas containment applications. These systems have shown a 40% improvement in fracture toughness, 20% improvement in flexural strength, 15% improvement in storage modulus, and 20% improvement in gas barrier properties with a 2% loading of nanoscale clays.
Sponsor: OCAST
PI/PDs: Ranji Vaidyanathan, Kevin Ausman

Chemical Forensics for Toxic Chemicals and Explosives
Several key questions regarding forensic sampling and subsequent analysis of chemical warfare agent precursors and degradation products were addressed, including lifetime of analytes on various surfaces, and the effectiveness of various sampling materials and extraction solvents.
Sponsor: UML/DOD
PI/PDs: Carey Pope, Kevin Ausman

Broad-spectrum Antifolates for Treatment of Drug Resistant Bacillus anthracis
The chemistry portion of this project is to synthesize certain derivatives of 2,4-diaminopyrimidine which have previously exhibited good activity against the enzyme dihydrofolate reductase. This enzyme is a critical component in the bacterial pathogen of anthrax. The targets for synthesis are labeled antifolates and will affect the key enzyme in the folate pathway that is essential for growth of the organism which causes anthrax. The project is led by Dr. William W. Barrow of the Department of Pathobiology in the College of Veterinary Medicine for a five-year period. Funding is from the National Institutes of Allergy and Infectious Disease of the National Institutes of Health.
Sponsor: National Institutes of Allergy and Infectious Disease of the NIH

PI/PDs: K. Darrell Berlin, Richard A. Bunce, Stacy Benson
College of Veterinary Medicine: William Barrow

Copolymers and Plasticized Polymers at Interfaces
We are focused on determining the behavior of copolymers and plasticized polymers adsorbed on the surfaces of particles and on the development of nanocomposites where the interaction of the polymer with the particles is critical to their use in different applications. Polymers adsorbed at interfaces have properties that are altered compared to those in bulk. Their characterization is often difficult and sometimes impossible to determine with many techniques, as most of the interfacial polymer systems are opaque. A variety of techniques, including, nuclear magnetic resonance spectroscopy (NMR), and also modulated differential scanning calorimetry (MDSC), and Fourier-transform infra-red spectroscopy (FTIR) will be used to understand the behavior of these important interfacial systems.
Sponsor: National Science Foundation
PI/PD: Frank D. Blum

Advanced Polymer Systems for Defense Application: Power Generation, Protection, and Sensing
The portion of the work to be performed at OSU by Dr. Blum's research group is on the (i) dynamics of polymers at interfaces and (ii) conducting nanocomposites. The nature of the work on (i) is to prepare polymers that can be adsorbed on oxide surfaces which will then be studied with a variety of techniques, including nuclear magnetic resonance spectroscopy, Fourier transform infra-red spectroscopy, and differential scanning calorimetry. The effort on (ii) will include the synthesis of conducting polymer nanocomposites which encorporate nanometal clusters. These materials will be tested for their feasibility as sensors and memory devices.
Sponsor: ARO – Through Missouri University of Science and Technology
PI/PDs: Frank D. Blum
MST: Nicholas Leventis

Exploring the Physical Chemistry of Clathrate Hydrates at Low Pressures and Temperatures
Clathrate hydrates are viewed as having a host-lattice structure of water molecules much like ice but differing by the presence of cages holding small molecules. Because of their abundance in nature, there is a considerable science of clathrate hydrates at high temperatures and pressures. For temperatures below 150 K, our program remains the primary source of formation data. The latter temperatures are particularly conducive to basic-science exploration of clathrate-hydrate properties. We have emphasized the ease of formation of clathrate-hydrate films for proton-acceptor guest species and the relationship of this property to a surprising level of mobility which enables our kinetic studies at temperatures near 100 K.
Sponsor: National Science Foundation
PI/PD: Paul Devlin

Exploring the Physical Chemistry of the Catalysis-Based All-Vapor Instant Formation of Gas Hydrates
The project addresses basic physics and chemistry of gas hydrates; i.e., small molecules such as carbon dioxide and methane trapped in cages within a water lattice. Gas hydrate formation, typically from ice or liquid water, is often so slow as to discourage studies. In this project a slow mixing step is avoided by using a novel all-vapor method with the component guest molecules fully premixed with water vapor. When a guest catalyst molecule is used, the result is solid

hydrate formation on a sub-second timescale. The research focuses on optimizing catalysis through choice of guest identity, temperature, and pressure.
Sponsor: National Science Foundation
PI/PD: Paul Devlin

Fundamental Research on the Biological Stability of Future Naval Fuels and Implications for the Biocorrosion of Metallic Surfaces.
The Navy has experienced problems with biodiesel, because it accelerates corrosion of steel fuel ballast tanks that are compensated for content reduction with seawater. Since such problems may be due to the susceptibility of fuel components to biodegradation by microbes that form corrosive biofilms, this interdisciplinary investigative team seeks to explore the fundamental mechanisms of fuel-induced biocorrosion, including connections between the chemical composition of the fuel and acceleration of biocorrosion. The research will provide a basis for assessing the biological stability of alternate fuels and their impact on biocorrosion and will lead to better tools for monitoring and mitigating corrosion.
Sponsor: Office of Naval Research
PI/PDs: Margaret A. Eastman
Colorado School of Mines: Anthony M. Dean
Montana State University: Recep Avci, Zhiyong Suo, and Xinghong Yang
OU: Joseph M. Suflita, Deniz F. Aktas, Iwona B. Beech, Irene A. Davidova, Kathleen E. Duncan, Mark A. Nanny, Jan Sunner

Before, During and After Class Learning Cycle Activities
This project focuses on the development of 24 sets of linked activities that support an inquiry oriented instructional strategy. These instructional materials will be activities for “before”, “during”, and “after” class meetings using an inquiry oriented instructional strategy (the Learning Cycle Approach). The Before Class Exploration is a web-based exercise that students complete before lecture. It will usually consist of a data collection activity using a simulation program or a set of questions. The instructor can access student responses at anytime, and use them to customize the lecture activities. The During Class Invention poses questions/problems and is designed to be done in small cooperative groups. The After Class is a web-based set of questions that will allow students to apply their knowledge of the concept introduced by the BCE and ‘invented’ by the DCI.
Sponsor: National Science Foundation
PI/PDs: John Gelder
OU: Michael Abraham

Strategies for Targeting Sub-Glycoproteomics
The proposed research project entails the development of a liquid phase-based platform for facilitating the inherently challenging measurements involved in glycoproteomics. The platform is aimed at profiling of aberrantly fucosylated glycoproteins, which are indicative of cancers. After developing, characterizing and optimizing the multistage platform, we will demonstrate its effectiveness in the accurate and reproducible differential quantitative analysis of sub-glycoproteomics by coupled chromatography and mass spectrometry. The success in differential sub-glycoproteomics measurements between healthy and diseased states will certainly have significant clinical diagnostic potential.
Sponsor: National Institute of Health
PI/PD: Ziad El Rassi

High-Throughput IMS-MS and IMS-IMS-MS Techniques for Glycomics Analysis
A genetic algorithm (GA) for pattern recognition analysis of multivariate chemical data will be developed to identify cancer biomarkers in ion mobility spectral data. The pattern recognition GA selects features (i.e., time tags) that optimize the separation of the classes (cancer versus normals) in a plot of the two or three largest principal components of the data. The genetic algorithm identifies potential biomarkers for cancer by sampling key feature subsets, scoring their principal component plots, and tracking those samples and/or classes that were most difficult to classify. The boosting routine used this information to steer the population to an optimal solution.
Sponsor: National Institute of Health
PI/PD: Barry Lavine

Improving Investigative Lead Information and Evidential Significance Assessment for Automotive Paint and the PDQ Database
Pattern recognition techniques for searching infrared spectral libraries of the Paint Data Query (PDQ) automotive paint database will be developed to extract investigative lead information from a clear coat paint smear.
Sponsor: National Institute of Justice
PI/PD: Barry Lavine

Catalysts for Biofuel Production from Cellulosic Materials
Biomass has the potential to offset our demand for exported oil. Production of ethanol from lignocellulose has the advantage that feedstock is abundant, diverse, and inexpensive when compared to other potential sources such as corn and cane sugars. However, the production of ethanol from cellulosic materials requires a greater amount of processing because the lignocellulose must be converted to sugars and then feremented to ethanol. Hydrogen bronze regent will be investigated as a potential water-soluble catalyst for hydrolysis of cellulose. It is possible that these materials can be used to develop an efficient process for conversion of cellulose into sugars.
Sponsor: East Central University/EPSCOR Summer 2012 ROA Grant of Dane Scott
PI/PDs: Allen Apblett, Nicholas Materer

"Black" Photoactive Materials for Organic Solar Cells: Eumelanin-Based Polymers
The search for alternative fuels to power the future and alleviate human effects on the environment is a daunting task. Solar energy is foremost of these renewable energy sources due to its potential for providing nearly 750 terawatts of power per year (about 40 more times the human power usage). The proposed research presents the design and synthesis of well-defined, soluble eumelanin-based polymers as “black” light absorbing electron donor materials in polymer solar cells. The novel plastics offer the advantage of harnessing more solar radiation than the current materials therefore enhancing polymer solar cell performance. The proposed project has the potential to create economical, lightweight and flexible alternatives to harvest and convert solar energy into electricity.
Sponsor: Oak Ridge Associated Universities (ORAU)
PI/PD: Toby Nelson

Self-Assembly of Electrophilic Late Metal Catalysts and Catalyzing Careers in Research
New methods to create metal catalysts for chemical synthesis will be explored. The catalysts will be used to promote chemical reactions that could be used to invent pharmaceuticals or new materials. The reactions to be targeted are challenging and do not work without a catalyst. This research will be closely tied with an educational outreach program that aims to introduce rural Oklahoma students to the importance of scientific research in the modern world, with a particular emphasis on technologies that use catalysts.
Sponsor: National Science Foundation
PI/PD: LeGrande Slaughter

Novel Chelate Ligands for Olefin Polymerization Catalysis
Transition metal catalysts for the conversion of petroleum-derived hydrocarbons into plastic materials will be sought. The research will use a novel approach to synthesis that will provide a large number of variation on a basic catalyst structure. This will allow tuning of the catalyst properties to create polymeric (plastic) materials with commercially useful properties. A long-term goal is to create catalysts that allow more efficient conversions of valuable hydrocarbons into new materials compared with existing commercial processes.
Sponsor: Chevron Phillips
PI/PD: LeGrande Slaughter

Harnessing Nonclassical Metal-Arene Interactions to Achieve Enantioselective Catalysis
Many compounds of medicinal value exist as mixtures of two "mirror images" or enantiomers. These enantiomers can have very different effects on the human body, so methods of obtaining them pure are an important goal. This research pursues a new strategy for selective formation of single enantiomers using metal catalysts. Chiral ligands will be created with aryl groups that are optimally placed to form weak interactions with the metal. These interactions will steer the catalyst toward selective formation of one enantiomer. A science outreach program aimed at Native American middle school students will be closely tied to the research.
Sponsor: National Science Foundation
PI/PD: LeGrande Slaughter

New Heterocycles Via Ligand-Tunable Gold Catalysis
Heterocycles containing oxygen or nitrogen form the core molecular frameworks of many important drugs. For effective drug discovery, routes to diverse structural variations on these heterocyclic motifs are needed. This research will develop a novel set of gold-catalyzed ring-closure reactions of unsaturated molecules that can lead to different types of heterocyclic lactone structures, depending on the ligand attached to the catalytic metal. In particular, ligand control of reaction pathways leading to bicyclic, spirocyclic, and chiral lactones will be sought.
Sponsor: OCAST-Oklahoma Health Research Program
PI/PD: LeGrande Slaughter

F**acilitating Germanium-Germanium Bond Formation and Promoting Careers in Science**
Methods for the synthesis of discrete oligogermanes having germanium – germanium single bonds has, until recently, been complicated by the formation of complex mixtures of products and/or low yields, and this has precluded a detailed survey of the structure/property relationships in these systems. We have developed a method for the rational synthesis of these compounds that employs the hydrogermolysis reaction between a germanium amide and a

germanium hydride, either alone or in conjunction with a hydride protection/deprotection strategy. Using this method, we have obtained a library of oligogermanium compounds having a variety of chain lengths and substituent patterns, and both linear and branched systems have been prepared. We wish to report our recent findings in this area, and will discuss the preparation of a series of para-tolyl substituted linear systems as well as several new rare branched compounds having hydride or halide substituents. Both types of oligogermanes have been characterized by UV/visible spectroscopy and cyclic voltammetry, and we have correlated their spectral and electrochemical data with their structures.
Sponsor: National Science Foundation
PI/PD: Scott Weinert

Interdisciplinary Program in Molecular and Cellular Biophysics
Sponsor: Oklahoma State University
PI/PDs: Wouter D. Hoff, Robert Burnap, Aihua Xie, Jeff White, Junpeng Deng

