

College of Arts and Sciences – FY 2004 Research Abstracts

BOTANY

Salt Plains Microbial Observatory

This four year, multi-investigator collaborative project (Oklahoma State University, University of Tulsa, and Wichita State University) studies the salt tolerant algae, bacteria, and archaea of the Salt Plains National Wildlife Refuge near Cherokee, OK. Hundreds of microorganisms are being isolated and characterized, many of them new to science. The project also studies the role of the Salt Plains' extreme physical and chemical conditions of the ecology of the resident microbes.

Sponsor: National Science Foundation

PI: William Henley

Microbiology and Molecular Genetics: Robert Miller

LeXEn: Response of Photosynthetic Microbes of the Salt Plains National Wildlife Refuge to Dynamic Extreme Conditions

This laboratory and field project concerns the physiological ecology of salt tolerant algae under extreme stress conditions. Isolated organisms are studied in laboratory experiments combining physical and chemical stress factors. Field studies relate algal biomass to physical and chemical conditions on the Salt Plains.

Sponsor: National Science Foundation

PI: William Henley

Collaborative Research Grant

Supporting projects in Arabidopsis functional genomics and comparative studies between the model plants Arabidopsis thaliana and Medicago truncatula will be done. Emphasis is being placed on genes with essential functions during seed development.

Sponsor: S.R. Noble Foundation

PI: David Meinke

Essential Gene Functions in *Arabidopsis* Seed Development

The project is a large-scale collaborative project on the analysis of genes that perform an essential function during seed development in Arabidopsis and give a seed phenotype when disrupted by mutation. Project deliverables include detailed information of 300 essential genes, phenotype information and seed stocks for the corresponding mutants, summaries of relevant expression data, and a central online database (<http://www.seedgenes.org>) that summarizes information for general use by the community.

Sponsor: National Science Foundation

PI: David Meinke

Virginia Bioinformatics Institute: Allan Dickerman

Syngenta Agricultural Biotechnology Research, Inc: David Patton

OSU Plant Biotechnology Network

This project involves interdepartmental activities in molecular plant biology that are associated with the OSU Plant Biotechnology Network (BioNet). Included are graduate student training, seminar and outreach activities, and research interactions with the S.R.

Noble Foundation.

Sponsor: S.R. Noble Foundation

PI: David Meinke

Molecular Genetics of *Arabidopsis titan* Mutants

This project involves basic research on a collection of *Arabidopsis* mutants that exhibit striking defects in chromosome mechanics during seed development. The long term objective is to understand the genetic basis for differences between embryo and endosperm development in flowering plants.

Sponsor: National Science Foundation

PI: David Meinke

Tallgrass Prairie Vegetation Monitoring

This project involves a long-term vegetation-monitoring program at the Tallgrass Prairie Preserve by establishing and sampling permanently marked study plots.

Sponsor: The Nature Conservancy

PI: Michael Palmer

Functional Analysis of Vacuolar Potassium Channels

The objective of this project is to evaluate the molecular mechanisms of vacuolar K⁺ transport. For this a combination of reverse genetic, biophysical, and physiological approaches is applied. An insight into the structure and function of vacuolar K⁺ channels will lead to a better understanding of plant growth, turgor driven movements, and K⁺ nutrition in general

Sponsor: National Science Foundation

PI: Gerald Schoenknecht

Improving Plant Physiology Teaching

To raise the interest and commitment of students of the science of plant physiology, new teaching material was developed. Web-based multimedia learning aids for plant physiology enables each student to choose from a variety of materials best suited to her/his personal learning style. Improved instructions for lab exercises give students a better and more realistic impression about the process of doing science

Sponsor: Howard Hughes Medical Institute

PI: Gerald Schoenknecht

Assessment of Ecological Disturbance to a Crosstimbers Habitat

Study goal is to assess the effects of a natural disturbance on habitat quality (vegetation structure and species composition) for twelve wildlife species of conservation need and to assess the long-term implications of disturbance on habitat change.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: Michael Palmer

Factors Affecting Replication of MCMV in BMS Protoplasts

MCMV infections in plants and maize protoplasts are already known facts. Work will initially be concentrated on analysis of the components of the MCMV genome and the replications of MCMV at the cellular level.

Sponsor: Pioneer H-Bred International Inc
PI: Kay Scheets

Suppression of RNA Silencing in Maize

Using sequence information from GenBank, the investigator will design primers to make a cDNA copy of the P1/HCpro-encoding region of the potyvirus *Maize dwarf mosaic virus-A* (MDMV-A) via RT-PCR from viral RNA that the investigator will provide. The cDNA will initially be cloned into a pUC-like plasmid, its sequence will be confirmed, and then will be transferred into the expression plasmid.

Sponsor: University of South Carolina
PI: Kay Scheets

Functional Analysis of Two-Pore-Domain Potassium Channels

The long term goal of the project is to elucidate the molecular mechanisms of intracellular K⁺ transport. Current research focuses on functional characterization of KCO channels in *Arabidopsis*. A combination of reverse genetic, biophysical, and physiological approaches is used.

Sponsor: OU Health Sciences Center
PI: Gerald Schoenknecht

NIH BRIN Summer Research Project

This study focuses on cell cycle progression in higher plants using male meiosis in *Arabidopsis thaliana* as a model system to address how cell cycle progression is controlled and how it is coordinated with the development of a complex organ(ism.). Hopefully, research in this area will reveal fundamental mechanisms controlling plant growth, development, etc.

Sponsor: OU Health Sciences Center
PI: Ming Yang

CENTER FOR SCIENCE LITERACY

A Partnership for Minority Achievement in Mathematics and Science

The purpose of this project is to create an exemplary learning environment in science and mathematics, K-12, in 11 public schools in an economically disadvantaged section of Tulsa, Oklahoma. Change will be affected through the introduction of hands-on, inquiry-centered science into curriculum. This initiative will serve as a national model for statewide systemic reform.

Sponsor: Toyota USA Foundation
PI: Smith Holt

An Integrated Approach to Teaching Language Arts, Mathematics, and the Social Studies through the Natural Sciences

A team composed of public school teachers, OSU faculty from the College of Arts and Sciences, and the College of Education, along with representatives from the center for Science Literacy are creating innovative supplemental instructional materials to assist teachers at the K-9 level. These materials will provide teachers with the tools necessary to integrate major content areas into science instruction, which ultimately provides a more comprehensive education for all students.

Sponsor: The Pfizer foundation

PI: Smith Holt

Chemistry Alternative Certification Pilot

This project involves a weeklong workshop in chemistry for 20 alternative certification candidates. This workshop will be directed toward those individuals who have the appropriate subject area content but lack the professional education background. The workshop is laboratory-centered and will emphasize a constructive methodology called Hypothesis-Based Learning.

Sponsor: State Department of Education

PIs: Smith Holt

Chemistry: Mark Rockley

Oklahoma Leadership and Assistance for Science Reform (LASER)

Using the LASER network, the Center for Science Literacy will build capacity by conducting workshops in the hub cities of the Washington State, Orange County, CA, South Carolina, Alabama, Tri-State (New Jersey, Eastern Pennsylvania, and Southern Connecticut), Western and Central Pennsylvania, and Rhode Island and Southern New England Regional LASER sites. After one year of classroom practice, the OSU faculty will return and work with the teachers so they can assume the role of trainers in their own regions. The goal is to build a cadre of secondary teachers, nationwide, who will serve a nucleus for change in their region.

Sponsor: Arthur Vining Davis Foundation

PI: Smith Holt

Oklahoma Teacher Education Collaborative (OTEC)

Oklahoma State University is a lead member in the Oklahoma Teacher Education Collaborative (OTEC). OTEC is a statewide group of higher education institutions that have come together to better prepare teachers of mathematics and science. This project, funded by the National Science Foundation Collaboratives for Excellence in Teacher Preparation program, includes the development and implementation of a series of general education science courses along with scholarships to under graduate students preparing to be teachers.

Sponsor: University of Tulsa (National Science Foundation)

PIs: Smith Holt

University of Tulsa: Robert Howard

Success in Science and Mathematics Professional Development Institute (SSPDI)

The Center for Science Literacy offers three types of science institutes: K-8 SSPDI; 9-12 SSPDI in Chemistry, Physics and Biology; and K-8 Teacher Development Institute-TDI. The K-8 SSPDI are a series of workshops in inquiry-based learning delivered in the context of grade specific exemplary science-based teaching and learning modules. The Teacher Development Institute provides additional training for the development of trainers for the K-8 SSPDI. The participants receive intensive professional development during the TDI in additional content, brain research, cooperative learning, facilitation skills, adult learning theory, and peer coaching. The 9-12 Chemistry and Biology Institutes provide all of the K-8 components, as well as incorporate training in the use of computer technology. These institutes serve nearly 500 teachers per year.

Sponsor: Oklahoma Commission for Teacher Preparation
PI: Smith Holt

Star Schools: The New Millennium Oklahoma State University

This is a multi-departmental education project directed toward improving, via distance education, the science and mathematics preparation of in-service middle school science and mathematics teachers.

Sponsor: Department of Education

PIs: Smith Holt

Department of Physics: Bruce Ackerson

Arts & Sciences Extension: Robert Brown

Microbiology & Molecular Genetics: James Blankemeyer

Department of Mathematics: James Choike

Department of Chemistry: Mark Rockley

A Middle School Professional Development Institute in Hand-on, Inquiry-based Science

This program provides professional development to middle school teachers in data-driven, hands-on, inquiry-centered science. The model employed utilizes commercially available materials and stresses a deep conceptual understanding of content and the acquisition of skills that lead to successful integration of math and language arts.

Sponsor: Oklahoma Department of Education

PI: Sandy Sparkman

Collaborative Teacher Education Fund – Fourjay

Sponsor: OSU Foundation/Fourjay Foundation

PI: Smith Holt

A Professional Development Institute on Algebra and its End-of-Course Assessment

This project is designed to provide a model for effective classroom teaching of algebra that teachers will be expected to use with their students, to increase teacher content knowledge in algebra, to provide exemplar lessons of algebra to serve as models for effective strategies for content delivery, and to increase teacher experience and facility in using formative assessment strategies to increase student growth in understanding algebra.

Sponsor: Oklahoma State Regents for Higher Education

PI: Gayla Hudson

Development of a Web-based Curriculum for the Oklahoma Teacher Enhancement Program

The curriculum content focus is training educators to use the teacher evaluation form and how to mentor teachers for professional improvement. Training will include two full days of face-to-face, on-site training with web curriculum follow-up and surveys being completed on individual school site computers. Participants must log on the training site to complete the surveys, document completion of training by completing online assessments, and provide feedback on the assessment instrument and process so modifications and inter-rater reliability can be established or help provided.

Sponsor: Oklahoma State Regents for Higher Education

PI: Smith Holt

CHEMISTRY

Development of Technology Addressing Power Generation and Storage Challenges

For the proposed research an established, vertically integrated, interdisciplinary, multi-university team will address several concerns of NASA in the area of electricity generation and storage. One goal will be the development of technology for roll-to-roll processing of metal-selenide-based solar cells into flexible polymeric substrates. At the same time, the project will target improvements in electrical storage through research that will allow the incorporation of novel ion conducting materials such as nano and microporous ceramic membranes and biological ion-conducting channels into lithium polymer batteries leading to enhanced lithium ion conductivity and battery performance.

Sponsor: University of Oklahoma

PI: Allen Apblett

Expanding Efforts in the Ultrapure Water Group to Address Resin Chemistry Issues – Phase 2

Phase two covers two directions: defining the impact of the hypothesized fouling mechanism on ion exchange resin performance and fouling the resins by specific chemical/physical means.

Sponsor: Electric Power Research Institute

PI: Alan Apblett

Process for *In-situ* Incapacitation of Explosives

This research will develop two promising techniques for rapidly and safely neutralizing explosives under ambient conditions. One method will involve the reduction of explosive compounds to non-explosive compounds. The second process decomposes aromatic or cyclic explosives by reacting them with organic amines at moderate temperatures.

Sponsor: Memorial Institute for the Prevention of Terrorism

PI: Allen Apblett, Nicholas Materer

Tandem Reaction Strategies for Drug Synthesis

This research is directed toward the study of tandem reaction for the efficient synthesis of new heterocyclic drug candidates. The reaction sequences being studied are initiated by reduction of an aromatic nitro group that is captured in subsequent reactions to generate novel structures for drug testing. The focus of this study is to develop and optimize each new process, elucidate its mechanism and scope, and to search for ways to generate product compounds with higher stereoselectivity.

Sponsor: Oklahoma Center for the Advancement of Science and Technology (OCAST)

PI: Richard A. Bunce

Physics and Chemistry of Hydrogen-Bonded Nanoparticles and Their Interactions with Strong Absorbates

This program continues to be unique in its focus on the properties of icy nanoparticles at the molecular level. Of particular current interest is the comparative nature of the surfaces of ice and methanol particles and their respective interactions with strong H-bonding absorbates to $T < 140$ K. Methanol particles have been selected for a study complementary

to that of ice. The results of these particle studies are pertinent to several active areas of science including: solvation processes/H-bond chemistry in chemical and biochemical systems; H-bond chemistry and physics of (charged) icy particles in the atmosphere; and clathrate hydrates in fuel science and in the life-cycle of comets.

Sponsor: National Science Foundation

PI: J. Paul Devlin

Bioavailability of Aromatic Hydrocarbons and Dynamics of Their Interactions with Natural Organic Matter: Linkin Molecular- and Microbial-Scale Interactions

The purpose of this project is to bridge the gap between microbial-scale and molecular-scale interactions in order to define and quantitatively characterize bioavailability in terms of nanoscale processes. A predicted, applicable outcome from this research is the development of an enzymatic assay and a whole-microbe assay that utilize enzymes and bioluminescent bacteria, respectively, for characterizing and quantifying different levels of bioavailability in complex environmental matrices. It is intended that these assays will eventually permit risk assessments and remediation interventions to be evaluated by contaminated bioavailability rather than total contaminant concentration.

Sponsor: University of Oklahoma

PI: Margaret Eastman

Biophotonics: Collaborative Research: Photoactivated Coupling of Nanoparticle Multilayers and Nerve Cells

In this project, a multidisciplinary and multi-university research team is investigating the dynamics and mechanisms of the live/lifeless matter interaction in a model system consisting of a thin film composed of nanoparticles and cultured nerve cells. Specifically, the objectives of the project are the following: 1) preparation and optimization of biocompatible nanoparticle multilayers that can be attached to nerve cells, and 2) registration and characterization of the photoinduced nerve cell membrane currents and potentials following optical excitation of the interface as function of nanoparticle and biological structures.

Sponsor: National Science Foundation

PIs: Warren Ford, Nicholas Kotov

Department of Physics: James Wicksted

Composite Latexes of Dendrimers and Polystyrene

The goals of this research are to synthesize polymer colloids 15-100nm in diameter that are more nearly monodisperse than any made before and to assemble the spherical particles into colloidal crystals. The new particles are expected to self-assemble into colloidal crystalline arrays having lattice dimensions smaller than those of any previous colloidal crystals. The new materials may serve as calibration standards for electron microscopy, as optical filters and switches, and as templates for the synthesis of photonic bandgap materials.

Sponsor: American Chemical Society

PI: Warren Ford

EPSCoR Research Infrastructure improvement Plan

Continuing its long-term strategy of building upon existing strengths, Oklahoma invests in the emerging fields of nanotechnology and functional genomics to bring them to a nationally

competitive level. Both fields are federal as well as state priorities. Two multidisciplinary, multi-campus research groups were formed by investigators at Oklahoma State University, University of Oklahoma, OU Health Sciences Center, University of Tulsa, Oklahoma Medical Research Foundation, and the private sector. The participating institutions provided start-up costs and sustained commitments to new faculty positions throughout the state. Targeting of reference standards, utilizing the Mesonet system, investment in improved microscopy equipment, statewide scientific symposia, promotion of linkages between university researchers and small business, extensive education, human resource, and outreach programs were some of the goals charted for these groups. This will facilitate efforts to develop major research centers, enhance private sector research and development in the state, and improve the statewide educational infrastructure to provide highly qualified students and graduates for the state's emerging high technology businesses.

Sponsor: National Science Foundation, EPSCoR

PI: Warren Ford

Radical Routes to New Copolymeric Materials

Two new types of polymers will be synthesized and characterized. Copolymers formed by emulsion polymerization, which has been used for the manufacture of synthetic rubber latex and coatings for more than 50 years, may provide a low cost alternative to the block copolymers that are used now to stabilize polymer blends. Model polyampholytes will be synthesized to enable testing of current theory of their structures and properties in aqueous solutions.

Sponsor: National Science Foundation

PI: Warren Ford

Molecular Laboratory Experiments in Chemistry

This project addresses four perceived problems in instruction at the introductory level in Chemistry. The following are the key issues to be studied: 1) curriculum materials that will support an inquiry oriented instructional strategy; 2) the difficulty students have linking macroscopic, microscopic, and symbolic levels of understanding; 3) computer-based instructional materials that are simple, dynamic, and interactive; and 4) identification and addressing of student's misconceptions. Instructional materials implemented followed a macroscopic (sensory)/microscopic/symbolic inquiry-oriented, laboratory-based model. Specifically the eight Molecular Level Experiment (MoLE) simulations will be developed: Gas Laws, Gas Phase Equilibrium, Kinetics, Atomic Structure and Periodicity, Acid-Base Chemistry, Calorimetry, Electrochemistry, and Molecular and Solid State Structure. Each MoLE includes a powerful, interactive, dynamic computer simulation and is accompanied by a guided and open-inquiry activity.

Sponsor: National Science Foundation

PI: John Gelder

3-D Tissue Constructs by Sequential Layering for *Ex-vivo* Immune System

This joint project between Oklahoma State University, University of Texas Medical Branch, Nomadics, Inc., and NASA is aimed at the development of an *ex-vivo* analog of the immune system via directed differentiation of hematopoietic stem cells seed on a new type of rigid scaffolds tailored specifically for this purpose. They will be made from colloidal crystals and their inverted replicas surface-modified by means of the layer-by-layer

assembly. The resulting layered coating will provide optimal conditions for successful hematopoietic cell differentiation into immune cell lineages, which will be demonstrated by different experimental techniques. The developed procedure will be transferred into the bioreactor environment and optimized for further development of the immune tissues and vaccine productions.

Sponsor: United States Army Office of Research

PIs: Nicholas Kotov, Neil Purdie

Implanted Nanoparticle-Based Sensor for *In Vivo* Optical Monitoring of Analytes

Fabrication and testing of a novel implantable polymer-based sensor, which responds to changes in glucose concentration, can be accurately monitored using interferometric/OCT technique. Specifically, thin film technology and recent developments in design and manufacturing of nanoparticles and micro-optics will be used to design and test multi-layered, polymer-based implants with enhanced optical contrast that would be engineered to change optical and morphological properties as functions of glucose concentration, where the changes in the implant can be accurately quantified non-invasively by monitoring the changes in optical path length within the probe. This will enable advancement of the field of noninvasive/minimally invasive glucose sensing toward development of a practical, accurate, and reliable sensor.