Polyolefin Miscibility: New Insights from an Experimental Molecular Perspective
Through acquisition of the chain-specific data at the atomic level, this research is resolving long-standing questions about the relative importance of polymer chain packing and chain architecture in the creation of new materials from existing polymers. The fundamental scientific questions surrounding polyolefin phase behavior reach far beyond the specific materials used in this study. Specifically, polyolefins and their blends are ideal systems for the experimental resolution of some long-standing questions regarding how liquids, disordered solids, and multicomponent mixtures behave as useful materials. Given the varying chain architectures possible with polyolefins, distinct degrees of freedom within and between molecules can be engineered, and the ensuing end-use behavior examined from molecular dimensions all the way up to large components.
Sponsor: National Science Foundation
PI/PD: Jeffery L. White

Structure-Property Investigations of Semicrystalline Polymers
Using advanced magnetic resonance methods, the PI is establishing relationships between microscopic structure and end-use properties in a variety of semicrystalline macromolecules and their blends.
Sponsor: Chevron Phillips
PI/PD: Jeffery L. White

GOALI: Defining Dynamic Morphology, Order-Disorder Transitions, and Interfaces in Gradient Copolymers
In collaboration with Chevron Phillips Chemical Company, we seek to discover how to control the creation of useful new materials made from existing macromolecules, but in new ways. These new types of materials are called gradient copolymers, which are created from different types of large molecules that are chemically bonded in different sequences. The collaborators have found through preliminary experiments that relatively small regions out of the total material synthesized, known as the interface (since it corresponds to the transitions in the different types of molecules bonded together), actually have a large impact on the overall bulk behavior of the material. Due to the unique aspects of this collaboration between university and industrial scientists within the State of Oklahoma, students from all levels will

have the opportunity to participate in research, and observe differences in the practice of science and technology in academic and industrial environments..
Sponsor: National Science Foundation
PI/PD: Jeffery L. White

COMPUTER SCIENCE

Collaborative Research: Enabling Petascale Ensemble-Based Data Assimilation for Numerical Analysis and Prediction of High-Impact Weather
This project is to design adaptive and intelligent software for enabling petascale ensemble data assimilation applications for real-time weather forecasting and prediction. This is collaborative project with OU and Pittsburgh Supercomputing Center.
Sponsor: *National Science Foundation*
PI/PD: Subhash Kak

Exploring a Robust Quantum Cryptography Protocol for Securing Optical Burst Switching Networks
This proposal explores a robust quantum cryptography protocol for securing optical burst switching (OBS) networks, providing a means to make the OBS-based future Internet trustworthy from the ground up. Since the OBS network has a one-to-one correspondence between the header and its associated burst, the same relationship can be exploited for encryption. The new 3-stage quantum cryptography protocol allows practical photon sources to be used in the quantum key exchange, making it feasible to extend quantum cryptography services beyond trusted routers. This research will be verified on a reconfigurable optical burst switching test bed.
Sponsor: *National Science Foundatio*
PI/PD: Subhash Kak

Acquisition of an Optical Motion Capture System for Human-Centered Computing Research
This project is to build a motion capture system for human-centered computing, involving high precision motion cameras and wireless body sensor networks.
Sponsor: *National Science Foundation*
PI: Subhash Kak

Acquisition of a High Performance Compute Cluster for Multidisciplinary Research.
Under this Major Research Instrumentation (MRI) project, Oklahoma State University High Performance Computing Center (OSUHPCC) will acquire, deploy and maintain an HPC cluster supercomputer, to be named Cowboy, that will support computing-intensive research and research training across a broad variety of Science, Technology, Engineering and Mathematics (STEM) disciplines. As a campus-wide shared resource, Cowboy will be available not only to all of OSU's faculty, staff, postdocs, graduate students and undergraduates, but to researchers across Oklahoma. This project includes seven women senior personnel who serve as role models and are creating interest and excitement about computational science and engineering.
Sponsor: *National Science Foundation*
PI/PD: Dana Brunson

Application of Genetic Programming in Time-Series Forecasting

Forecasting is a tool used by managers and analysts to predict parts demand in an aircraft maintenance facility. Part failure data can be viewed as a time series. In this research, we are developing a new computational method for time-series forecasting. Stock index data is used for testing purposes.

Sponsor: *VG Enterprises Inc.*

PI/PD: K.M. George

Creating Scalable, Reliable, Robust, and Secure Applications for the MySource Enterprise Framework

The work was a collaborative effort in the context of a social network application called MySource which provides several utilities for generating content. The task mainly involved the design, implementation, testing, and integration of a new utility. A framework was also set up for a number of other potential users of the social network application. An Agile software development methodology called Scrum was utilized, and the main programming language used was C# in .Net framework. The content management system DotNetNuke was used along with the database management system SQL. One graduate student was supported for eight months.

Sponsor: *CREC (Central Rural Electric Cooperative, Inc.)*

PI/PD: M.H. Samadzadeh

Advancement of a Whole-chain, Stakeholder Driven Traceability System for Agricultural Commodities: Beef Cattle Pilot Demonstration

The long-term goal of this project is to develop and implement an internet-based stakeholder-driven traceability and marketing system for food products that is not punitive or profit- limiting but that adds value to the process while providing a method to limit and remedy food safety outbreaks and biosecurity breaches. This system will include data input by producers, vendors, and consumers. This data not only provides information to facilitate mitigation but also marketing information, value-added details, cultural and sociological features about the production or handling of the produce, quality standards criteria, and a feedback opportunity for consumers to rate or improve product quality. Data will be controlled within the context of a multi-tenant social media system. In the proposed system, stakeholders, particularly producers, will maintain granular privacy control over access to data. This is critical, since the ability to trace food through a supply chain depends on private firms sharing product information with competitors as well as collaborators. If they are not assured of privacy control over information, they may refuse to participate in the system.

Sponsor: *United States Department of Agriculture, National Institute of Food and Agriculture - Integrated Research, Education, and Extension Competitive Grants Program – National Integrated Food Safety Initiative*

PI/PDs: Blayne Mayfield, Johnson P. Thomas

Biosystems and Agricultural Engineering: M. Buser

Proactive Methodology for Identifying Problem Aerospace Parts

The Air Force SBIR Phase I topic AF112-208, Proactive Methodology for Identifying Problem Aerospace Parts, states “Develop a methodology to accurately predict/evaluate parts performance/reliability with compounding problem criteria factors for early corrective actions and acquisition of aerospace parts”. Accurate prediction of part performance/reliability is at the core of health management of air vehicles and supply chain management. “Bad Actor” (BA)

parts chronically will have poor performance. As defined in the problem description of the topic, "A Bad Actor is a serial-numbered/ National Stock Numbered (NSN) item that has lower life cycle service life resulting in decreased reliability, repair processes, or field maintenance activities". Currently, there are no methodologies to accurately predict bad actors. In this context, the goal of this project is to develop methodologies (new procedures, algorithms, and models) to accurately predict such parts before acquisition begins.
Sponsor: *Air Force SBIR Phase I* (*VG Enterprises Inc.)*
PI/PD: N. Park

A Research and Education Infrastructure for Enabling Autonomic Sensor Grid Systems and Multidisciplinary Application
The objective of this grant is to design and implement infrastructure for research in autonomous sensor systems. Work has focused on secure protocols for inter-network roaming, a wireless sensor network for agricultural production and configuration protocols for autonomous agents. This is an interdisciplinary project involving Biosystems and Agricultural Engineering, Electrical and Computer Engineering as well as the Universities of Florida and New Mexico.
Sponsor: *National Science Foundation*
PI/PD: Johnson P Thomas

COMMUNICATION SCIENCES AND DISORDERS

Thirst Set-Point and Salivary Output in Huntington's Disease
It is speculated that hypothalamic alterations may result in changes in feeding and thirst set points in Huntington's disease (HD). A first step in testing this hypothesis is determining if salivary output, independent of neuroleptic-associated xerostomia, is altered in HD. Salivary volume, salivary ph levels, and thirst perception in individuals with HD and healthy age-matched controls were examined. Four HD participants and four controls participated in the study. Salivary volume was significantly reduced in the HD participants. Consistent with reduced salivary volume, salivary acidity was significantly increased. The thirst perception rating scale could not differentiate the two groups.
Sponsor: Huntington's Disease Society of America
PI/PDs: Jordan Easterwood, Cheryl L. Giddens

Rehabilitation in Huntington's Disease
Huntington's is a progressive neurological disease for which there is no cure. Functions such as swallow and speech are commonly impaired and swallow impairment often results in aspiration, and ultimately death. Treatment of the disease is symptomatic and although evidence supporting rehabilitation is scarce, the PI demonstrated improved cranial nerve function in five HD patients in 2009 following only one month of daily therapy. Respiratory, laryngeal, and cognitive therapy is being conducted daily with a 65-year-old HD patient. Effects upon swallow, voice, and psychological functions are being analyzed quarterly in hopes of demonstrating that functional improvement can be maintained long-term.
Sponsor: Huntington's Disease Society of America
PI/PD: Cheryl L. Giddens

GEOGRAPHY

Thematic Survey of Historic Barns in Northeast Oklahoma (FY12)
This project involved locating, identifying, and documenting barns and other agricultural outbuildings over fifty years of age that warrant nomination to the National Register of Historic Places or should be further studied for their architectural and historic significance to Oklahoma's agricultural and architectural heritage. The study also involved the development of an historic context for evaluating historic barns within the 19-county study area.
Sponsors: Oklahoma Historical Society, National Park Service
PI/PD: Brad Bays

National Register Nomination of the Bennie L. Aupplerle Dairy Barn, Newkirk Vicinity, Kay County, Oklahoma
This project involves researching, documenting, and preparing a report and forms for an historic barn in rural Kay County so that it may be considered for listing in the National Register of Historic Places.
Sponsors: Preservation Oklahoma, Inc., National Park Service
PI/PD: Brad Bays

National Register Nomination of the Elmer Baker Barn, Hooker Vicinity, Texas County, Oklahoma
This project involves researching, documenting, and preparing a report and forms for an historic barn in rural Texas County so that it may be considered for listing in the National Register of Historic Places.
Sponsors: Preservation Oklahoma, Inc., National Park Service
PI/PD: Brad Bays

Use of Low-Elevation Oblique-Perspective Aerial Photograph (LEOPAP) to Locate Historic Resources in Areas with Obscured Lateral Visibility
This project tests the feasibility of low-elevation oblique-perspective aerial photography to detect historic buildings in heavily-wooded and hilly terrain. Funding supports the ground-truthing of targeted locations identified with this remote sensing technique in a portion of Adair County in the Oklahoma section of the Ozark uplift. Specific properties located which hold historic significance for historic preservation planning will be recorded for the Oklahoma Landmarks Inventory.
Sponsor: College of Arts & Sciences Fall 2011 Research Travel Grant
PI/PD: Brad Bays

Thematic Survey of Historic Barns in Central and South-Central Oklahoma (FY11)
This project involved locating, identifying, and documenting barns and other agricultural outbuildings over fifty years of age that warrant nomination to the National Register of Historic Places or should be further studied for their architectural and historic significance to Oklahoma's agricultural and architectural heritage. The study also involved the development of an historic context for evaluating historic barns within the 17-county study area.
Sponsors: Oklahoma Historical Society, National Park Service
PI/PD: Brad Bays

Analysis of FARS Data on State Highways in Oklahoma
This project studies the locations of highway fatalities in Oklahoma to identify the physical characteristics of the state's highways (i.e. grade, geometry, and design) that contribute to higher rates of fatality crashes. This research uses statistical analysis to uncover relationships between fatality crashes and road characteristics along predominantly rural segments of the state's roadways. This information will help transportation engineers evaluate current construction practice and seek ways to address design issues that contribute to crashes. This is accomplished with fatality data for Oklahoma from the national Fatality Analysis Reporting System (FARS) and Oklahoma road inventory data from the Oklahoma Department of Transportation.
Sponsor: Oklahoma Transportation Center (OkTC)
PI/PD: Jonathan Comer

FY11-12 Oklahoma Landmarks Inventory and National Register Website
This project is a continuation of support for storing, maintaining, and updating, via computerization, the Oklahoma Landmarks Inventory database and Oklahoma's National Register of Historic Places website. The information about the state's historic buildings, districts, structures, sites, and objects will be accessible to its many users. Continued work on locational enhancement will be undertaken as part of the ongoing project for this academic year, to include site location gathering in counties in southern and central Oklahoma.
Sponsors: Oklahoma Historical Society, Oklahoma State University
PI/PD: Allen Finchum

FY12-13 Oklahoma Landmarks Inventory and National Register Website
This project is a continuation of support for storing, maintaining, and updating, via computerization, the Oklahoma Landmarks Inventory database and Oklahoma's National Register of Historic Places website. The information about the state's historic buildings, districts, structures, sites, and objects will be accessible to its many users. Continued work on locational enhancement will be undertaken as part of the ongoing project for this academic year, to include site location gathering in northeastern Oklahoma.
Sponsors: Oklahoma Historical Society, Oklahoma State University
PI/PD: Allen Finchum

China's Urbanization and Sustainability Under Future Climate Change
Sustainable urban development is the only viable option for China and other emerging countries. This project studies the interactions between urbanization in China and climate change. Using Shanghai and Urumqi as cases, this project integrates land use model and regional climate model to evaluate the impacts of urbanization on regional climate. This project also evaluates impacts of climate change on Shanghai and Urumqi focusing on how climate change will affect urbanization through land availability and change of production and consumption activities.
Sponsor: National Aeronautics and Space Administration
PI/PDs: Jianjun Ge
Michigan State University: Peilei Fan

Automated and Accurate Bridge Deck Crack Inspection
This project aims to develop a smart mobile sensing system equipped with advanced sensors such as cameras, laser range finders, inertial measurement units, and innovative software

algorithms to conduct accurate crack inspection and mapping for bridge decks. Such a system can significantly improve the state of the art of bridge deck structural inspection. The developed system can also be applied in a much wider spectrum of structure health monitoring applications. The project consists of three major tasks: 1) the development of a platform for robotic crack inspection and mapping; 2) the development of robot autonomous navigation for inspection; 3) the development of crack detection and crack map generation.
Sponsor: Oklahoma Transportation Center
PI/PDs: Jianjun Ge
Oklahoma State University: Weihua Sheng

Mozambique: Agricultural Weather Risk Mapping
The goal of this project is to study climate change and threats of extreme weather and variability to agricultural sector and to improve understanding of crop vulnerability in Mozambique. One primary task is to use remote sensing and GIS to generate maps of weather zones and crop thresholds.
Sponsor: World Bank
PI/PDs: Jianjun Ge
Applied Geosolutions LLC: Nathan Torbick

Quantitative Assessment of Climate Variability and Land Surface Change on Streamflow Decrease in the Upper Cimarron River
Long term water resource planning and in-stream flow implementation require improved understandings of how climate, land use and land cover changes (LULC), and human activities have collectively affected streamflow. The overall objective of this project is to quantitatively assess the effects of climate, land surface change and human activities on long term streamflow characteristics of the upper Cimarron River.
Sponsor: Oklahoma Water Resources Research Institute
PI/PDs: Jianjun Ge
Oklahoma State University: Chris Zou

Developing Biological Data Layers for Great Plains Species of Concern Using Predictive Models
In 2008 the Western Governors' Association (WGA) created the Western Governors' Wildlife Council consisting of representatives from 17 WGA members working toward developing policies and tools to identify and conserve crucial wildlife habitat and corridors across the region. One of the main objectives of the WGWC is to improve landscape analysis of energy, land use, and transportation projects, as well as of conservation and climate adaptation strategies. The objective of this project is to produce remote sensing data that will inform and produce predictive suitability maps for five species of concern in the southern Great Plains.
Sponsor: Oklahoma Department of Wildlife Conservation
PI/PD: Jianjun Ge

Fellowship: Centre of Arab and Islamic Studies, Australian National University
This fellowship supported travel and associated expenses for research and collaboration with faculty and graduate students at Australian National University in Canberra, Australia. Several collaborative publications and projects resulted from this support, including a large grant proposal to the Australian Research Council.

Sponsor: Australian National University
PI/PD: Reuel Hanks

Qanats in the Atlantic: History and Ecology of Galerias in the Canary Islands
Traditional methods of water management were investigated in the Canary Islands to find evidence of qanat irrigation and to place these systems in the broader story of qanats in North Africa, Europe, and the Americas. Qanats have been situated in the Canary Islands in numerous published sources with conflicting details regarding who introduced them and when (pre-Spanish or Spanish colonial periods). Multiple lines of evidence (documents, landscape interpretation, interviews, oral histories) confirm that the features described as historical qanats are *galería* spring tunnels, all of which were constructed in the modern era, at least 350 years later than the presumed introduction of qanats to the Canary Islands.
Sponsor: National Geographic Society, Committee for Research and Exploration
PI/PD: Dale Lightfoot

AAPG-OSU Petroleum Geosciences GIS Consortium
The Consortium provides to the international community a Geographic Information Systems (GIS) petroleum database that serves as a comprehensive coverage of the world to enhance database accessibility and mapping capabilities for the energy/petroleum sector. Coverage includes an extensive range of thematic projects including a global oil and gas fields database and a global database of geological information as it relates to petroleum exploration and production. The Consortium is a partnership between the Boone Pickens Digital Geology Fund, the American Association of Petroleum Geologists and the Departments of Geography and Geology at Oklahoma State University.
Sponsor: American Association of Petroleum Geologists Foundation.
PI/PD: Dale Lightfoot
Oklahoma State University: Michael Larson

Food Security and Native American Peoples
This project seeks to research Native American food knowledge, ways, opportunities, and obstacles. Conducting a thorough literature review, key informant interviews, and hosting a summit, we will provide the USDA a valuable report from which action plans to address food security issues may be developed.
Sponsor: United States Department of Agriculture (USDA)
PI/PDs: Rebecca Sheehan
Sociology: Beth Schaefer Caniglia, Tamara Mix

Wind Powering Oklahoma
This was the final year of a project by the Oklahoma Wind Power Initiative addressing the development of wind power in Oklahoma. Utility-scale wind farms are well established and increasing in number, but Oklahoma-owned projects of smaller scale are lacking. This project used public meetings, a Web site, and white papers to attempt to foster smaller-scale (community) wind developments. The premise was that encouraging home/farm turbines will pave the way for the advent of large wind farms into the much more heavily populated eastern 2/3rds of Oklahoma. This expanded geography of large farms is needed as Oklahoma works towards the Department of Energy's vision of 20% wind power generation by 2030. There must be continued public education if our state is to avoid the "Not in my backyard" pushback

strongly encountered in other states. A portion of the work was subcontracted to our partners at the University of Oklahoma.
Sponsor: US Department of Energy
PI/PD: Stephen J. Stadler

Deforestation and Degradation: Impacts on Carbon Stocks, Biodiversity and the Potential Effects of PES/REDD initiatives on People and Forests in the Korup National Park (KNP), Cameroon
This study identifies the drivers of tropical deforestation across scales in the Korup National Park, Cameroon. Linking household surveys, ethnography, forest mensuration and remote sensing analysis, we seek to understand how decisions made at the micro scales affect household livelihood, land use, biodiversity and carbon stock dynamics in tropical forests. This study also seeks to increase understanding of how Payments for Environmental Services (Reducing Emissions from deforestation and degradation (REDD)) will affect land use decisions at both the household and community scales. Lastly, we hope to address the challenges faced in striking a balance between environmental conservation and poverty alleviation.
Sponsor: NSF DDRI (Dissertation Improvement Grant)
PI/PDs: Jacqueline Vadjunec
Oklahoma State University: Siewe Siewe Siewe

Decision Support System for Road Closures in Flash Flood Emergencies
Flash floods are the most common and widespread natural disasters in the U.S. More than half of the deaths in flash flood are due to drowning victims in a traffic environment. Timely decision on road closure in flash flood emergencies is critical to save lives. The objective of this project is to develop a novel decision support system (DSS) supported by geographic information systems (GIS) to predict the roads that could become dangerous for driving during flash flood scenarios and remotely turn on TADD (Turn Around Don't Drown) Red flash lights to close the roads.
Sponsor: Oklahoma Transportation Center
PI/PDs: Hongbo Yu
Oklahoma State University: Tieming Liu , Terry Collins, Jason Vogel, Lan Zhu
University of Oklahoma: Yang Hong

GEOLOGY

RAPID: Understanding Early Time Biogeophysical Signals of the Microbial Degradation of Crude Oil from the BP Spill in Saline Marshlands
This is a collaborative project between Oklahoma State University and Rutgers University. The objective is to identify unique electromagnetic (EM) geophysical signatures that reflect specific changes in sediment physical, chemical, and microbiological characteristics due to oil spills in highly saline environments. Potential benefits include development of geophysical methodologies for the rapid characterization of microbial activity in extreme environments such as the deep ocean.
Sponsor: National Science Foundation
PI/PDs: Estella Atekwana, Eliot Atekwana, Babu Fathepure

Collaborative Research: Integrated Studies of Early Stages of Continental Extension: From Incipient (Okavango) to Young (Malawi) Rifts
This is a collaborative project between Oklahoma State University, Woods Hole Oceanographic Institution, Missouri University of Science and Technology, Columbia University and University of Texas El Paso. Our objective is to investigate the question of what happens in the early stages of continental rifting. We will undertake a multi-disciplinary study of the youngest branch of the EARS (the southwest branch) which includes the very early stage Okavango Rift Zone, where classic geomorphic rift features are just beginning to emerge, and the Malawi Rift, where geomorphic features are fully developed but magma (if present) has yet to breach the surface. We will apply a combination of geophysical, geological, geochemical and geodynamic techniques.
Sponsor: National Science Foundation
PI/PDs: Estella Atekwana, Eliot Atekwana

Biogeophysics for Optimized Mitigation of Hydrocarbon Contaminated Soils: From Theoretical Developments, Laboratory Experiments to Field Validation
This is a collaborative project between Oklahoma State University, Rutgers University, and Western Michigan University. The objective is to investigate to quantitatively characterize biological, geochemical and physical processes contributing to detectable biogeophysical signals at sites impacted with hydrocarbons. Major outcomes of our proposed project will include (1) an enhanced understanding of the underlying fundamental mechanisms of microbially induced biogeophysical signals, (2) the development of a new class of petrophysical models for interpreting biogeophysical data from hydrocarbon contaminated environments and (3) an understanding of the limitations of the use of biogeophysical techniques at sites contaminated with contaminants of concern to Chevron.
Sponsor: Chevron Technology Company
PI/PDs: Estella Atekwana and Eliot Atekwana

IRES: Research Opportunities to Investigate Carbon Cycling in the Okavango River Delta, Botswana for US Undergraduate and Graduate Geosciences Students
This project supported research and educational activities for 2 undergraduates and 1 graduate OSU students to investigate carbon cycling in the Okavango River Delta, Botswana. The project was conducted in collaboration with scientists from the University of Botswana (UB) and the Okavango Research Institute. Two UB students participated in the project. The US and UB students conduct field experiments to test the hypotheses that vegetative evapo-concentration controls the mass transfer of riverine dissolved inorganic carbon. The students were mentored over a 6 week field campaign on the collection, analysis, and synthesis of data sets to address the project hypothesis.
Sponsor: National Science Foundation
PI/PD: Eliot Atekwana

Characterization of terrestrial primary, eroded, and mantled volcanic surfaces for a more complete understanding of Martian volcanic deposit modification
This project is an evaluation of small volcanic landforms on Earth as an analog for potential similar features on the surface of Mars.
Sponsor: National Aeronautics and Space Administration (NASA)
PI/PD: Jeffrey Byrnes

Characterization of Global Ophiolite Distribution
This is a mapping project examining the worldwide distribution and nature of ophiolite complexes, which are assemblages of rock found on continents that have similarities to oceanic crust.
Sponsor: American Association of Petroleum Geologists (AAPG)
PI/PD: Jeffrey Byrnes

Effects of Near-Term Sea-Level Rise on Coastal Infrastructure
The primary objective of this interdisciplinary project is to develop models for quantifying the potential impact and risk to coastal systems and infrastructure from near-term sea-level rise and the attendant increases in hurricane activity over the next century. Specific objectives include: 1) examining both the direct and indirect effects of sea-level rise on coastal facilities, 2) developing guidelines for using existing technologies for reducing sea-level rise impacts and risks to coastal systems and infrastructure, and 3) developing new mitigation methods to achieve additional impact and risk reduction.
Sponsor: DOD Strategic Environmental Research and Development Program.
PI/PD: Joseph Donoghue

Nitrogen cycle changes across the Cretaceous-Paleogene mass extinction event
This project seeks to evaluate the paleoenvironmental conditions in the oceans through the mass extinction event at the Cretaceous-Paleogene boundary, with a focus on the nitrogen cycle. A range of geochemical data, including nitrogen and carbon isotopic values, will be measured on samples obtained from five deep-sea sediment cores. The data will provide information about the processes of global mass extinction and the subsequent recovery. The grant fully supports one graduate student, with partial support for another graduate student and an undergraduate student. Funding is also provided for the development of a novel educational activity by an outside educational coordinator.
Sponsor: National Science Foundation
PI/PD: Tracy Quan