Sponsor: University of Texas Medical Branch

PI: Nicholas Kotov

New Materials for Photonics

This project will study an integrated approach to the study and design of new optical and optoelectronic materials in the university environment. The primary goals for this research are the development of structural characterization and diversification of nanoparticles modified by metal complexes and to study their photochemical and photophysical properties.

Sponsor: National Sciences Foundation

PI: Nicholas Kotov

A Novel Molecular Template for the Discovery of New Anticancer Drugs

A new methodology for synthesis of anticancer drugs will be developed in the research. Large libraries of chiral, small organic molecules with a drug-related structure, will be prepared based on a template molecule that was generated by a novel rearrangement. This rearrangement is initiated by enzymatic hydrolysis and renders large-scale production of the rearranged product in quite simple and mild conditions starting from inexpensive sources. Therefore, this method will not only increase the efficiency of the production of a diverse set of derivatives, but also lower the cost compared to the existing methods in drug discovery. The derivatives synthesized in this method will be screened for inhibitors of human papillomaviruses and p210^{bcrabl} kinase in order to observe the preliminary results on the inhibitory effects.

Sponsor: Elsa U. Pardee Foundation

PI: Satomi Niwayama

Ocular Proteomics of Rodent Retina

The goal of this project is to define all the proteins expressed in rodent retinas in order to

provide vision researchers with information regarding the proteins actually expressed in retinal cells.

Sponsor: National Institute for Health, University of Oklahoma Health Sciences Center

PI: Satomi Niwayama

Modeling of the Metal Cutting Process

The project will work on molecular dynamics (MD) simulations of the machining process. Objectives of the project are to advance the understanding of the machining process in general and, in particular, nanometric cutting. Another project objective is to model the submicron diamond turning process of both non-ferrous and semiconducting materials at the atomistic level.

Sponsor: National Science Foundation

PIs: Lionel Raff

College of Architecture, Engineering and Technology: Ranga Komanduri

Multiscale Modeling and Simulation of Material Processing

This research will address some critical issues involved in multiscale, multiphenomena material modeling, theory, and simulation. The primary goal is to develop scaling laws for multiscale simulations, using such material testing techniques as tension and indentation, from atomistic to continuum, via mesoplasticity, to enable the design engineer to use these scaling laws as a CAS tool for various materials design and processing applications.

Sponsor: Air Force Office of Scientific Research

PI: Lionel Raff

Biochemical and Biophysical Characterization of Cytochrome b_5 from Outer Mitochondrial Membrane

Membrane-anchored, mammalian cytochromes b_5 are located in the endoplasmic reticulum and the outer membranes of mitochondria. Although MC cytochromes b_5 have been identified from a number of mammalian sources the only OM cyt b_5 that have been positively identified to date originate from rat liver. A systematic study will be conducted in what residues in the OM protein are replaced with the corresponding residues in the bovine Mc isoform. These studies will be performed with the expectation of decreasing the stability and kinetic barriers for heme release of rat OM cyt b_5 . It is also important to establish whether the biophysical properties of rat OM cyt b_5 are restricted to this protein or rather are common to mitochondrial cytochromes b_5 . If the latter is true, it would be an indication that nature has tailored these proteins for specific activity in the outer mitochondrial membrane. This would set the stage for future investigations regarding the specific function of these intriguing, yet poorly understood proteins.

Sponsor: National Science Foundation

PI: Mario Rivera

Chemistry Alternative Certification Pilot

This project is a week-long workshop in chemistry for 20 alternative certification candidates. This workshop will be directed toward those individuals who have the appropriate subject area content but lack the professional education background. The workshop is laboratory-centered and will emphasize a constructive methodology called

Hypothesis-Based Learning.

Sponsor: State Department of Education

PIs: Mark Rockley

Center for Science Literacy: Smith Holt

Star Schools: The New Millennium Oklahoma State University

This is a multi-departmental education project directed toward improving, via distance education, the science and mathematics preparation of in-service middle school science and mathematics teachers.

Sponsor: Department of Education

PIs: Smith Holt

Department of Physics: Bruce Ackerson

Arts & Sciences Extension: Robert Brown

Microbiology & Molecular Genetics: James Blankemeyer

Department of Mathematics: James Choike

Department of Chemistry: Mark Rockley

Theoretical Chemical Dynamics Studies of Elementary Combustion Reactions

The goal of this research is to develop methods and perform studies of the reactions of polyatomic radicals involved in hydrocarbon combustion.

Sponsor: Department of Energy

PI: Donald L. Thompson

Atomic Emission from Neutral Species Formed by Ion Bombardment of Chemically Modified Semiconductor Surfaces

This research project aims to understand the fundamental mechanisms that give rise to electronically excited neutral species following energetic bombardment of the surface of a target.

Sponsor: NSF

PI: Nick Materer

Matching Funds from the Regents

For the proposed research, an established, vertically integrated, interdisciplinary, multi-university team will address several concerns of NASA in the area of electricity generation and storage, as recently articulated in NRA-01-GRC-1, Space Power Technology.

Sponsor: The University of Oklahoma

PI: Allen Aplett

Advanced Nanostructured Hybrid Coatings for the Protection of Aircraft Aluminum Alloys

Corrosion protection properties of sol-gel-clay-polyelectrolyte coatings are investigated in this project. The layer-by-layer method of their preparation affords the function-specific design of the multilayer structure difficult to achieve by other techniques.

Sponsor: Air Force

PI: Nicholas Kotov

Regents Match for EPSCoR Research Infrastructure Improvement Plan

Sponsor: Oklahoma State Regents for Higher Education

PI: Warren Ford

Accurate Theoretical Predictions of the Properties of Energetic Materials

This is a comprehensive theoretical/computational research program to develop, validate, benchmark, and apply methods and models that will provide predictive capabilities for energetic materials.

The thrust of the work is the development of atomic-level models and *ab initio* quantum chemistry methods that are generally applicable to chemical decomposition of condensed-phase energetic materials under extreme conditions.

Sponsor: U.S. Army

PI: Nicholas Kotov

Catalysis with Readily Modified Chelating Carbene Complexes

The proposed research involves the syntheses of transition metal complexes containing novel chelating carbene ligands and investigation of their activity as homogenous catalysts for reactions that are important in the conversion of petroleum raw materials into useful substances.

Sponsor: American Chemical Society, PRF Type G

PI: LeGrande Slaughter

Advanced Nanostructured Hybrid Coatings for the Protection of Aircraft Aluminum

Sponsor: Department of Defense, EPSCoR, U.S. Air Force

PI: Neil Purdie

Surface Profile Analysis of General Purpose Bomb Bodies Prepared for Thermal Arc Spray Coatings

To perform surface analysis on general-purpose bomb body samples provided by OO-ALC/WMB, each sample will be tested on three random locations. At each location, the analysis will include peak height, mean roughness, roughness depth, peak count, peak depth and peak angle.

Sponsor: Air Force

PI: Allen Aplett

Critical Thinking in the Biological Sciences

The goal of this project is to improve critical thinking skills and problem-solving skills in students. The laboratory portion provides students the opportunity to work in small groups as well as hands-on access to chemicals. There is also pre-lecture exploration and in-class exercises.

Sponsor: Howard Hughes Medical Institute

PI: Chemistry: John Gelder

Zoology: Donald French

Biochemistry: Margaret Essenberg

Atomic-Level Modeling of Energetic Materials

Molecular dynamics simulation methods and *ab initio* electronic structure calculations have undergone significant new developments in recent years, providing accurate practical methods for predicting the energetics and rates for very large complex systems. The approach and goals of this research project are designed with the ultimate aim of accurate

theoretical modeling of the combustion and detonation of energetic materials.

Sponsor: U.S. Army Research Office, DURIP Program

PI: Donald Thompson

Porous Nanostructured Catalysts Derived From Metal-Functionalized Dendrimers

The major focus of this research program is controlling the activity and selectivity of catalytic reactions. The primary approach is ligand design, drawing on the investigator's background in organometallic chemistry. Successful control of catalyst selectivity using the proposed porous materials may lead to a new class of recyclable catalysts with significant synthetic utility.

Sponsor: Regents Cost Share to NSF/EPSCoR

PI: Warren Ford

Nanostructuring of Semiconductor Surfaces

The objective of this project is to develop methods that utilize the nanoscale periodicity inherent to the Si(100) surface to order an organic overlay. Initial experiments will involve multifunctional organic compounds that can react with the surface to impart unique properties.

Sponsor: Regents Cost Share to NSF/EPSCoR

PI: Nick Materer

Ecologically Benign Corrosion Protection by Stratified Coatings

Testing to be carried out for this research includes a trained technician spraying ORMOSIL coatings onto substrates or LBL films, and Salt Fog Chamber measurements.

Sponsor: Nomadics, Inc

PI: Allen Aplett

***In-Situ* Incapacitation of Explosives**

The goal is to develop a catalyst system that forms stable suspensions in water, butanol, or organic amines that can be sprayed or pumped onto an explosive device and render it harmless.

Sponsor: MIPT

PI: Allen Aplett/Nick Materer

Simulations of Processes in Energetic Materials

A long-term goal of our research is the development of methods and models for realistic simulations of the chemical reactions associated with the initiation and consumption of solid energetic materials. Such simulations will provide mechanistic details and reaction rates for the sequences of processes leading to the chemical depletion of the material from the initiating reactions to the formation of final products. Both classical and quantum mechanical methods will be used

Sponsor: Department of the Army

PI: Donald Thompson

Accurate Theoretical Predictions of the Properties of Energetic Materials

The goal of the work is to achieve a better understanding of the solubility and other properties of substances in supercritical fluids and to employ that understanding in the development of supercritical fluid technologies for recycling and reclamation of energetic

materials.