HISTORY

Lutheranism's Frontier: The Reformation in Finland 1523-1611
This research project will make several contributions to the extant scholarship. It will be the first monograph in any language on the Lutheran Reformation in Finland. This study's focus will serve as a model for additional regional studies in respect to the Swedish kingdom and Scandinavia. Such studies, while plentiful and useful in respect to other European countries, are lacking in respect to Scandinavia. This study will refute the assumption, particularly in English-language scholarship, that the Swedish kingdom, to which Finland belonged until 1809, went irrevocably over to Lutheranism during Gustav Vasa's reign.
Sponsor: Academy of Finland Center of Excellence "History of Society: Re-thinking Finland 1400-2000."
Previous Sponsors: Oklahoma State University, Oklahoma Humanities Council, Finnish Cultural Foundation.
PI/PD: Jason Lavery

Scapegoat Country: Leningrad during the Stalin Terror of the 1930s
The well-publicized Moscow show trials of the 1930s long defined the essence of the Stalinist terror both to Soviet citizens and to the world. Examination of the January 1937 trial of the so-called "Parallel Anti-Soviet Trotskyite Center" and popular responses to it in the Leningrad region, using secret police and Communist party reports, will illuminate a wide variety of opinions on the trial, as well as on the actual political, social, and economic concerns of ordinary people and on problems in the top leadership. This is part of an ongoing project.
Sponsors: State of Oklahoma, Center for Russian, East European & Eurasian Studies (University of Kansas)
PI/PD: Lesley Rimmel

MICROBIOLOGY AND MOLECULAR GENETICS

Unraveling Genetic Regulatory Circuits Integrating the Light and Dark Reactions of Oxygenic Photosynthesis
Solar energy drives metabolism in plants and other photosynthetic organisms and results in the production of economically and agriculturally important products. The advent of genomic engineering has opened the biotechnological door into a world will see the increased use of cyanobacteria and microalgae to produce new products or existing products in new ways. This project uses cyanobacteria as experimental models to understand changes in the photosynthetic mechanism necessary to accommodate the redirection of metabolic product fluxes in such engineered systems.
Sponsor: DOE
PI/PDs: Robert Burnap, Han Bao

Assembly and Function of the Photosystem II Complex
Photosystem II (PSII) produces the vast majority of reductant used to fix inorganic carbon into the earth's biosphere and, at the same time, O_2, the by-product of the H_2O-oxidation reaction catalyzed by PSII. Despite the basal role of PSII in photosynthesis, many aspects of the enzyme's O_2-yielding H_2O-oxidation mechanism remain poorly understood. The major objectives are to elucidate 1.) the molecular mechanisms responsible for the detection and repair of the D1 protein, 2.) assembly of catalytic the metal atoms into protein coordination environment, and 3.) proton ejection during assembly and catalysis.
Sponsor: NSF
PI/PDs: Robert Burnap, Han Bao

The Effect of Endothelial Cell, Monocyte-activating Polypeptide II on CD40 Ligand Expression of Mouse Dendritic Cells
Endothelial cell monocyte-activating polypeptide II (EMAP II) is a protein released from dying cells. We were interested in the effect of this factor on dendritic cells that play an important role in initiating immune responses to infectious agents and tumors by stimulating T cells. We analyzed the effect of EMAP II on a surface protein on dendritic cells of mice that allows them to interact with T-cells and found that it increased expression of this protein, which, in turn, likely increases the capacity of these cells to initiate immune responses.
Sponsor: Oklahoma IDeA Network of Biomedical Research Excellence (OK-INBRE)
PI/PD: D. Kim Burnham

A Genomics and Cultivation-Based Study on Novel Candidate Divisions OD1, SR1, OP11, and TM7 in a Sulfur-Rich Spring (Zodletone Spring, OK)
The goal of this project is to investigate the physiological characteristics, and potential ecological roles of four of important yet-uncultured bacterial groups, termed candidate divisions, OD1, SR1, OP11, and TM7. These four groups have been shown to be relatively abundant in Zodletone spring, a sulfide and sulfur- rich spring in southwestern Oklahoma. Zodletone spring will be used as a microbial observatory to study these groups. A set of novel genomic and isolation techniques will be used. Ultimately the data will be used to understand the chemical reactions and the ecological roles performed by members of each these groups.
Sponsor: National Science Foundation
PI/PD: Mostafa Elshahed

Biofuel Production from Lignocellulosic Biomass Using of Members of the Anaerobic Fungi (Phylum Neocallimastigomycota): A Dual Bioprospecting and Strain Development Strategy
The overall goal of this project is to isolate members of the anaerobic fungi (Phylum Neocallimastigomycota), and to explore their utility and potential use as bioconversion agents in biofuel research. Multiple anaerobic fungal strains will be isolated, their physiological characteristics and metabolic potential characterized, and the genome and transcriptome of the most promising isolates will be sequenced using high-throughput sequencing approaches. In addition, various schemes to improve alcohol production and alcohol tolerance in these strains will be explored.
Sponsor: National Science Foundation EPSCoR program
PI/PD: Mostafa Elshahed

Characterization and Mediation of Microbial Deterioration of Concrete Infrastructures
Biogenic sulfuric acid is a major cause for the deterioration of concrete structures including bridges and wastewater plants. Studies have shown that sulfur-oxidizers produce sulfuric acid from sulfur compounds that reacts with concrete producing ettringite and gypsum resulting in severe corrosion. We used molecular tools to study the microbial diversity in deteriorating concrete at various bridge sites. Also, microcosms were set up to determine the extent of sulfuric acid production. Results showed that diverse microbial communities including acid-producing organisms existed in corroded-concrete compared to non-corroded concrete. Microcosm studies showed decrease in pH from 7 to 3 and this decrease was accompanied by the accumulation of calcium, sulfate, and iron in the medium indicating deterioration of concrete.
Sponsor: Oklahoma Transportation Center
PI/PDs: Babu Fathepure
College of Engineering, Architecture and Technology: Joshua Ramsey, Tyler Le, Gregory Wilber

Understanding Early Time Biogeophysical Signals of the Microbial Degradation of Crude Oil from the BP Spill in Saline Marshlands
The major goal of this project is to characterize biogeochemical processes contributing to detectable geophysical signals during crude oil transformations *in-situ* in salt marshes of Louisiana that are impacted with the BP oil spill. We have obtained pre-spill baseline geophysical, microbiological, and geochemical data and subsequently studied microbial transformation of oil on the geophysical signatures. Our initial results show that salt-tolerant hydrocarbon-degrading organisms belonging to genus *Marinobacter* and *Halomonas* were

dominant in soil impacted by BP oil spill compared to soil collected from locations away from the shores suggesting microbial response to BP oil spill.
Sponsor: National Science Foundation
PI/PDs: Babu Fathepure
Department of Geology: Estella Atekwana
Rutgers-Newark: Lee Slater

Discovery of Novel Lignin-Degrading Genes in Bacteria Using Metagenomic and Proteomic Approaches for Enhanced Biomass Conversion to Biofuel
The primary goal of this project was to identify novel lignin degrading genes in bacteria that can be used in the bioconversion of plant biomass to biofuel. We have enriched several bacterial consortia that degrade lignin from decaying biomass. To gain insight into the microbial community composition and their metabolic capacity, metagenomic analysis of an enrichment culture was performed. In-Silico analysis revealed the presence of a variety of lignin degrading as well as cellulose degrading genes in the metagenome suggesting biomass degrading potential of the enrichment cultures. In addition, several strains of bacteria that degrade lignin as the sole source of carbon have been isolated.
Sponsor: SunGrant (US Department of Transportation)
PI/PDs: Babu Fathepure, Rolfe Prade
Biochemistry and Molecular Biology: Patricia Canaan

The Study of Azoreductase
Azoreductase is an part of the oxidoreductase family of enzymes, and it is found in a variety of bacteria ranging from soil to the human intestine. Azoreductase is involved in the metabolism of the azo dyes, which are common food and industrial dyes. In some cases the metabolic products can be toxic to humans. Within the field of azoreductase, the role azoreductase plays in bacterial physiology and human health is not fully understood. Our work with azorductase from *Enterococcus faecium* and *Clostridium perfrigens,* two prominent human intestinal microorganism, will improve our understanding of the role of azoreductase.
Sponsor: National Science Foundation
PI/PD: Gilbert H. John

Role of STAT Proteins in MAPK Signal Transduction Pathways
Signal transduction pathways mediated by G proteins and MAP kinases (mitogen activated protein kinases, MAPKs) have been associated with the regulation of cell growth and differentiation and the development of diseases such as cancer, cardiac hypertrophy, and obesity. These signaling proteins and STAT (signal transducer and activator of transcription) proteins have been identified in a wide range of eukaryotes but the role of STAT proteins in G protein/MAPK pathways remains to be determined. The proposed research will investigate the regulation of STAT proteins in MAPK mutants in *Dictyostelium* development because recent studies suggest an overlap in MAPK and STAT function in the regulation of tissue specific gene expression.
Sponsor: NIH
PI/PD: Jeff Hadwiger

Bacterial Light Sensing by Photoactive Yellow Protein
We will determine *in vivo* signaling mechanisms of photoactive yellow protein (PYP) in bacteria. Aim 1: We will develop a generally applicable tool to examine PYP function using the

pharmacological approach involving locked chromophore analogs that we recently reported. Aim 2: We will identify photocycle events required for *in vivo* signaling of PYP. Aim 3: We will determine modes of downstream signaling by PYP. We have reported that the PYP from *Idiomarina loihiensis* likely interacts with a GGDEF protein, while the PYP from *Salinibacter ruber* is a DNA binding protein. We will perform experiments to test these proposals.
Sponsor: National Science Foundation
PI/PD: Wouter D. Hoff

Calcium and *P. aeruginosa* Infective Endocarditis
Calcium (Ca^{2+}) regulates a wide range of essential biological processes. Abnormalities in Ca^{2+}-homeostasis may cause a number of heart diseases, including heart failure. The opportunistic pathogen *Pseudomonas aeruginosa* forms biofilms that may result in infective endocarditis and device-related infections. This research aims to 1) establish Ca^{2+} homeostasis in *P. aeruginosa* PAO1 cells; 2) identify the genes and proteins that are responsible for PAO1 biofilm development at high Ca^{2+}; and 3) determine the ability of PAO1 to deposit Ca^{2+}extracellularly. This proposal will be the first to address the relationship between Ca^{2+}, the processes that control *P. aeruginosa* pathogenecity and infective endocarditis.
Sponsor: American Heart Association
PI/PD: Marianna A. Patrauchan

Induced Polarization Signature of Biofilms in Porous Media: From Laboratory Experiments to Theoretical Developments and Validation
Growth and metabolic activities of microorganisms can significantly influence geochemical processes. The goal of the project is to quantitatively characterize major components and processes within bacterial biofilms contributing to geophysical signals using spectral induced polarization (SIP) signatures. Through a combined effort of three laboratories we will (i) evaluate the contribution of biofilm components and biogenic minerals to SIP signatures, (ii) determine if the SIP signatures can be used to quantify the rates of biofilm formation and biogenic mineral accumulation in subsurface media, and (iii) develop models to predict the geophysical response associated with the development of biofilms in field conditions.
Sponsor: Department of Energy
PI/PDs: Marianna A. Patrauchan
Geology: Estella Atekwana
Colorado School of Mines: André Revil

Antimicrobial Effect of a New Class of Light Resistant Silver (I) Complexes. Adhesion and Biofilm Studies
Development of severe bacterial infections is a serious complication in all implant-inserting surgeries. It requires development of new implant materials with strong antimicrobial activity without toxic effects on host. The goal is to study UV-light resistance of the newly synthesized silver(I) cyanoximates (SA) and identify their antimicrobial effect on bacterial adhesion and biofilm formation. We will synthesize novel SAs and test their UV light resistance, prepare solid polymeric composites containing SAs and acrylamide-type glue for antimicrobial studies, and identify and quantitatively characterize the effect of SAs on bacterial adhesion and biofilm formation of *P. aeruginosa*, *S. aureus* and *S. mutans.*
Sponsor: National Institutes of Health (NIH)
PI/PDs: Marianna A. Patrauchan
Missouri State University: Nickolay Gerasymchuk

Antibiotic resistance in *Pseudomonas aeruginosa*
Pseudomonas aeruginosa is a facultative human pathogen and a leading cause of nosocomial infections as well as severe chronic infections in cystic fibrosis (CF) patients. It is ranked as a "superbug" due to its resistance to most antimicrobial drugs available on the market and thus represents a very difficult challenge in healthcare worldwide. The goal is to elucidate the mechanisms of calcium (Ca^{2+})-induced antibiotic resistance in this organism. We will aim to determine the effect of Ca^{2+} on the expression of the responsible genes, and to elucidate the role of Ca^{2+} signalling in Ca^{2+}-induced antibiotic resistance in *P. aeruginosa.*
Sponsor: OCAST
PI/PD: Marianna A. Patrauchan