Sponsor: U.S. Army Research Office

PI: Donald Thompson

Development of High-Value Composite Materials

The goal of this project is the successful development of a prototype material that provides several times the strength of existing alloys and composites in a lightweight structure. Under this project, the team will develop larger scale production capabilities, making the new materials a viable option for commercial uses.

Sponsor: Nomadics, Inc

PI: Warren Ford/Nicholas Kotov

Development of Artificial Tissue Constructs

This research is focused on developing an artificial immune system that is primarily for military usage. Also focuses on expanding hematopoietic stem cells for transplant, differentiating stem cells to blood cells, and using the artificial immune system for research on autoimmune diseases.

Sponsor: Nomadics, Inc

PI: Neil Purdie

COMMUNICATION SCIENCES AND DISORDERS

Speech-Language Pathology in the Public Schools: Investigating and Addressing Specific Training Needs

In year one of this research, the primary focus has been developing and disseminating the three surveys which will identify training needs for recruitment, retention, and retraining of speech-language pathologists in the public school systems of the state of Oklahoma. Aggregation of survey data and on-site research preparation as well as development of graduate assistantships are proceeding successfully.

Sponsor: Oklahoma Department of Education

PI: Penny Cremeens

Practicum Agreement

Project allows provisions for graduate students to provide speech and language pathology services to the clients of the Sheltered Workshop for Payne County, Inc.

Sponsor: Sheltered Workshop for Payne County, Inc

PI: Randolph Deal

Practicum Agreement

Project allows provisions for student clinicians to provide speech and language pathology services to the clients of Gateway Foundation.

Sponsor: Gateway Foundation

PI: Randolph Deal

Development of a Language Development Lab within the OSU Speech-Language-Hearing Clinic

Project allows provisions to develop and outfit a language development lab within the OSU Speech/Language/Hearing clinic. This lab would serve as a research and training center for

undergraduate and grad students in the department of Communication Sciences and Disorders.

Sponsor: New Directions Foundation

PI: Randolph Deal

COMPUTER SCIENCE

Small Volume Accurate Data Forecasting Models

The objective of the research is to identify and acquire new data, provide forecasting functionality, and develop user's manuals. This project is to develop a new methodology applicable to other weapon systems by choosing KC-135 as the research target to acquire new data.

Sponsor: Automated Science Group, Inc.

PI: KM George

Technologies for New Data Acquisition and Forecasting for the DRAIR Information System (Phase 1)

This work will expand the capabilities of the G050 Information System. In order to expand the capability of G050 a three-fold approach will be used: 1) development of methods, 2) develop of acquiring new and state of the art forecasting technologies, and 3) research and develop interaction components for other systems using a distributed system architecture based on .NET to plug-in data, programs, and users.

Sponsor: Altech Services, Inc.

PI: KM George

Virtual Reality Technology for Depot Floor Insertion

Oklahoma City Air Logistics Center (OC-ALC) is one of the major service depots responsible for maintaining U.S. Air Force weapon systems. Some of the continuous challenges faced by OC-ALC include reduction of maintenance time, increase in maintenance quality, increase in safety, and reduction of maintenance cost. Recent developments in real-time digital photogrammetry, virtual reality and visualization have the potential to provide a virtual inspection and maintenance environment. In the virtual environment, OC-ALC personnel will be able to visualize and interact with 3D representation developed from photographic images of the current state of the systems being repaired.

Sponsor: Automated Science Group, Inc.

PI: Douglas Heisterkamp

Automated Tech Orders (TO) Management System

Tech Orders are documents that describe the components, parts, repair process, and other important details of different aircraft components. This project will concentrate on evaluating the existing tech order formats, defining a versatile common meta-format for tech orders and will include the necessary conversion programs from the existing formats to the defined meta files.

Sponsor: University of Oklahoma

PI: Nohpill Park

Toward an Integrated Web-GIS Decision Support System for Evaluating United

States Department of Agriculture Conservation Reserve Program (CPR)

This project will address some of the critical aspects by designing a hardware-in-the-loop (HIL) simulation platform where novel software-enabled control strategies can be tested. Structure of this project will be along the following thrusts: a simulation and visualization tool for UAV navigation, robust mode-switching control for autonomous formation flight, and an experimental platform for hardware-in-the-loop/Unmanned Aerial Vehicles coordination.

Sponsor: University of Oklahoma, NASA EPSCoR

PIs: Johnson Thomas

Geography: Mahesh Rao

School of Electrical & Computer Engineering: Gouliang Fan

SGER: Yield Assurance and Optimization for Clockless Wave Pipeline

This program supports basic research underlying the science and methodologies for designing integrated systems comprised of micro systems in traditional silicon VLSI technology, in MEMS technologies, and in computing media of the future.

Sponsor: NSF

PI: Nohpill Park

REU Sites in Computer Graphics, Vision, and Content-Based Image Retrieval at OSU

The objective for this program is to allow students to become familiar with all aspects of research; to expose talented undergraduate students to research environments not available at their home institutions and involve them in ongoing research projects. They will participate in research activities and follow-up activities.

Sponsor: NSF

PI: Doug Heisterkamp

ENGLISH

National Writing Project

The Oklahoma State University Writing Project offers teachers in Oklahoma a school-university partnership in developing strategies for writing, teaching writing, and research. As a result, the teachers will become active writers and/or researchers, their students will write more often, and the quality of their writing will improve. In addition, the university will improve the quality of its teacher education program in writing.

Sponsor: National Writing Project Corporation - California

PI: Britton Gildersleeve, Joyce Alberts

Examination of Language Used by Plantation and Town Inhabitants in Mid Eighteenth Century Virginia

This research examines language use in mid-eighteenth century Virginia. It focuses on the inhabitants of both plantations and town and will provide a description of the kinds of language used in the multi-ethnic area.

Sponsor: Oklahoma Humanities Council

PI: Susan Garzon

The Correspondence of Thomas Young, Tutor to John Milton, and Patrick Young, the Royal Librarian

This project involves the transcription and translation of seventeenth century Latin

correspondence between Thomas Young, Puritan divine and tutor to John Milton, and Patrick Young, the Royal Librarian under James I and Charles I. The holograph letters between the two men have never been translated nor assessed by Renaissance or Milton scholars.

Sponsor: Oklahoma Humanities Council

PI: Edward Jones

Ghosts of Babel: Silent Narrative and Translation in Cross Cultural Storytelling

The purpose of this study is formulate and use strategies for close reading of cross-cultural texts, to state the literary theory that informs these strategies, to increase the reader's bi- or multicultural orientation to contemporary ethical, political, and aesthetic issues, and to encourage the reader to be wary of ethnocentric claims of moral and aesthetic clarity in all cultures.

Sponsor: Oklahoma Humanities Council

PI: Brewster Fitz

Language, Violence, and Authority in Eighteenth Century Voyages of Discovery

The aim of the study is to investigate travelers who made forays into the South Seas and along the Pacific coast of the Americas in the seventeenth and early eighteenth century in order to prey on Spanish settlements and galleons as well as to reconnoiter for British imperialist initiatives.

Sponsor: Oklahoma Humanities Council

PI: Richard Frohock

As Far As Anyone Knows: The Anit-Televisual Paradoxes of Film Noir

The project provides provisional help in purchasing 40-50 VHS and DVD transfers of classic-period *films noirs* to finish two final chapters of book supporting the writer's theory that the films' crime narratives differ consistently from the headline news stories that appear on-screen.

Sponsor: Oklahoma Humanities Council

PI: Hugh Manon

Con conversationally Speaking: Extemporaneous Discourse and the Improvisatrice Tradition

Project provides provisional help for the investigator to conduct research in Boston. This project is based on the literary works of Margaret Fuller and her role as a rhetorical theorist and improvisatrice.

Sponsor: Oklahoma Humanities Council

PI: Melissa lanetta

GEOGRAPHY

Intensive Level Survey of and National Register Nomination for College Gardens Residential District

This project consists of an Intensive Level Architectural and Historic Survey and Nomination to the National Register of Historic Places for the College Gardens Residential District in Stillwater, Payne County, Oklahoma. This study area, as defined by the 1998 reconnaissance level survey, consists of both sides of Redwood Drive north of Admiral

Avenue, both sides of sides of Arrowhead Place west to King Street, then south to Arrowhead Drive, then west along arrowhead Drive to King Street, then south to Sunset Drive, then east to King Street, then south to West University Avenue, and the east to Redwood Drive.

Sponsor: Oklahoma Historical Society

PI: Brad Bays

Partnership between OSU & the University of World Economy and Diplomacy; and Samarkand State Institute of Foreign Languages

This proposal aims to strengthen the structure of higher education in Uzbekistan by providing curriculum development and instructional expertise directed at what is potentially one of the most profitable, and to day least exploited, of the country's natural assets: tourism. This will be accomplished by sharing American expertise in tourism development across a spectrum of disciplines: business, journalism, political science, and geography. American academics from these fields will share their knowledge and experience in tourism marketing, business law, management information systems, tourism advertising and strategy, economics, and in developing a cadre of public administrators for the tourist industry in Uzbekistan. The significant end product of the project is a comprehensive textbook on tourism in Uzbekistan, based on the cooperative work of the participants of the program. This text will be employed by future generations of Uzbekistani professionals in the field of tourism economics, thereby attracting badly needed foreign investment and currency, and generating employment opportunities in the Uzbek economy. Finally, the ancillary economic benefits to tourism development in Uzbekistan will be crucial to the future stability of the country.

Sponsor: USIA

PI: Reuel Hanks

GPS Tools for Geographers

The purpose of this project is to develop web-based instructional modules that address theory, operation, and applications of global positioning system (GPS) technology and its integration with Geographic Information Systems (GIS). Increasing use of GPS within agriculture, transportation, natural resource management, and other fields highlights the importance of understanding GPS principles and application. Four modules will be designed for adaptation within undergraduate geography (or related) courses that emphasize basic navigation/positioning, spatial data capture, data management/integration, or the analysis of geographic information. Modules will contain presentation materials for instructors, interactive web-based lessons and testing, and "hands-on" field and lab exercises emphasizing data capture, processing, integration, or analysis. Following evaluation by a curricula review team and testing within selected universities and courses, the GPS Tools for Geographers web page will begin dissemination of this educational resource.

Sponsor: National Science Foundation

PIs: Michael Myers, Thomas Wikle

Toward an Integrated Web-GIS Decision Support System for Evaluating United States Department of Agriculture Conservation Reserve Program (CPR)

This project will address some of the critical aspects by designing a hardware-in-the-loop (HIL) simulation platform where novel software-enabled control strategies can be tested. Structure of this project will be along the following thrusts: a simulation and visualization

tool for UAV navigation, robust mode-switching control for autonomous formation flight, and an experimental platform for hardware-in-the-loop/Unmanned Aerial Vehicles coordination.

Sponsor: University of Oklahoma, NASA EPSCoR

PIs: Mahesh Rao

Computer Science: Johnson Thomas

School of Electrical & Computer Engineering: Gouliang Fan

Oklahoma Wind Power Assessment Initiative. Phase II: Initial Analysis of Mesonet Wind Products and Landscape Data

The project is a joint effort with personnel from the University of Oklahoma studying the spatial variations in the suitability of the Oklahoma landscape relative to wind power development. The study is based on two scales: 1) small scale wind generation (50 Kw or less) suitable for households and small businesses, and 2) large scale wind farms (10 Kw or more) suitable for connection to existing power grids. In a geographic information system (GIS) covering the entire state, we are incorporating several layers of data (wind power potential, existing power transmission grids, access to roads, land ownership, etc.) to identify more and less suitable sites of potential development for wind power. The high spatial resolution of this work is fostered by the incorporation of the wind data from the Oklahoma Mesonet that provides mesoscale measurements of wind.

Sponsor: OSU Energy Institute

PIs: Steve Stadler, Allen Finchum

REU Site of GIS and Soil/Water Research

The Research Experience for Undergraduates (REU) Site provides ten undergraduate students with unique opportunities to taste the excitement of the research process through applications of geographic information system (GIS) to soil and water research problems. With assistance from their mentors, student researchers are responsible for: 1) conceptualizing a research question, 2) data collection, 3) GIS and statistical analysis, and 4) interpretation and presentation of project results. Examples of the topic areas for projects include GIS-based investigations of phosphorus and sediment transport, evaluating soil and water constraints on urban development, and studies of regional evapotranspiration.

Sponsor: National Science Foundation

PIs: Thomas Wikle, Michael Myers

FY04 Oklahoma Wind Power Initiative Work: Assessment, Research, Policy Study, and Outreach

The main areas of focus for this project will include continuation of the outreach and education efforts of OWPI; second is a report summarizing an analysis of the role that wind energy can play in developing a hydrogen/energy storage system; third is a discussion of the research efforts of OWPI along with our efforts to expand the program through additional projects and funding from external sources.

Sponsor: University of Oklahoma

PI: Stephen Stadler

Reconnaissance Level Survey for Portions of Frederick, OK

This project will emphasize the recording of extant properties at a minimum level of documentation and is designed to provide a cost-effective approach for increasing not only

the area inventoried within the state, but also the number of recorded properties. Results obtained are expected to provide information useful in making management decisions about properties potentially eligible for the National Register of Historic Places.

Sponsor: Melvena Heisch, SHPO, Oklahoma Historical Society

PI: Brad Bays

Thematic Survey of New Deal Public Art in Oklahoma

This thematic survey will concentrate on federal art projects that resulted from New Deal Era relief projects in Oklahoma between 1933 and 1942. The project will provide a minimum level of documentation for individual buildings, as well as any art within them, as outlined by the State Historic Preservation Office.

Sponsor: Melvena Heisch, SHPO, OK Historical Society

PI: Alyson Greiner

Vegetation Mapping Around Lake Hudson, Oklahoma

The overall goal for this project is to conduct a shoreline inventory of wetland/terrestrial habitat types between elevations 619-636 feet of the Lake Hudson in Mayes County, OK.

Sponsor: Atkins Environmental

PI: Mahesh Rao, David Leslie

The Oklahoma Wind Power Initiative and Wind Powering America

These funds will be used to supplement production of a one-day Farm Bill workshop. This workshop will focus on wind power for OSU Extension and Experiment Station personnel.

Sponsor: University of Oklahoma

PI: Stephen Stadler

Hydro-Geological Calibration of Interview-Based Mapping for Assessing Groundwater

Fluctuations at a Multi-Oblique Level in Uzbekistan

This project is to combine surveys of traditional water systems and computer trend-surface mapping with information derived from users of traditional wells to depict change in groundwater over time. This information offers a source of proxy data which, when collected across a broad area, can be mapped to show regional variations in depth to groundwater. Results can offer a graphic portrayal of groundwater trends.

Sponsor: National Research Council

PI: Dale Lightfoot

USAID/Higher Education and Development Program (HEAD) Oklahoma Higher Education Partnership (OHEP)

The goal of the project is to establish partnerships between U.S. and Iraqi colleges and universities to invigorate and modernize Iraq's institutions of higher education. This program will provide technical expertise to Iraq's universities and technical colleges, and engage Iraqi higher education administrators, faculty, and students in the revitalization of the substance and process of Iraq's higher education system.

Sponsor: USAID, M/OP/REG/ALPS

PI: Nani Pybus

Rural Alliance for Improving Science Education (RAISE)

Many students from rural Oklahoma communities lag behind the nation in math and science ability. A large number of these students are from high-poverty areas and/or are Native Americans. The RAISE program will place 30 outstanding teachers in 6th-12th grade classrooms to work with public school teachers in three rural school districts in north-central Oklahoma. The principal benchmark for project success will be improvement in student performance on science sections of the state-mandated Oklahoma Core Curriculum Test administered to 8th and 12th grade students.

Sponsor: National Science Foundation

PI: Thomas Wikle

FY04 Oklahoma Landmarks Inventory

Project provides provisional support for storing, maintaining, and updating via computerization the Oklahoma Landmarks Inventory database and Oklahoma's National Register of Historic Places website so that the information about the state's historic buildings, districts, structures, sites and objects will be accessible to its many users.

Sponsor: Melvena Heisch, SHPO, OK Historical Society

PI: George Carney, Allen Finchum

GEOLOGY

US-India Cooperative Research

The goal of this project is to use a combined geochemical, structural, and geomorphological approach to test the hypothesis that the Main Central Thrust (MCT) shear zone accommodated slip and sustained seismic activity since the Miocene.

Sponsor: National Science Foundation

PIs: Elizabeth Catlos, Richard Marston

Environmental Characterization and Monitoring of LNAPL

This project tests the feasibility of three questions with the framework of the final question used to direct the research: 1) Can a low cost electrical resistivity tomography (ERT) system capable of irregular placement of electrodes with high speed data collection and inversion be developed for solute detection and monitoring, especially in the presence of fingering solutes? 2) Can the geophysical responses be verified in order to gain confidence in system output by correlating the response with hydrogeological measurements and modeling? 3) Can an ERT system installation and monitoring be simplified for consultants and regulators and integrated into current regulatory standards?

Sponsor: Oklahoma Corporation Commission

PI: Todd Halihan

Post Remediation Characterization of LNAPL Using Electronic Resistivity and Direct Push Techniques

The project will test the effectiveness of a direct push electrical resistivity tomography (DPERT) in evaluating post remediation LNAPL traces. The site used for the study will determine if the technique is useful in determining when a site is clean enough to allow site closure.

Sponsor: Oklahoma Corporation Commission

PI: Todd Halihan

Geomorphic Adjustment of the Washita River, Washita Battlefield National Historic Site, Oklahoma

The purpose of this project is to evaluate: 1) the present geomorphic condition of the Washita River through the Washita Battlefield in western Oklahoma; 2) the adjustment of the present channel to the prevailing water and sediment supply to the channel, and how this adjustment has changed through time; and 3) the likelihood that a modified channel similar to that which existed in 1868, at the time of the battle, could remain in equilibrium with the present conditions of flow and sediment. The stream network has been delineated from digital elevation models in the Washita River upstream of the battlefield site. The location of over 60 dams has been digitized. The sediment that has accumulated behind these dams has been surveyed. Piezometers have been installed at two locations adjacent to the river to monitor groundwater as it fluctuates with river stage. The project will eventually determine whether conditions will sustain a viable population of cottonwoods trees similar to that which existed in 1868.