Control of type III Secretion of *Shigella* by IpaD
Shigella flexneri causes shigellosis, a severe form of diarrhea, which affects populations around the world including those involved in humanitarian/military causes in endemic areas of the world. *Shigella* uses a type III secretion apparatus (TTSA) which resembles a molecular syringe and needle as a conduit to deliver proteins to cells of the large intestine to promote its infection. We have shown that IpaD is the protein located at the tip of the needle to control the protein delivery. Herein, we examine the function of IpaD which now becomes an important candidate for a subunit vaccine against *Shigella.*
Sponsor: National Institutes of Health
PI/PD: Wendy L. Picking

A *L. lactis*-based Vaccine for Children with Broad Spectrum for Enteric Pathogens
The specific aims of this investigation are to construct GEM particles displaying *Shigella, Salmonella,* and *Yersinia* antigens, demonstrate the immunogenicity and vaccine efficacy of the candidates, and characterize the final product to prepare for clinical trials.
Sponsor: National Institutes of Health
PI/PD: Wendy L. Picking

Use of Type III Secretion System Antigens as a Novel Vaccine Against *Shigella* spp
The specific aim of this investigation is to develop a vaccine against *Shigella* spp. using purified protective antigens.
Sponsor: PATH
PI/PD: Wendy L. Picking

TTSS proteins as protective antigens against *Salmonella*
The specific aim of this investigation is to develop a vaccine against *Salmonella* spp. using purified protective antigens.
Sponsor: OCAST
PI/PD: Wendy L. Picking

A Mechanism for *Shigella* Type III Secretion Activation
The *Shigella* Type III Secretion System is a novel model system for exploring the steps of type III secretion induction in bacterial pathogens. We hypothesize that IpaD senses environmental signals to trigger the controlled recruitment of IpaB to the needle tip complex. We thus plan to determine the physical and molecular mechanism responsible for IpaB recruitment to the TTSA needle tip complex. To do this, we will: 1) *solve the crystal structure of IpaD with DOC bound;* 2)

target key sites for mutational characterization; and 3) *determine the influence of targeted mutations on IpaD structure and function*.
Sponsor: National Institutes of Health
PI/PD: William D. Picking

Mucosal Immunity, Vaccines and Microbiota Interplay in Humans and Macaques
A problem encountered in human pathogen research is the need for purified molecules that are recognized by the immune response. This project will generate the antigens needed for projects that are part of the NIH program "Mucosal immunity, vaccines and microbiota interplay in humans and macaques" (housed at the University of Maryland-Center for Vaccine Development. The goals here are to: 1) provide cloning and over-expression of gene products for Program investigators; 2) use customized protocols for purifying over-expressed proteins; 3) characterize purified proteins for purity structure and solubility; and 4) provide somatic antigen as requested.
Sponsor: National Institutes of Health
PI/PD: William D. Picking

Targeting *Shigella* Secretion to Prevent Dysentery
Type III secretion systems are recognized as important virulence determinants for many pathogens, however, the underlying mechanisms controlling TTS remain unknown. With *Shigella* as our model system, we are the only groups to have demonstrated the individual steps leading to TTS induction. We will now use this system and a unique interdisciplinary approach to provide insight into the steps that govern TTS induction and translocon formation. This information will allow the design of new practical methods for blocking the onset of TTS in *Shigella* with potential application to other important pathogens.
Sponsor: OCAST
PI/PD: William D. Picking

Gene Library for Bio-mass-Conversion Enzymes
As enzymatic degradation of biomass to feedstock sugars moves towards the forefront of the biofuel industry, an overriding barrier is its inherent recalcitrance. Biomass composition becomes highly variable, with lignin and hemicellulose being removed in various ratios, to different extents, and from different substructures. Enzymatic hydrolysis of solid and oligomeric carbohydrates is different for each treatment. Finding the optimal benefit of pretreatment and enzyme synergy can be greatly facilitated by a diverse and comprehensive enzyme activity library that can be used in mixing studies to evaluate the required activities and ratios for a given pretreatment product. The goal of this project is to create this enzyme activity library.
Sponsor: National Renewable Energy Laboratory NREL/DOE
PI/PD: Rolf Prade

Analysis of the *Coxiella burnetii* Type IV Secretion System During Infection
Coxiella burnetii is an obligate intracellular bacterium and the causative agent of acute Q fever and chronic diseases. It is a zoonotic pathogen which has been designated a Category B level Select Agent by the CDC. Very little is known about the molecular interactions of *C. burnetii* and its host cell. In the current proposal we will characterize the *C. burnetii* type IV secretion system (T4SS). Considering the established role of the T4SS in infection and development of other bacteria, these studies will likely lead to the identification of unique diagnostic, therapeutic, and vaccine targets for Q-fever detection and intervention.

Sponsor: National Institutes of Health
PI/PD: Edward I. Shaw

Research Supplements to Promote Diversity in Health-Related Research
This is an NIH sponsored supplement to Dr. Shaw's parent grant which was awarded as a means to provide a substantial research experience to a promising undergraduate student from a population which is underrepresented in the medical research sciences. The undergraduate research assistant, Mr. Devin Leslie, will help to characterize the *C. burnetii* type IV secretion system (T4SS). Considering the established role of the T4SS in infection and development of other bacteria, these studies will likely lead to the identification of unique diagnostic, therapeutic, and vaccine targets for Q-fever detection and intervention.
Sponsor: National Institutes of Health
PI/PD: Edward I. Shaw

Analysis of *C. burnetii* Phase II (avirulent) in Colostrum Whey: The Effect of Heat (58°C), Heat (58°C) and H_2O_2 Treatment, and H_2O_2 Treatment Alone, on Subsequent *C. burnetii* Infectivity
Coxiella burnetii are obligate intracellular bacterial pathogens which have traditionally been cultured in either tissue culture cells or embryonated eggs. In the current project, we will determine whether these agents will survive and grow after exposure to elevated temperatures (58°C) for 40 minutes and after treatment with 2.5% H_2O_2 for 150 and 210 minutes, respectively. The resulting data will be compiled to determine the LOD_{50} and level of inactivation of viable *C. burnetii* in a tissue culture infection model after the treatments.
Sponsor: Zinpro Corporation
PI/PD: Edward I. Shaw

MUSIC

A&S Dean's Humanities Lecture Series Grant
Will host *Big Robot* electronic multi-media performance team for public performance, lecture and master class.
Sponsor: College of Arts and Sciences
PI/PD: Meredith Blecha

A&S Travel Grant: To present at the American String Teachers Association convention last spring in Atlanta. My lecture entitled "Recruiting Basics for College Educators: Building Your String Program," was well received. At the same conference, I served as the representative (president-elect) from the Oklahoma chapter of ASTA and attended various leadership meetings. This was especially beneficial and certainly helped to contribute to my visibility on the national level.
Sponsor: College of Arts and Sciences
PI/PD: Virginia Broffitt

Dean's Incentive Grant
This grant was used partially to fund travel to Chicago and Lansing, MI over the summer to record a trio CD. Four days were spent rehearsing in Chicago before traveling to Lansing for

three days of recording sessions. The other portion of the grant was used to fund some travel expenses to the National Flute Association Convention.
Sponsor: College of Arts and Sciences
PI/PDs: Virginia Broffitt, Meredith Blecha
Peer Institution: Jeffrey Brown

Friends of Music Faculty Professional Assistance Grant
This grant was used to fund some expenses for travel to the National Flute Convention. This year, I performed on three separate concerts and coordinated the Young Artist Competition (the premier annual flute competition in the country).
Sponsor: Friends of Music
PI/PD: Virginia Broffitt

ASR +1 Grant
This grant was used to fund preparation and expenses for a trio CD recording. The recording sessions were in Lansing, MI in July of 2012. The $1000 in travel funds will be used this year for travel to perform concerts to publicize the CD recording.
Sponsor: College of Arts and Sciences
PI/PD: Virginia Broffitt, Meredith Blecha, Jeffrey Brown (peer institution)

A&S Fall Travel Grant
This grant was used to fund the majority of the travel expenses for the National Flute Convention on which I performed and coordinated the premier competition. The five-day event was held in Las Vegas, NV on August 8-12, 2012.
Sponsor: College of Arts and Sciences
PI/PD: Virginia Broffitt

Friends of Music Faculty Professional Assistance Grant
This grant will be used to fund travel to Kansas City, MO and Manhattan, KS to perform Guest Faculty Chamber Concerts and give master classes to instrumental studios.
Sponsor: Friends of Music
PI/PDs: Virginia Broffitt, Celeste Johnson, Meredith Blecha
Peer Institution: Jeffrey Brown

OSU Friends of Music Faculty Professional Assistance Grant: A private conducting lesson and rehearsal observation with Larry Rachleff, Director of Orchestras at the Shepherd School of Music at Rice University (October 2011).
Sponsor: Friends of Music
PI/PD: Douglas Droste

Conn-Selmer Artist Grant
Michael Sachs, principal trumpet with the Cleveland Orchestra, presented a master class to OSU trumpet students. They were coached individually and then as a complete orchestral brass section.
Sponsor: Conn-Selmer
PI/PD: Ryan Gardner

Conn-Selmer Studio Program
$18,000 in instruments loaned (renewable)
Conn-Selmer loaned the OSU trumpet studio 3 B-flat trumpets, 2 C trumpets, 1 piccolo trumpet, 1 e-flat trumpet and 1 cornet for students to access. These instruments are of the highest quality and were used in various ensembles at OSU.
Sponsor: Conn-Selmer
PI/PD: Ryan Gardner

Conn-Selmer Music Education Program
$7,900 in instruments loaned (renewable)
Conn-Selmer loaned the OSU Music Department 8 trombones, 8 horns, 4 euphoniums and 4 tubas for OSU brass methods courses. This allows for a higher enrollment in classes and the opportunity for music education majors to learn on high quality instruments.
Sponsor: Conn-Selmer
PI/PD: Ryan Gardner

Friends of Music Fall Faculty Professional Assistance Grant – International Trumpet Guild 2012
The International Trumpet Guild Conference was held in Columbus, Georgia in June 2012. I performed as a member of the Festival of Trumpets with other professors from around the world. Additionally, the OSU student trumpet ensemble auditioned and was invited to perform as part of the Trumpet Prelude and Tower Music segments of the conference.
Sponsor: Friends of Music
PI/PD: Ryan Gardner

Department of Music Funding – International Trumpet Guild 2012
The International Trumpet Guild Conference was held in Columbus, Georgia in June 2012. I performed as a member of the Festival of Trumpets with other professors from around the world. Additionally, the OSU student trumpet ensemble auditioned and was invited to perform as part of the Trumpet Prelude and Tower Music segments of the conference.
Sponsor: OSU Department of Music
PI/PD: Ryan Gardner, Brant Adams

Reba Nosoff Grant – National Trumpet Competition 2012
For the first time in OSU history, the OSU Trumpet Ensemble advanced by audition to the live Semi-Final round of the National Trumpet Competition in Faifax, Virginia, where they competed against the elite trumpet programs in the country.
Sponsor: Reba Nosoff
PI/PD: Ryan Gardner

Department of Music Funding – National Trumpet Competition 2012
For the first time in OSU history, the OSU Trumpet Ensemble advanced by audition to the live Semi-Final round of the National Trumpet Competition in Faifax, Virginia, where they competed against the elite trumpet programs in the country.
Sponsor: Department of Music
PI/PD: Ryan Gardner, Brant Adams

OSU Institute for Creativity and Innovation – OSU Jazz Festival 2012
Funding used to initiate our Artist in Residence program in the Jazz Area. Drummer Stockton Helbing taught lessons to students, provided clinics for the jazz ensembles, delivered master classes and performed as part of the OSU Jazz Festival 2012.
Sponsor: OSU Institute for Creativity and Innovation
PI/PD: Ryan Gardner

President Hargis Funding – OSU Jazz Festival 2012
Grammy-Award winning trumpeter Randy Brecker performed on the OSU Jazz Festival 2012 with the OSU Jazz Ensemble I. He also provided a master class available to college and high school students.
Sponsor: President Hargis Funding
PI/PDs: Ryan Gardner, Paul Compton, Brant Adams

Arts and Sciences Summer Research and Supplemental Travel Grant – Three-fifths Brass Trio Recording Project
Brass trios represent an uncommon brass chamber music setting. However, there is an enormous amount of trio music that has been written. Some examples include: Anthony Plog's *Trio for Brass*, J. Mark Stambaugh's *The Armed Man*, as well as works written for or arranged for my ensemble, the Three-fifths Brass Trio. The recording took place in New York this summer and is now in the editing stage.
Sponsor: College of Arts and Sciences
PI/PD: Ryan Gardner

Dean's Incentive Grant – Solo Recording Project
As an active member in the trumpet community, it is essential to have a voice that can be heard worldwide. My passion has always been to find relatively unknown cornet classics and to bring them to the surface for the trumpet community to enjoy. Through my research, I have found a collection of works that fit this criterion. They are all published as a collection entitled *Nine Grand Cornet Solos* and were recorded this summer with pianist Charity Wicks.
Sponsor: College of Arts and Sciences
PI/PD: Ryan Gardner