Sponsor: National Park Service

PI: Richard Marston, Todd Halihan

New Frontiers: Research Experience for Undergraduates in the Space and Planetary Sciences

The purpose of this project is to provide a research experience for 12 undergraduate students (eight at the University of Arkansas and four at OSU) in planetary and space science. For a 10-week long period in the summers of 2002, 2003, and 2004, top students were selected from applicants across the country to work closely with OSU faculty mentors in science and engineering fields. In the summer of 2002, undergraduate students came to OSU to work on rock glaciers on Mars; dosimeters for applications in astronaut radiation dosimetry and Martian sediment dating; luminescence dating instruments for landing on Mars and dating the sediments; and developing a sensor for detecting life on Mars. Students participated in weekly seminars and were escorted on site visits to the Johnson Space Center and private industries in the region involved in space science.

Sponsor: National Science Foundation, Astronomy Program, Research Experience for Undergraduates

PI: Richard Marston, Elizabeth Catlos

Physics: Stephen McKeever

Hypothesis-Based Learning in Earth Science

A team of OSU faculty members, including three faculty members (Marston, Puckette, Paxton) from the School of Geology, is developing a web site that will introduce middle school math and science teachers to a revolutionary new integrated approach to their subject areas. The launch date was June 4, 2003. Faculty from chemistry, physics, biology, mathematics, computer science, earth sciences, education, and language arts have cooperated to develop a curriculum and series of workshops and lessons for teachers that they can access directly from their classrooms. The project is coordinated by the OSU Arts and Sciences Extension Service and the Center for Science Literacy. A unique aspect of the project is that it encourages students to approach science the way scientists do. Using Hypothesis-Based Learning (HBL), teachers encourage their students to use

observation, hypotheses, and experimentation to solve problems. The web site gives teachers suggestions and demonstrations for using encouragement and effective questioning to inspire their students.

Sponsor: U.S. Department of Education

PI: Richard Marston, Jim Puckette

Mapping of Mudstone and Sandstone Layers of Central Oklahoma Aquifer

This goal of this project is to provide a better understanding of the hydrologic and geochemical controls on the distribution of naturally occurring arsenic in an oxygen-rich red-bed aquifer, development of a new strategy to protect drinking water supplies, and an improved understanding of the Central Oklahoma aquifer system.

Sponsor: USGS

PI: Stan Paxton

Arbuckle-Simpson Aquifer Study

The purpose of the task is to compile, describe, and assess existing literature and data pertaining to the hydrology of the Arbuckle-Simpson aquifer and related surface waters. Types of information include physical setting, cultural setting, geology, and hydrology groundwater and surface water quality and water use. Results will provide background information for the hydrologic investigation, assist researchers to identify where data are present or lacking, and provide historic water resources information.

Sponsor: Oklahoma Water Resources

PI: Todd Halihan

HISTORY

The Venetian Regulation of the Terraferma: Communal Government and Charity in Renaissance

These research findings on a study of the mechanisms of Venetian expansion during the Renaissance will be the final chapter of a book manuscript on charity and community in the Renaissance Treviso.

Sponsor: Oklahoma Humanities Council

PI: David D'Andrea

Law Enforcement and Social Change in Late Ming Rural Communities

This research studies the dynamic interaction between law enforcement and social change in rural communities during the last century of the Ming Dynasty, specifically how local magistrates strove to build local society in accordance with the dynastic law codes in times of drastic social change and what ways the new social elements affected law enforcement in local villages.

Sponsor: American Council of Learned Societies

PI: Younglin Jiang

Manifesting the Mandate of Heaven: The Great Ming Code as a Cosmological Instrument for Transforming the Realm

Project provides support to collect and research rare books at Beijing National Library, leading to completion of a book-length study of the great Ming Code.

Sponsor: Oklahoma Humanities Council
PI: Younglin Jiang

The History of Finland with Emphasis on the Nineteenth and Twentieth Centuries

This work will survey Finland's past with an emphasis on the nineteenth and twentieth centuries. Finland's past offers three special perspectives: since prehistoric times Finland has occupied the political, cultural, religious, and economic borderlands between eastern and western Europe; in spite of its geographically peripheral position, the country has found itself in the mainstream of the developments that have created modern Europe; and although a small country, Finland has made important contributions to European and world civilization ranging from the Helsinki Accords on human rights to the invention of the mobile telephone.

Sponsor: Oklahoma Humanities Council
PI: Jason Lavery

The Economic Decline of Jordan in the Middle Ages as Part of the Decline of the Greater Syria Under Mamluk Administration

The economic decline of Jordan in the middle ages must be understood as part of the larger atmosphere of political, financial, social, and environmental decline of Greater Syria under Mamluk administration during the fifteenth and early sixteenth centuries. The archaeological survey of northern Jordan is part of a larger study on Mamluk agricultural policies in the country, their successes in the fourteenth century, and apparent failure by the fifteenth century. The oft-repeated whole-scale abandonment of this region after the plague of the 1340s is far from a proven theory. It remains to be determined to what degree Jordan really was abandoned by the Mamluk authorities and subsequently depopulated and what factors accounted for this.

Sponsor: Oklahoma Humanities Council
PI: Bethany Walker

Teaching American History Program

This project will provide increased professional development and immersion activities for its teachers, as well as rigorous academic standards and enrichment activities for its students. The main goal is to raise student achievement in traditional American history as evidenced by local and state testing.

Sponsor: Lonnie Hamilton, American History Grant Administrator, El Reno Public Schools
PI: William Bryans

French Priests Renouncing Revolution (1791-1801): Patterns of Guilt and Expediency

This project studies priests who had taken an oath of loyalty to the new revolutionary government in 1790 and then retracted their oath, asking for reconciliation with the Roman church. The investigator will examine the motives of the retracting priests, the retractees, to understand better the patterns of guilt and expediency operative in the Church-State strife that was a central feature of the French Revolution.

Sponsor: Oklahoma Humanities Council
PI: Joseph Byrnes

MATHEMATICS

Effective Biological Science through Mathematics

The Effective Biological Science through Mathematics (EBSM) project is an interdisciplinary effort involving faculty from the departments of Mathematics and Microbiology and Molecular Genetics. The goal is to contribute directly to student success in selected coursework areas in the biological sciences and to student retention in the biological sciences. The primary development activities include the development of an instructor- and student-friendly supplement on enzyme kinetics including simple enzyme kinetics, various forms of inhibition, and the effect of gating on Michaelis enzyme kinetics.

Sponsor: Howard Hughes Medical Institute

PIs: Douglas Aichele, Alan Noell

Microbiology and Molecular Genetics: James Blankemeyer

Cohomology of Exponential Sums

Exponential sums originally arose in basic problems in number theory, such as trying to estimate the number of integer solutions to an equation. This project will attempt to extend some of the classical results in the subject to new classes of exponential sums.

Sponsor: National Science Foundation

PI: Alan Adolphson

Algebra for All

The “Algebra for All” project is a five-year program to develop internet-based professional development training for middle-math teachers in algebra content and pedagogy. The training will be delivered through exemplar inquiry-based algebra-for-all lessons with an embedded instructional design that will serve to train teachers in content and in effective ways to engage all students in learning algebra.

Sponsor: United States Department of Education

Pi: James R. Choike

Oklahoma State University AP Calculus Institute

This project conducts a week-long Summer Institute for Oklahoma Mathematics teachers on the content, pedagogy, and assessment of Advanced placement Calculus AB and BC.

Sponsor: Oklahoma State Department of Education, Office of AP Initiative

PI: James R. Choike

Converse Theorems and L-Functions of Automorphic Forms

This project investigated L-functions of automorphic representations and their applications in the following three contexts: 1) the converse theorem for $GL(n)$ and functoriality; 2) number theoretic applications of L-functions for $GL(3)$; and 3) an exposition of the theory of L-functions for $GL(n)$.

Sponsor: National Security Agency

PI: James Cogdell

Topics in Number Theory and Representation Theory

This project has two components. The first concerns the arithmetical theory of prehomogenous vector spaces and the second concerns L-functions and the representation theory of p-adic groups.

Sponsor: National Science Foundation

PI: Anthony Kable

Essential Laminations and Essential Surfaces in 3-Manifolds

The goal of this project is to explore the topology of 3-manifolds using essential laminations and essential surfaces. The techniques used in this project could have great impact on some fundamental problems in knot theory (e.g., Property P for knots and the cabling conjecture).

Sponsor: National Science Foundation

PI: Tao Li

3-Manifolds and Floer Homologies

The problems addressed in the research are in the area of the instanton/monopole Floer theory of 3-manifold and infinite-dimensional symplectic manifolds. The main theme in this study is the fundamental and important properties of the gauge-theoretic/symplectic Floer homology, and to study the interactive relation between the Floer cohomology and the semi-infinite cohomology, and the Seilberg-Witten-Floer theory intertwining the instanton and monopole results.

Sponsor: National Science Foundation

PI: Weiping Li

Polynomials with Integer Coefficients

This project is devoted to the study of several central topics in polynomials with integer coefficients, which is based on a unifying approach via Potential Theory and Approximation Theory.

Sponsor: National Security Agency

PI: Igor Pritsker

Arithmetic Groups and Tessellations of Homogeneous Spaces

One focus of this project is the study of tessellations of homogeneous spaces. Namely, if G/H is a non-compact, simply connected homogeneous space of a connected Lie group G , the question is whether there is a properly discontinuous subgroup D of G , such that the orbit space $D\backslash G/H$ is compact. This project also studies crystals in mathematical spaces other than the three-dimensional universe that we live in. A crystal is a material whose atomic structure is very symmetric. The most fundamental problem in this subject is to decide which spaces contain crystals, and which do not. For this question, the most interesting spaces are homogeneous, which means that every point of the space looks exactly like all of the other points.

Sponsor: National Science Foundation

PI: Dave Witte

Geometric Structures for Elementary Teachers (GeoSET)

The GeoSET project will support the full development and dissemination of the curriculum and pedagogy for a discovery-based course in geometry intended for prospective elementary teachers. A wide range of curricular and pedagogical activities are supported by the prototype workbook-style text currently used successfully at Oklahoma State University including: group activities, extensive writing, math-literature connections, project, constructions with manipulatives, and proofs.

Sponsor: National Science Foundation

PIs: John Wolf, Douglas Aichele

Efficient Triangulations of Three-Manifolds

This project involves the development and use of efficient triangulations and normal surface theory in the study and understanding of 3-manifolds. This project proposes further investigation of efficient triangulation and its relationship to one-vertex and ideal triangulations of 3-manifolds.

Sponsor: National Science Foundation

PI: William Jaco

Laminations and Dehn surgery on Knots

One of the most common ways of understanding a manifold is to cut the manifold into simpler pieces along a codimension one object. This kind of geometric method has been proven extremely fruitful in the study of 3-manifolds. Certain codimension one objects reveal tremendous topological and geometric information on the 3-manifolds. One goal of the proposed research is to prove the conjecture that if a 3-manifold contains an essential lamination, then it contains a tight lamination.

Sponsor: National Science Foundation

PI: Tao Li

MICROBIOLOGY AND MOLECULAR GENETICS

Star Schools: The New Millennium Oklahoma State University

This is a multi-departmental education project directed toward improving, via distance education, the science and mathematics preparation of in-service middle school science and mathematics teachers.

Sponsor: Department of Education

PIs: James Blankemeyer

Center for Science Literacy: Smith Holt

Department of Physics: Bruce Ackerson

Arts & Sciences Extension: Robert Brown

Department of Mathematics: James Choike

Department of Chemistry: Mark Rockley

Assembly and Function of Cyanobacteria H₂O-Oxidation Complex

The focus of this project is on the structure and assembly of the catalytic site of the H₂O-splitting reaction. The work combines molecular genetic, biochemical, and biophysical approaches to clarify the process of photoactivation, which is the sequential light-dependent assembly of the catalytic tetramer of manganese atoms that forms the core of the H₂O-oxidation complex.

Sponsor: National Science Foundation

PI: Robert Burnap

Functional Genomics of Plant Stress Tolerance

The long-term goal of this proposal is to isolate, characterize, and define the functional roles of all genes essential, important, and ancillary to the water and ion stress response and tolerance phenotype of plants. To tackle the genetic basis of abiotic stress tolerance in higher plants in the most efficient, comprehensive, integrative way possible, a consortium

has been formed between Purdue University, Oklahoma State University, and the University of Arizona. There will be four distinct, yet complimentary approaches to isolate, characterize, and assess the function of the core-set of stress responsive genes involved with the water and ion stress response and tolerance phenotype in plants. Considering the exceptional impact of abiotic stress on crop productivity, which according to USDA statistics amounts to two-thirds of all yield reductions in agriculture, the project to define and understand the number and nature of genes and physiological mechanisms that constitute abiotic stress tolerance is exceptionally timely.

Sponsor: National Science Foundation

PIs: Robert Burnap, Rolf Prade

Oklahoma Biomedical Research Infrastructure Network

This project features an interdisciplinary and multi-institutional focus on biomedical research in Oklahoma with institutions offering services and education from undergraduate level to professional health care training and clinical trials.

Sponsor: University of Oklahoma Health Sciences Center, Biomedical Research Infrastructure Network

PI: Robert Burnap

Sustainability of Aerobic Biodegradation of *cis*-Dichloroethene (*cis*-DCE) and Vinyl Chloride (VC) in Subsurface: Natural Attenuation and Plume Control

This project seeks to: 1) determine the sustainability key factors including degradative bacteris, substrates, and the environmental conditions controlling contaminant degradation, 2) evaluate the potential of VC as a carbon source for aerobic TCE, *cis*-DCE, and *trans*-DCE degradation, and 3) develop 16S rDNA-based probes for the detection of *cis*-DCE and VC degrading bacteria at contaminated aquifers.

Sponsor: Environmental Institute for Water Research

PI: Babu Fathepure

Minority PhD Recruitment in Microbiology and Molecular Genetics

This project features an initiative to increase the number of minority graduate students in the microbiological and molecular sciences through recruiting and mentoring. Recruitment will cover the state of Oklahoma with the assistance of those with histories in educating minority students. The formation of a website aimed at minority grants and the graduate program in the Department of Microbiology and Molecular Genetic at Oklahoma State University will broaden the range to other states in the southwest.

Sponsor: Sloan Foundation

PI: Gilbert John

A Mucosal DNA Vaccine for Equine Influenza Virus

Because of antigenic drift, immunization against influenza virus requires repeated vaccinations and constant upgrading of the vaccine. Current vaccines are based on inactivated whole virus. This approach is inadequate due to the low immunogenicity and a long lag time is required for testing after a vaccine strain has been chosen. A DNA vaccine circumvents the lag time involved in vaccine updates. A DNA vaccine elicits both cell-mediated and humoral immune response. The results of testing a DNA vaccine expressing the HA gene of equine influenza virus indicates that mucosal immunization with this DNA vaccine confers complete protection.

Sponsor: Fort Dodge Animal Health, Hong Kong Jockey Club

PI: Alexander Lai

Analysis of the *Pseudomonas Aeruginosa* Type III Secretion Apparatus

This project has three specific aims: 1) to detect and isolate the *P. aeruginosa* needle complex, 2) to determine the topology of the protein components of the *P. aeruginosa* needle complex, and 3) to examine the channel-forming ability of the isolated complexes.

Sponsor: Oklahoma Center for the Advancement of Science and Technology

PI: Anand Sukhan

Native Americans in Biological Sciences (NABS) at Oklahoma State University

Although some Native American students initially declare biomedical majors, few complete degrees in the field. The current proposal seeks to address this problem by increasing the success rate of Native Americans in science, thereby increasing the number of Native Americans who graduate with biologically related degrees from OSU.

Sponsor: NIH

PI: Robert Miller

Minority PhD Recruitment in Microbiology and Molecular Genetics

The goal of this project is to fund Minority PhD recruitment and retention in the Department of Microbiology and Molecular Genetics at Oklahoma State University.

Sponsor: National Council for Minorities in Engineering

PI: Gilbert John

Dual Sensor for Detecting Xenobiotics and Microorganisms

The goal of the project is to develop a dual sensor that can be used to rapidly detect both xenobiotics and microbial organisms (bacteria) in drinking water that can be harmful to humans.

Sponsor: U.S. Geological Survey

PI: Gilbert John

Electrical and Computing Engineering: Gary Yen

PHYSICS

Star Schools: The New Millennium Oklahoma State University

This is a multi-departmental education project directed toward improving, via distance education, the science and mathematics preparation of in-service middle school science and mathematics teachers.

Sponsor: Department of Education

PIs: Bruce Ackerson

Techniques and Instruments for *In-situ* Dating of Martian Sediments

This research will focus on testing the thermoluminescence (TL), optically stimulated luminescence (OSL), and electron spin resonance (ESR) properties of various materials that may be encountered on Mars, as well as developing a low-weight, low-power, instrument to conduct TL, OSL and EST studies.

Sponsor: National Aeronautic and Space Administration

PIs: Michael Blair

Jet Propulsion Laboratory: Soon Sam Kim

Coherence Effects in 1D Nanostructured Systems

The objective of this research is to determine the extent to which phase coherence plays a role in determining transport properties in 1D semi-classical systems so that it will become possible to employ these micro-fabricated wires in electronic application. To accomplish the overall objective of this research specific studies on 1D wires composed of chains of semiconductor Nanoparticle will be completed including the following: 1) to dielectrophoretically induce the formation of chains of semiconductor nanoparticles between designated points in a simple circuit, and 2) to study the transition between quantum and classical conduction in these 1D wires.

Sponsor: National Science Foundation, Oklahoma EPSCoR

PIs: Bret Flanders, Xincheng Xie

Directed Assembly of Microscopic Wires from Semiconductor Nanoparticles

This project focuses on methods for externally directed, spontaneous assembly in 2D populations of semiconductor nanoparticles. A particular aim is to induce the formation of wires of microscopic diameter and arbitrary length. The study will also gain knowledge of how the experimental parameters can be used to tailor the phase structure facilitating the development of methods for externally interacting with the population, which will advance the research effort towards the long-term goal of using spontaneous assembly of the nanoscopic electronic components.

Sponsor: National Science Foundation

PI: Bret Flanders

Field-Portable Chip-Based 'Anti-Terrorism' Microanalyzer

This collaborative research effort addressed the urgent needs for providing timely analytical data on major explosives and chemical warfare agents (CWA) through the development of a miniaturized hand-held analyzer based on advanced "Lab-on-a-chip" technology. The new hand-held unit will provide a rapid post-analysis "fingerprints" of a disaster site as well as the alarm necessary for preventing terrorist activity.

Sponsor: University of California, Riverside

PIs: James Harmon

University of California, Riverside: Ashok Mulchandani

New Mexico State University: Joseph Wang

Naval Research Laboratory: Greg Collins

Second Generation Photocatalytic Oxidation Processes

This research project is comprised of five objectives: 1) to develop granular titanis(Pt)-silica composite catalysts that, when utilized in a packed bed photoreactor, will provide enhanced performance over conventional catalysts, 2) to develop porphyrin-modified catalysts capable of utilizing visible light for photocatalytic oxidation (PCO) and for generating molecular oxygen *in-situ* for use in PCO, 3) to develop a clear understanding of PCO reaction mechanisms and rates as they apply to the primary contaminants in the NASA WRS, 4) to identify refractory by-products within the WRX system using advanced analytical technology, and 5) to pursue aggressively the transfer of this second generation PCO technology to terrestrial applications through collaboration with industry and the United States Environmental Protection Agency.