Friends of Music Spring Faculty Professional Assistance Grant – National Association of College Wind and Percussion Instructors Conference 2012
I was a featured performer and lecturer at the National Conference in San Diego, California. My presentation "Higher, Faster, Louder" focuses on the importance of trumpet fundamentals.
Sponsor: Friends of Music
PI/PD: Ryan Gardner

Start-up Funds – College Music Society South Central Chapter Conference
Featured poster demonstration, performer and lecturer at the regional conference in Ada, Oklahoma. The poster outlined practicing strategies and the presentation discussed similarities between sports and music psychology.
Sponsor: Department of Music
PI/PD: Ryan Gardner

Jazz Fine Arts Allocation Funding – Fall 2011 Concert
Trombonist, composer and arranger Ryan Haines delivered master classes and performed on the OSU JazzConcert in October.
Sponsor: Jazz Fine Arts Allocation
PI/PDs: Ryan Gardner, Paul Compton

OSU Institute for Creativity and Innovation – OSU Brass Day 2012
OSU Brass Day will feature James Thompson, Professor of Trumpet at the Eastman School of Music, Adam Unsworth, Professor of Horn at the University of Michigan and Randall Hawes, Bass trombonist with the Detroit Symphony. These artists will perform and provide master classes for OSU students and high school students from Oklahoma and Texas.
Sponsor: OSU Institute for Creativity and Innovation
PI/PD: Ryan Gardner

Yamaha Corporation Artist Grant – OSU Brass Day 2012
OSU Brass Day will feature James Thompson, Professor of Trumpet at the Eastman School of Music, who is a Yamaha Performing Artist. They have decided to partner with OSU to alleviate some of the cost to the department.
Sponsor: Yamaha Corporation
PI/PD: Ryan Gardner

Michael Kirkendoll – Assistant Professor
Guest Composer Gabriela Lena Frank - OSU Festival of Contemporary Music
Composer Gabriela Lena Frank was the principal guest artist for the OSU Festival of Contemporary Music. Gabriela coached her own compositions with the student members of the Frontiers New Music Ensemble, including her award-winning String Quartet, *Leyendas*. In addition, Gabriela presented a lecture/demonstration at the OSU Library.
Sponsor: Norris Grant
PI/PD: Michael Kirkendoll

Guest Artists Forrest Pierce, Gregory Oakes, Ken Ueno, and Mary Fukushima - OSU Festival of Contemporary Music
These guest artists joined Gabriela Lena Frank at the first OSU Festival of Contemporary Music. They coached students in the Frontiers New Music Ensemble, lectured to OSU theory/composition students, and performed in the special guest-artist recital as part of the festival.
Sponsor: A&S Lecture Series
PI/PD: Michael Kirkendoll

Dean's Incentive Grant – CD Recording
I used a Dean's Incentive Grant of $3,000 to begin recording a disc of new works by composer Forrest Pierce for release on the Grammy Award winning Meyer-Media record label. The disc will feature works for solo piano, as well as music composed for my flute/piano duo, DuoSolo. Completion of the disc will be later in 2012 with release in 2013.
Sponsor: College of Arts and Sciences
PI/PD: Michael Kirkendoll

Attend/Perform/Direct the 2011 Cortona Sessions for New Music
I received the Travel Award to assist with my expenses to travel to Italy for the 2011 Cortona Sessions for New Music for which I am the founder, artistic director, and piano faculty. The Cortona Sessions brings young performers and composers from around the world to Italy for two weeks of study, collaboration, and performance with a renowned faculty of new-music specialists.
Sponsor: College of Arts and Sciences: Travel Award
PI/PD: Michael Kirkendoll

FY12 Spring Travel Award: Attend/Perform/Direct the 2011 Cortona Sessions for New Music + World Saxophone Congress
I received the Travel Award to assist with my expenses to travel to Italy for the 2012 Cortona Sessions for New Music for which I am the founder, artistic director, and piano faculty. The Cortona Sessions brings young performers and composers from around the world to Italy for two weeks of study, collaboration, and performance with a renowned faculty of new-music specialists. In addition, I joined the h2 Saxophone Quartet in St. Andrews, Scotland for performances at the World Saxophone Congress.
Sponsor: College of Arts and Sciences: Travel Award
PI/PD: Michael Kirkendoll

OSU Friends of Music Faculty Professional Assistance
I received funds in the spring 2012 semester to defray costs for a trip to present a master class for the Piano Department of the University of Texas-Austin on the afternoon of October 29th, 2012. The following day I will present a master class for all collaborative piano majors.
Sponsor: Friends of Music
PI/PD: Thomas Lanners

OSU Friends of Music Faculty Professional Assistance
I received funds in the fall 2011 semester to defray travel costs for a trip to New York City to present a master class on the NYU Steinhardt School of Music's *Piano Artist Master Class Series* on February 9th, 2012.
Sponsor: Friends of Music
PI/PD: Thomas Lanners

Visit by Anton Nel
Received funds to bring renowned pianist and pedagogue Anton Nel, Professor of Piano and Chamber Music at the University of Texas-Austin, to OSU to present a full solo piano recital on September 23rd and a two-hour piano master class on September 22nd, 2012. Anton won first prize in the 1987 Naumberg International Piano Competition and was a prizewinner in the Leeds International Competition in England. He has performed as soloist with the Cleveland Orchestra, the symphonies of Chicago, San Francisco, Seattle, Detroit, and London, and many others. As recitalist he has appeared at Carnegie Hall, Lincoln Center, and the Library of Congress in Washington, DC, and internationally in Canada, England (Queen Elizabeth and Wigmore Halls in London), France, Holland (Concertgebouw in Amsterdam), Japan (Suntory Hall in Tokyo), Korea, and South Africa.
Sponsor: A&S Arts and Humanities Lecture Series
PI/PD: Thomas Lanners

Visit by Ning An
Received funds to engage pianist Ning An for a piano master class at OSU on November 16th, 2011 and a recital on November 17th. An has won prizes in numerous international competitions, including first prize in the William Kapell Competition, and has performed worldwide in major halls and with renowned conductors and orchestras, such as the Cleveland Orchestra, London Symphony, Warsaw Philharmonic, Moscow Radio Symphony Orchestra and many others. He is currently Artist-in-Residence in the piano department at Lee University in Tennessee.
Sponsor: Fae Rawdon Norris Endowment for the Humanities
PI/PD: Thomas Lanners

Travel to International Horn Symposium
Received funds for travel to the International Horn Symposium in San Francisco, California, June 20-25, 2011. I performed along with students in a Contributing Artists Recital and attended several lectures on horn pedagogy. Students that performed were Ben Korzelius, Chuck Stewart, Amber Slayton, and Tony Cleeton.
Sponsor: College of Arts and Sciences
PI/PD: Lanette Lòpez-Compton

Fae Rawdon Norris Foundation for the Humanities Grant
The American Horn Quartet will be Artists in Residence at Oklahoma State University on April 3 and 4 of 2013. The residency will include private instruction, ensemble coaching, and lecture presentations for OSU music students. There will also be an educational outreach component that could involve students from other departments in Arts and Sciences. They will present a lecture-demonstration adapting the "art of chamber music" using musical examples to show the similarity between building a chamber group and teambuilding in any area of life. The residency would conclude with a concert that will be open to all OSU students, faculty, and the general public.
Sponsor: Fae Rawdon Norris Endowment for the Humanities
PI/PD: Lanette Lòpez-Compton

Ad Astra Foundation: for this year's Oklahoma Bass Bash at OSU.
The Bass Bash is a four-day camp/clinic for pre-college bass players. Primarily serving students from around Oklahoma, the Bass Bash is a collaborative effort between OSU and OU, with the location alternating between Stillwater and Norman. The 2012 Bass Bash, which took place in Stillwater, brought 30 students and 5 guest faculty members to the OSU campus.
Sponsor: Ad Astra Foundation
PI/PD: George Speed

PHYSICS

An Ultra-Precise Bio-magnetic Scanning Microscope
A low-cost and portable ultra-precise magnetic scanning microscope will be developed and applied into widespread medical uses, especially in magnetoencephalography and magnetocardiography.
Sponsor: Oklahoma Center for the Advancement of Science and Technology (OCAST)
PI/PD: Yingmei Liu

Implementing Spin-squeezed Bose-Einstein Condensates in Optical Lattices
This proposal is targeted towards creating spin-squeezing with sodium spinor Bose-Einstein condensates in optical lattices, and realizing its immediate applications in quantum metrology.
Sponsor: Army Research Office
PI/PD: Yingmei Liu

Medical Physics Research and Education Center
This project establishes a Medical Physics program in the Department of Physics to prepare graduate and undergraduate students for careers in this field. A critical need exists for training, medical physicists to meet the future demand for radiation therapy and diagnosis facilities, especially proton therapy facilities. This project establishes a new Medical Physics program specializing in radiation therapy and proton therapy in particular. New personnel will be hired, students scholarships created, new curricula produced, and new teaching laboratories developed. program builds from the existing efforts to establish a leading national center of excellence in the training of medical physicists.
Sponsor: Public Health Service, Health Service Research Administration
PI/PD: Stephen W.S. McKeever

Study of Exactly Solvable Models in Statistical Mechanics
The main objective is to develop new mathematics to obtain exact expressions for correlation functions in magnetic and other model systems, together with new numerical procedures to evaluate them to high precision. New insight into experimentally accessible low-dimensional systems is to be obtained from these exact theoretical studies.
Sponsor: National Science Foundation
PI/PDs: Jacques H H Perk, Helen Au-Yang Perk

Prompt Gamma Imaging During Proton Radiotherapy
The proposed research aims to develop novel methods to measure and image the atomic composition of tissues irradiated during proton radiotherapy in-vivo, allowing us to study biological changes and response of these tissues over the course of treatment. Such capabilities would allow for the monitoring of a patient's response to proton radiotherapy (via measured changes to tissue composition), thus providing a means for the oncologists to change and adapt treatment delivery for each patient individually based on their measured response.
Sponsor: National Institute of Health (National Cancer Institute)
PI/PD: Jerimy C. Polf

Cross-Polarization Mode Coupling in Whispering-Gallery Microresonators
Two presentations were given at the Pacific Rim Conference on Lasers and Electro-Optics, in Sydney, Australia in August 2011: a poster with the title given above, and a talk with the title "Measuring Thermal Accommodation Coefficients Using a Whispering-Gallery Optical Microresonator." The first represents a potential method for delaying a light pulse without sending it through a very long optical fiber, a capability essential for optical circuitry. The second is a novel method for measuring heat exchange between a very small surface and the surrounding air, which could improve the management of heat in computer circuit boards.
Sponsor: College of Arts & Sciences, Department of Physics
PI/PD: Albert T. Rosenberger

Oklahoma EPSCoR Research Infrastructure Improvement Plan: Building Oklahoma's Leadership Role in Cellulosic Bioenergy
The research consists of three objectives addressing critical issues in developing the cellulosic bioenergy industry – feedstock development and biomass conversion. One objective concentrates on establishing a better understanding of the molecular mechanisms of biomass development to improve yield potential while enhancing the tolerance to abiotic and biotic stresses. The other objectives are focused on the molecular mechanisms for efficient microbial conversion and new catalytic/thermochemical processes for converting cellulosic biomass to liquid fuels.
Sponsors: National Science Foundation, State of Oklahoma
PI/PDs: James P. Wicksted
College of Agricultural Sciences and Natural Resources: Raymond L. Huhnke
University of Oklahoma: Lance L. Lobban

VSM Library for Infrared Structural Biology
Many enzymes are associated with devastating human diseases, such as HIV protease in AIDS, b-secretase in Alzheimer's disease, and cathepsin D in cancer. Understanding the catalytic mechanism of disease-related enzymes is crucial for knowledge-based drug design. Advancement in drug design is hampered by the lack of dynamic structural information on catalytic intermediate states. The goal of this research is to develop a powerful and innovative technique, time-resolved infrared structural biology, to significantly improve our ability in elucidating the catalytic mechanism of enzymes, and thereby benefit the development of drug design to fight serious human diseases.
Sponsor: Oklahoma Center for the Advancement of Science and Technology (OCAST)
PI/PD: Aihua Xie

Infrared Structural Biology Initiative
To build an OSU core collaborative and user facility for infrared structural biology that is accessible to OSU and Oklahoma investigators and to investigate the structural basis of the catalytic mechanism of a ROC GTPase enzyme that is associated to the Parkinson's Disease using advanced infrared structural biology techniques.
Sponsor: Oklahoma State University
PI/PDs: Aihua Xie
College of Agricultural Sciences and Natural Resources: Junpeng Deng

Development of Biosensors for National Security Enhancement
To develop protein based biosensors that are compact and portable. These sensors can be targeted for rapid and early detection of deadly biological agents in event of bioterror and for affordable and rapid detection of human infection diseases.
Sponsor: Oklahoma State University, Department of
PI/PDs: Aihua Xie, Wouter D Hoff

Molecular and Cellular Biophysics
To initiate multi-collaborative interdisciplinary biophysical research projects involving the training of 5 graduate students. One of them is the Xie-Burnap collaboration on FT-IR studies on the mechanism of energy harvest from sun light in plants and bacteria.
Sponsor: Oklahoma State University
PI/PDs: Rob Burnap, Wouter D Hoff, Aihua Xie, Jeff White, Junpeng Deng

Microbiology and Molecular Genetics: Wouter D Hoff, Rob Burnap
Chemistry: Jeff White
College of Agricultural Sciences and Natural Resources: Junpeng Deng

Investigation of New Luminescent Aluminum Oxide Crystals for Application in Radiation Dosimetry
The objective of this project is to characterize Al_2O_3:C and Al_2O_3:C,Mg crystals produced by Landauer Inc. for commercial dosimetry applications, identifying potential obstacles, and investigating strategies to overcome these obstacles.
Sponsor: Landauer, Inc.
PI/PD: Eduardo Yukihara

Luminescence Materials as Nanoparticle Thermal Sensors
This program proposes to develop new inorganic materials with characteristics suitable to determine the thermal history experienced by particles in extreme environments of TL peaks, based on the thermoluminescence phenomenon. These particles can then be used to assist in determining the temperature created in explosions and supporting DTRA's counter-WMD mission.
Sponsor: Defense Threat Reduction Agency (DTRA)
PI/PD: Eduardo Yukihara (PI)

Novel Nanophosphors for Dose Mapping in Radiotherapy
The goal of this project is to develop novel photostimulable nanophosphors with a unique combination of luminescence and dosimetric properties currently not available in any single phosphor. These innovative nanophosphors can then be incorporated into image plates for spot laser scanning readout, enabling the next generation image plate technology with transformative capability for high-precision measurements.
Sponsor: Oklahoma Center for the Advancement of Science and Technology (OCAST)
PI/PD: Eduardo Yukihara

Effects of Membrane Elasticity in Assembly of HIV
This project aims to study *in vitro* assembly of the precursor Gag polyprotein, the major structural HIV protein necessary and sufficient for the assembly of virus-like particles, on synthetic bilayer membranes with different lipid compositions and elasticity.
Sponsor: INBRE
PI/PDs: Donghua Zhou
Northeastern State University: Rui Zhang

Structural Investigation of Lipid Storage Protein by Solid-State NMR
Lipid droplets are micron-sized fat warehouses inside cells. Proteins covering the droplet surface actively regulate the storage and breakdown of fats inside the droplets. However, the regulation mechanism is poorly understood. This project seeks to improve our understanding on lipid storage regulation on the basis of three-dimensional structure of lipid storage protein.
Sponsor: NIH
PI/PDs: Donghua Zhou
Biochemistry and Molecular Biology: Jose Soulages

PSYCHOLOGY

Competing Core Processes in ADHD
Attention-deficit/Hyperactivity Disorder (ADHD) is concurrently one of the most common and devastating disorders among children and adolescents. The current study is the first to experimentally test competing predictions stemming from working memory and behavioral inhibition models of the disorder, and may help explain the inefficacy of existing cognitive therapies that target symptoms related to impulsivity/behavioral inhibition deficits. That is, interventions that effectively target and improve underlying core deficits are likely to positively affect secondary symptoms of ADHD, and once developed, may hold considerable promise for promoting long-term treatment gains.
Sponsor: Oklahoma Center for the Advancement of Science and Technology (OCAST)
PI/PD: R. Matt Alderson

Maternal Dietary Nutrients and Neurotoxins in Infant Cognitive Development
Nutritional research into infant cognitive development has focused on single nutrients and examined individual components of cognition. In this project, we take the approach of examining multiple cognitive processes and nutrition factors when infants are three, six, and nine months old to develop a model of the effects of nutrition on infant development. We will test the hypothesis that significant variation in infant cognitive development assessed at these three ages will be accounted for by variation in the zinc, iron, lead and cadmium content of maternal milk and blood sampled from mothers of breastfed infants when they are three months old.
Sponsor: United States Department of Agriculture
PI/PDs: David G. Thomas
Nutritional Sciences: Tay S. Kennedy

Nutrition and Early Child Development Program
This program formalizes an existing collaboration among faculty in Psychology and Nutritional Sciences and Human Development and Family Science in the College of Human Sciences. The program has three goals. Research: We will assess the cognitive development of participants in our longitudinal development project when they are 2 to 4 years old. Teaching: We will develop an upper division seminar using interdisciplinary, cross-cultural case studies to explore the bio-psycho-social factors contributing to early cognitive development. Outreach: We will translate our research results and those of other investigators into extension programs to meet needs of Oklahoma parents of infants.
Sponsor: Office of the Provost, Oklahoma State University
PI/PDs: Tay S. Kennedy (Nutritional Sciences)
Psychology: David G. Thomas, Jennifer Byrd-Craven
Nutritional Sciences: Barbara Stoecker
Human Development and Family Science: Laura Hubbs-Tate

ZOOLOGY

Collaborative Research: URM: Preparing Biologists through Stewardship, Professionalism and Practice
This program is a collaborative project with Comanche Nation College (CNC) to increase the number of Native Americans who pursue graduate degrees in the biological sciences. The program includes activities for students at CNC and OSU. The OSU-URM program provides research experiences, as well as financial, academic, and professional development support, to Native Americans who transfer to OSU from a two-year school and pursue a bachelor's degree in biological science, zoology, or physiology.
Sponsor: National Science Foundation
PI/PDs: Kristen Baum, Donald French

Broadening Opportunities for Biologists
This program provides scholarships of up to $10,000 per year to students transferring from two-year colleges and pursuing bachelor's degrees in biological science, physiology, or zoology at Oklahoma State University. Scholarships will be awarded to academically talented, financially needy students, and the program will provide scholarship recipients with academic support, professional development, and research related activities.
Sponsor: National Science Foundation
PI/PDs: Kristen Baum, Donald French
Office of Scholarship and Financial Aid: Charles Bruce
University Academic Services: Martha McMillian
Tulsa Community College: Melissa Gentry

Broader Implications of Heterogeneous Burning Regimes in Rangelands for Ecosystem Services: Potential for Disease Control and Pollination Services
Heterogeneous burning regimes interact with selective foraging by livestock on previously burned areas to increase the diversity of native plant communities. Increased plant diversity may increase the availability of plant species and associated nectar and pollen sources for pollinators. Fire may reduce tick abundance by reducing suitable habitat and modify tick-cattle interactions since cattle selectively forage on recently burned patches. Thus, the main objective of this project is to evaluate the effect of Heterogeneous burning regimes on pollinators and ticks in rangelands.
Sponsor: United States Department of Agriculture
PI/PDs: Kristen Baum
Center for Veterinary Health Sciences: Mason Reichard
College of Agricultural Sciences and Natural Resources: Samuel Fuhlendorf

Chemical Analysis of Passive Samplers for Munitions Constituents
Contamination of TNT and RDX can occur during several stages of munitions production, storage, transport, usage, and demilitarization. Currently, the most common source of contamination is through seepage from unexploded ordinances (UXO). Contamination is typically transient in nature resulting in problems ascertaining environmental concentrations. Passive samplers accumulate contaminants from the environment over an extended time and have been previously reported to provide a time-weighted average. If passive samplers can accurately provide a time-weighted measurement under pulsed and continuous conditions for

munitions constituents, they will be a useful tool in contaminated aquatic environments. This project investigates the utility of integrated and equilibrium passive sampling techniques for measuring munitions constituents and related degradation products in aquatic environments under pulsed and continuous conditions and varying contaminant concentrations.
Sponsor: United States Navy, SPAWAR - SCP
PI/PDs: Jason Belden
USACOE: Guillermo Lotufo
US Navy: Gunther Rosen

Investigation of the Viability of Rainfall Harvesting for Long-term Urban Irrigation: Bioaccumulating Organic Compounds and the First Flush in Rooftop Runoff
Rooftop storm water runoff can be both a resource and a problem. With increasing demand on Oklahoma's water resources, all sources of water are potentially valuable. Harvested storm water can be used for irrigation, car washing, cooling, and even drinking if properly treated. However, rooftops can be significant sources of contamination. The asphalt and flame retardants used in roofing materials have been found in rooftop runoff. Atmospheric dust deposits can also contain significant amounts of contaminants such as PAHs, heavy metals, and bacteria. Fortunately, these contaminates are largely washed off the rooftops by the first rain water that falls during a storm. If this "first flush" can be diverted elsewhere, the remaining runoff is relatively clean. However, the amount of water that needs to be diverted is not easy to determine. This project will attempt to develop a site-specific estimate of the volume of the first flush based on the roofing material, roof orientation, and geographical location through continuous monitoring and analysis of contaminants found in the runoff throughout a storm event. It will also evaluate whether the contaminants from the roofing materials have the potential for long-term accumulation in soils from harvested rainfall used as urban irrigation.
Sponsor: Oklahoma Water Resources Research Institute
PI/PDs: Jason Vogel, Jason Belden, Glenn Brown

Experimental Sediment Phosphorus Release Rate Measurements for Select Oklahoma Reservoirs
Eutrophication is one of the leading causes of pollution in lakes and reservoirs worldwide. While eutrophication management has historically focused on controlling external nutrient loading, internal mechanisms can also contribute to, accelerate, and/or prolong the processes of eutrophication. For example, large quantities of nutrients can accumulate in lake sediments and then be released back into the water column over time. Unfortunately, sediment nutrient release rates are unknown for many reservoirs and as a result "default" or literature based estimates are often used in TMDLs and eutrophication models. The purpose of this project is to use sediment core incubation studies to measure phosphorus release rates from four Oklahoma reservoirs. Core incubation studies will provide a phosphorus release rate (mg P/m^2/day) under oxic and anoxic conditions for each reservoir. The resulting measurements of nutrient release will be used by the Oklahoma Department of Environmental Quality (ODEQ) in water quality models.
Sponsor: Oklahoma Department of Environmental Quality
PI/PD: Andrew Dzialowski

Identification and Characterization of Reference Conditions in Major Wetland Classes/Subclasses in Oklahoma

An important step in the development of effective bioassessment programs is the identification of "reference" sites that represent relatively unaltered or minimally disturbed conditions. Unfortunately, reference conditions have not been fully characterized for wetlands in many regions of the country. The purpose of this study is to provide an assessment and comparison of reference conditions in several of the major hydrogeomorphic (HGM) class/subclasses of wetlands in Oklahoma. To accomplish this goal we will first identify and screen reference wetlands from six wetland classes/subclasses (e.g. riverine riparian, riverine oxbow, closed depressional, impounded depessional, lacustrine fringe, and slope) using a combination of approaches. From candidate reference sites, we will select 10 sites from the different wetland classes and sample them using the National Wetlands Condition Assessment (NWCA) field protocols. The resulting data will provide a thorough characterization of reference conditions in Oklahoma wetlands that can be used in the development of effective statewide bioassessment, biocriteria and use attainability programs.

Sponsor: United States Environmental Protection Agency

PI/PDs: Andrew Dzialowski, Joseph R. Bidwell

College of Agriculture: Craig Davis

Zooplankton Availability and Use by Big-river Larval and Age-0 Fishes in Constructed Shallow-water Habitats of the Lower Missouri River

The Missouri River has experienced significant alterations over the past 100 years. Of particular concern has been the loss of shallow water habitat (SWH), which is defined by the U.S. Fish and Wildlife Service as having depths less than 1.5 m and velocities less than 0.61 m/sec. In response, the U.S. Army Corps of Engineers created roughly 1393 ha of SWH on the lower Missouri River (from Sioux City, Iowa downstream to the confluence with the Mississippi River) over the past 15 years. An important goal of these efforts is to determine if the created habitat is providing habitat to native fishes. In this project, we will assess fish use, prey selectivity, and growth in created shallow water habitats of the Lower Missouri River.

Sponsor: United States Army Corps of Engineers

PI/PDs: James Long, Andrew Dzialowski

A Survey of the Freshwater Turtles of Eastern Oklahoma

Our research evaluates the current status of Oklahoma's wild turtle populations, especially in relation to commercial turtle harvest. We 1) conducted an intensive two-year survey of the freshwater turtle species of eastern Oklahoma, 2) systematically surveyed and compared turtle populations from sites with little or no historical commercial harvest to sites with known historical commercial harvest, and 3) completed an experimental study in a group of suitable streams in eastern Oklahoma designed to measure the impact of simulated commercial turtle harvest on natural communities of freshwater turtles. A Master's thesis was completed and publications are being prepared.

Sponsor: Oklahoma Department of Wildlife and Conservation

PI/PDs: Stanley Fox

A Survey of the Freshwater Turtles of Eastern Oklahoma (extended project)

Fifty red-eared sliders with PIT tags (implanted ID microchips) in two fenced ponds near Lake Carl Blackwell are being monitored for trap occupancy in two hoop traps fitted inside with PIT tag antennas for remote query of individually identified subjects continuously over 4-day

intervals during July and August. Our objective is to determine how frequently and under what conditions individual turtles enter and exit hoop traps, i.e., how effective are the traps. Additionally, three turtles have been fitted with radio transmitters and are being tracked every day at random hours. Positions are fixed by GPS.
Sponsor: Oklahoma Department of Wildlife and Conservation
PI/PD: Stanley Fox

Complex, Long-term Care of Young in High-elevation Alpine Lizards of the Andes
Using visual sampling and observations, radiotelemetry of individuals with implanted radios, remote query of individuals tagged with implanted PIT tags (implanted ID microchips), motion-sensitive game cameras, a small-bore, articulating, video-capable borescope (fiber-optic cable), miniature temperature loggers and thermocouples to measure temperatures, and naturalistic clay models, we studied the long-term, complex details of care of sequestered neonates of a Chilean lizard that inhabits rocky outcrops at high, extreme environments in the Andes. Neonates are cared for by parents and other relatives and non-relatives inside deep, rocky crevices and do not leave the refuges for 10-11 months after birth inside.
Sponsors: National Geographic Society, Delta Foundation, Oklahoma State University A&S and the Department of Zoology
PI/PD: Stanley Fox

The Role of the Maternal and Developmental Environments in Adult Phenotype
Two hypotheses have been proposed to explain how the developmental and adult environments should impact offspring fitness. The environmental matching hypothesis proposes that fitness is maximized when quality of the developmental and adult environments is similar. The silver spoon effect states that individuals from high quality developmental environments always have higher fitness. This project tests these hypotheses simultaneously by manipulating exposure to bacterial antigens and stress hormones in females and developing young using a model songbird species, the zebra finch (*Taeniopygia guttata*). These studies should provide insight into the developmental origins of adult diseases and variation in behavioral responses.
Sponsor: National Institutes of Health
PI/PD: Jennifer L. Grindstaff

Organism-environment Interactions - Impact of Cultural Eutrophication on *Daphnia* Tracked by genomics, Physiology and Resurrection Ecology
Previous work indicated that dietary phosphorus affected gene expression, physiology, life-history, and ultimately the frequency of *Daphnia* genotypes. We are using methods in resurrection ecology (hatching, or extracting DNA from decades-old resting eggs) in a variety of lakes to understand the microevolutionary trajectories of relevant genes that may be affected by anthropogenic enhancement of P-loading into lakes in the last century. In concert, a variety of physiological (e.g., radiotracers), and genomic (e.g., microarray) tools are being deployed for a thorough understanding of how humans can impact the evolution of biota.
Sponsor: National Science Foundation
PI/PD: Jeyasingh

Genome Size, Cell Size and Growth; Searching for the Causal Links
This project will shed light on one of the core issues in biology; why does organisms show such a tremendous variability in their genome size? It will also explore the evolvability of this trait and

how it relates to key features like body size and growth rate. A variety of physiological and genomic assays are being planned to be executed this fall.
Sponsor: Research Council of Norway
PI/PDs: Jeyasingh
University of Oslo: Hessen

Paternal Care, Affiliation and Vasopressin: Mechanisms of Monogamy
The goal of this research is to understand the neurobiology of social behavior in prairie voles. Prairie voles, like humans, are monogamous animals that form long-term pairbonds and exhibit behaviors similar to those that humans call 'love'. This series of studies examines how hormones in the brain regulate affiliation, parental care, territoriality, and memory. We are investigating the control of the hormone, vasopressin, in brain areas that influence pairbonding and ask how the brain functions to maintain monogamous bonds, and promote child care from fathers. We are also asking what influence paternal care has on offspring brain and behavior development?
Sponsor: NIH/NICHD
PI/PD: Ophir, AG

Predicting Behavioral Suites from Genetic Profiles: Variation in Mating, Aggression and Exploration in Pouched Rats
African giant pouched rats are used to detect landmines. This research examines the behavior of this rodent in the wild and evaluates individual differences in behavior in the laboratory. This will aid in effectively identifying animals that are predisposed toward detecting explosives. This research also investigates the genetic variation associated with behaviors involved in enhanced explosives detection and will identify genetic signatures for animal screening. Profiling behavior and identifying genetic markers that can predict behavior will enhance the selection and utilization of these animals as efficient explosives biodetectors, and offer insight into the source of individual differences.
Sponsor: DoD/ARO
PI/PD: Ophir, AG

Development of NCU Infrastructure
The Non-Centralized Unit (NCU) of Animal Resources is located within the College of Arts & Sciences, Department of Zoology. The NCU has been continually maintained since 2004 with the primary goal of housing and caring for non-traditional laboratory animals by the investigators that use these animals and who are most familiar with their needs and care. This award will invest in the infrastructure of the NCU, providing 1) the purchase and installation of a cage washer, 2) ductwork to meet / exceed the National Research Council's recommendation for rodent air handling, 3) a new autoclave sterilizer. These improvements broadly increase the research capabilities for faculty within the NCU the Department of Zoology, patrons of animal resources, and OSU.
Sponsor: Oklahoma State Univ., Office of the Vice President for Research and Technology Transfer
PI/PD: Ophir, AG

An Etho-genetic Variation Appraisal System: Equipment to Facilitate Detection of Individual Differences in Genes and Behavior
Adopting pouched rats as explosives detectors provides a tremendous opportunity to the U.S. military in two areas: active detection in the field, and detection of contamination from

collected samples. Should the military decide to adopt pouched rat explosives detectors, it will be important to efficiently produce and scale animal numbers and select animals that would be most effective for military operations. Our funded research project aims to address both goals; the infrastructure discussed here will have a profound effect on the ability to meet these goals. Here we propose to set in place infrastructure to facilitate high-throughput assessment of individual variation. This "*Etho-genetic Variation Appraisal System*" is composed of three main components: computerized behavioral observation, quantitative PCR capabilities, and field equipment to study individual differences in natural behavior (including traps, cages, and a field vehicle).
Sponsor: DoD/ARO
PI/PD: Ophir, AG

Rugged Automated Training System
The objective of this proposal is to demonstrate the soundness, technical merit, and innovation of our Team's proposed approach, to the development of an automated training system that will train small mammals to reliably detect explosives. Such a system should generate empirically reliable data attesting to the skill and reliability of a trainee animal.
Sponsor: DoD/ARO
PI/PDs: Kades, T (*Strategic Feasibilites);*
Arts and Sciences: Ophir, AG
Center for Veterinary Health Sciences: Davis, M

Amphibian Community Composition in Man-made and Natural Wetlands in the Ouachita National Forest in Southeastern Oklahoma
Amphibian populations are on the decline and appropriate management strategies are necessary to improve populations in some regions. The US Forest Service in the Ouachita National Forest located in southeast Oklahoma constructs ponds which are useful for amphibians, though it is not known if man-made ponds provide the same ecosystem services (e.g., breeding habitat) as the natural aquatic features of the region. This project catalogs amphibian species in natural and man-made wetlands in the Ouachita National Forest and aims to determine the impacts of man-made ponds on species composition. This project was partially completed this summer.
Sponsor: United States Forest Service
PI/PD: Loren M. Smith

Greenhouse Gas Fluxes in Playa Wetlands: Restoration Potential to Mitigate Climate Change
Land use change has impacted services provided by playas in the High Plains, U.S. and likely affected their role in climate change forcing from greenhouse gas emissions. As a leading contributor to atmospheric greenhouse gases, the U.S. is taking steps to reduce emissions. This project was designed to examine seasonal greenhouse gas fluxes from playas embedded in dominant land use types in the western High Plains and Rainwater Basin region of Nebraska with the goal of evaluating the potential for U.S. conservation programs to reduce emissions from playas. This is a two year project scheduled for completion in October, 2013.
Sponsor: United States Environmental Protection Agency
PI/PDs: Loren M. Smith, Scott T. McMurry

Ecosystem Services Provided by Playa Wetlands Relative to USDA Programs
Ecosystem services are the values that society receives from the natural environment. As part of a national assessment, an OSU team is evaluating the services provided by playa wetlands in the High Plains and how those services are influenced by USDA conservation programs and practices. Some of the services provided by playas include biodiversity provisioning, pollinator capacity, groundwater recharge, floodwater storage, contaminant filtration, and recreation. Practices are being evaluated in Texas, New Mexico, Oklahoma, Kansas, Colorado, and Nebraska in over 300 playas. Some USDA programs enhance certain services a well as hamper others.
Sponsor: United States Department of Agriculture
PI/PDs: Loren M. Smith, Scott T. McMurry

Determining Factors affecting the Distribution of Endangered Fish and Crayfish Species with Emphasis on the Ozark Region in Northeastern Oklahoma
Freshwater habitats are among the most imperiled ecosystems in North America and are threatened particularly by overexploitation, water pollution, flow modification, habitat degradation, and the presence of invasive species. The Oklahoma Comprehensive Wildlife Conservation Strategy indicates that small rivers (Neosho River) and gravel/sandy bottom streams in the Tallgrass Prairie Region represent very high and moderate priority conservation landscapes respectively, while small rivers (Spring and Illinois Rivers), gravel bottom streams (Spavinaw Creek), and large rivers (Grand-Neosho River) in the Ozark Region represent very high and moderate priority conservation landscapes. These habitats historically and currently support fish and crayfish species that are listed as species of greatest conservation need within the state. This project aims to elucidate factors determining the distribution and population trends in small-bodied fishes and crayfishes in three river drainages of northeastern Oklahoma by combining extensive field sampling and comparisons of present and historic distribution with on site habitat assessments and ecological niche modeling.
Sponsor: Oklahoma Department of Wildlife Conservation
PI/PDs: Michael Tobler, Reid Morehouse

Replicated Ecological Speciation in Extreme Habitats: Patterns, Mechanisms, and Consequences of Multi-Trait Divergence
Livebearing fish that have independently colonized multiple highly toxic springs containing hydrogen sulfide are a model to investigate patterns and mechanisms of adaptation and speciation. Sulfide and the associated hypoxia provide a strong source of selection and have clear physiological and biochemical consequences, which facilitate identifying adaptive differences among populations and the underlying changes in the genome. The objectives of this study are to identify convergent patterns of phenotypic and transcriptomic divergence in replicated pairs of sulfidic and non-sulfidic habitats, to identify candidate genes potentially involved in the expression of adaptations to the toxic environment, and to use experimental approaches to estimate potential roles of phenotypic plasticity in trait expression and to link adaptation to mechanisms of reproductive isolation. The project addresses three basic questions about the evolution of sulfide adaptation and its role in mediating reproductive isolation between ecotypes: (1) How do multivariate phenotypes evolve along replicated environmental gradients? Quantifying phenotypic variation (including behavioral, physiological, and morphological traits) in wild-caught individuals allows elucidating convergent patterns of adaptive trait divergence in replicated pairs of sulfidic and non-sulfidic fish. Analyzing the same phenotypic traits in common garden-raised individuals will shed light on how heritable differentiation and phenotypic plasticity interact to express phenotypes in nature. (2) What are

the genomic changes underlying trait divergence? Identifying genes that show signatures of divergent selection or differential expression by applying next generation sequencing technologies (RNA-Seq) will be used to test for patterns of molecular convergence and to identify candidate genes underlying adaptation to the extreme environments. (3) What are the functional consequences of divergent traits under different environmental conditions for reproductive isolation? Comparing growth rates of laboratory-reared fish exposed to either sulfidic or non-sulfidic conditions will provide a direct link between adaptation and reproductive isolation in the form of immigrant inviability. Furthermore, comparing gene expression patterns will help to identify genetic pathways that are up- or downregulated in adapted fish, helping to narrow down the list of candidate genes from the analysis of wild-caught fish. Overall, this project links selection from physiologically explicit and stressful environmental factors to phenotypic and genetic changes involved in the ecological speciation process by combining field and experimental approaches from disparate fields including evolutionary ecology, physiology, and genomics.
Sponsor: NSF-IOS
PI/PD: Michael Tobler

Why Does Fertility Decline? Comparing Evolutionary Models of the Demographic Transition
Evolutionary anthropologists have given significant attention to the global phenomenon of the demographic transition, especially the remarkable decreases in fertility that characterize it. The literature is crowded with competing theories and sub-theories, and scholars often call for more comprehensive, better-controlled studies that would allow us to distinguish between competing causal models—yet only limited comparative work has previously been done. This collaborative project compares evolutionary models emphasizing decreasing risk, changing motivations for parental investment, and changing forms of cultural transmission as motivations for fertility decline. The goal is to determine which model, or combination of models, produces the most robust explanation of a rapid, recent demographic transition in rural Bangladesh.
Sponsor: National Science Foundation
PI/PDs: Mary K. Shenk, Mary C. Towner, Howard C. Kress, Md. Nurul Alam