Sponsor: University of Oklahoma, NASA, Oklahoma Regents for Higher Education
PI: H. James Harmon

Growth and Characterization of Photorefractive Crystals for Visible and Near-IR Applications

The purpose of this research and development effort is to advance the current state-of-the-art laser hardened materials technology through the performance of a series of short-term, specialized and focused efforts on innovative materials technologies, interactions, materials development, and application studies and tests.

Sponsor: Anteon
PI: Joel Martin

Development of Optical Fiber Dosimeters Based on Optically Stimulated Luminescence (OSL) From A10 for Use in Radiotherapy

The development effort focused on developing radiation sensitive crystals with shape and response characteristics suitable for remote measurement of radiation therapy fields through coupling the crystals with optically conducting fibers to an instrument capable of quantifying the luminescence emitted by the crystal as a result of optical stimulation or direct radiation processes.

Sponsor: Landauer
PI: Stephen McKeever

Miniature Age Dating/Material Characterization Instrument

The instrument is based on integration of three of the most powerful techniques in dosimetry, namely thermoluminescence (TL), optically stimulated luminescence (OSL), and electron spin resonance (ESR, or electron paramagnetic resonance (EPR), which have been utilized extensively for quaternary dating purposes on Earth. The applicable range of our dosimetric method extends up to ~1M years, and, depending on sensitivity, as recent as 10~100 years before present. The three techniques are used complementarily and integrated toward comprehensive analysis of samples.

Sponsor: Jet Propulsion Laboratory
PI: Stephen McKeever

Monolithic Integrated Radiation Sensor Using Stimulated Luminescence from Alumina

We propose the use of monolithic microelectronic technology to develop a novel integrated radiation sensor based on optically stimulated luminescence from A1203. Radiation-dosimetry-quality A1203 will be used as a substrate for the epitaxial growth of an InGaN-based photodiode, which will be used as a photovoltaic detector. The other side of the substrate will be intimately bonded to InGaN-based LEDs for optical stimulation. The radiation absorbed by the substrate will create trapped electronic charge at defect states in the A1203. Subsequent stimulation of the substrate with light from the LEDs (at 530 nm) will stimulate luminescence emission (at 420nm) from the substrate, which will be detected by the photodetector. The detected luminescence will be proportional to the absorbed dose. The merit of using InGaN is its narrow bandpass response without the need for additional optical filtration. The emission and detection wavelengths from the InGaN devices will be controlled by controlling the In mole fraction. The device will be low weight, with low power consumption, and of high radiation detection efficiency. It will be suitable

for use with a variety of space flight, remote lander, or micropenetrator platforms for the remote investigation of the radiation environment on planetary surfaces, or for use as a personal dosimeter by astronauts. Potential applications will also exist for environmental and personal applications on Earth.

Sponsor: NASA

PI: Stephen McKeever

A Near-Real-Time Radiation Dosimeter for Radiation Therapy

The intent of this proposal is to develop a near real time, surface, and/or *in vivo* dosimetry system for use in radiation oncology. The accurate measurement of radiation dose during radiotherapy in the treatment of cancer requires knowledge of the actual dose delivered to internal organs with a high level of accuracy. In addition to enduring that the prescribed dose has been delivered to the cancerous tissue, it is also necessary to limit the dose burden to healthy tissue to as low as possible. The only way to ensure that critical organs are getting the dose required is to measure the dose inside the patient (i.e., *in vivo* dosimetry) during treatment. Current dosimeters systems, however, are often too large and cannot easily be placed in or retrieved from a suitable body cavity for *in vivo* applications. Furthermore, few are able to provide the dose information to the physician in real time and only measure the dose after it has been delivered, rather than during delivery. The proposed system will retain, or improve, the high sensitivity and accuracy of current dosimetry systems, but will measure the dose, and report it to the physician, in real time. Additionally, the small size of the proposed dosimeters may open up *in vivo* opportunities that do not exist with current technology. A successful system will improve treatment, reduce costs, and reduce the number of repeat treatments required. The method is based on innovative luminescence techniques using new technology developed at OSU, and the project involves the development of dosimeter systems, performance testing, and clinical trials on animals

Sponsor: Oklahoma Center for the Advancement of Science and Technology

PI: Stephen McKeever

Computational Materials Physics of Helical Nanostructures

This project supports advanced modeling of materials that are critical components of several S&T mission areas involved in nanostructures and nanoscience. A major emphasis of the project is improved first-principles modeling techniques for carbon nanotube materials and other low-dimensional materials, electrical and optical properties that surpass the current performance limits of rigid-rod polymers in a number of important applications such as structural composites, electro-optically active thin films, or advanced full-cell membranes.

Sponsor: Office of Naval Research

PI: John Mintmire

Computational Tools for Nanoscale Materials Design

The overall goal of this project is to develop a scalable and portable suite of programs based on current scalar codes developed at the Naval Research Laboratory for calculating the first-principles local-density-functional based electronic structure, total energy, and energy derivatives of nanoscale structures whose dimensions exceed the capabilities of current DoD and academic computational approaches.

Sponsor: Naval Research Laboratory

PI: John Mintmire

Molecular Dynamics of Energetic and Non-Energetic Materials

This project supports advanced modeling of materials that are critical components of several Department of Defense (DoD) weapons and S&T mission areas. Many chemical properties require an understanding of the atomic-scale behavior of the reactants and products, while the increasing importance of nanostructured materials and devices makes an understanding of atomic-scale properties critical even for structural materials traditionally considered only at the macroscale. The atomic-scale potentials implemented by this project can be used to model the structural and tribological behavior of the DoD weapons systems.

Sponsor: Office of Naval Research

PI: John Mintmire

Microsphere Based Evanescent-Wave Optical Sensor

This project is an investigation of molecular trace-gas sensing and chemical solution absorbance measurement using light in the evanescent component of the whispering-gallery modes (WGM) of individual fused-silica microspheres. The objectives in this project include improving the coupling to make it more efficient, uniform, selective, robust, and practical; further investigating the measurement of next and intrinsic Q by comparing different measurement methods and the effects of different ambient media; and ruggedizing the sensor, culminating in prototypes for gas and liquid sensing.

Sponsor: Oklahoma Center for the Advancement of Science and Technology

PI: Albert Rosenberger

Microsphere Whispering-Gallery Modes for Diverse Optical Sensing

The objective of this research was to study applications for, and possible enhancements of, Whispering-Gallery Modes (WGM) optical microsensors. In part, this research was a detailed investigation into how previously demonstrated techniques of optical WGM micorsensing can best be extended in order to contribute to NASA's research mission areas and the investigation of methods of enhancing sensitivity, thereby opening up new sensing applications.

Sponsor: National Aeronautic and Space Administration, EPSCoR

PI: Albert Rosenberger

Collaborative Research in High Energy Physics between Oklahoma State University and FermiLab

This joint project will initiate a research partnership between Oklahoma State University and Fermi Nation Accelerator Laboratory in the area of theoretical High Energy Physics. Several collaborative research projects covering a wide range of High Energy Physics topics of current interest will be studied. Topics include new signals for the Higgs boson, the physics implications of large extra compact dimensions, collider signals for supersymmetry, physics of extra Z bosons, and new phenomena associated with neutrino masses and oscillations. It is expected that the completion of these projects will lead to significant progress in our understanding of elementary particle interactions.

Sponsor: United States Department of Energy

PIs: Satyanarayan Nandi, K.S. Babu

FermiLab: Joseph Lykken

Theoretical Research in Weak, Electromagnetic, and Strong Interactions

This project covers a wide range of topics in the theory and phenomenology of elementary particle interactions. They fall into four broad categories: 1) physics implications of large compact dimensions, 2) unifications, neutrino masses, and nucleon stability, 3) topics in Higgs physics; and 4) issues in supersymmetry breaking and associated phenomenology. The topics include: effects of Kaluza Klein excitations of the electroweak gauge bosons and the gluon at the present and future colliders; supersymmetry effects in theories with large extra dimensions; implications of large compact dimensions on the Higgs boson mass and decay; grand unified model building in view of the SuperKamiokande neutrino data and its implications for proton decay; minimal models of neutrino masses which fit all the current data; minimal supersymmetric left-right model and its impact on CP violating phenomena; dynamical suppression of fermion electric dipole moments in supersymmetric models; a new mechanism to explain the μ problem in the context of gauge mediated supersymmetry breaking; and phenomenological and model-building aspects of extra Z bosons. It is hoped that the completion of these projects will help improve our understanding of the nature of fundamental particles and their interactions

Sponsor: U.S. Department of Energy

PIs: Satyanarayan Nandi, K.S. Babu

Research Experience for Undergraduates—Optical Materials and Lasers

This research includes a summer program providing research experience for undergraduates in the area of optical materials and lasers. The materials to be investigated in this program will include laser-host, electro-optic, photorefractive, and colloidal materials with present or potential applications in optical systems. The participants are actively involved in nine related projects involving crystal growth, time-resolved site-selection spectroscopy, laser instabilities, optical characterization of quantum well structures, thermal and electrical transport properties, light scattering, and thermally- and optically-stimulated luminescence.

Sponsor: National Science Foundation

PI: David Peakheart

Studies of Exactly Solvable Models in Statistical Models

This is a research project for the study of exactly solvable models of statistical mechanics, including the integrable chiral Potts model and various Ising models. These models will be studied by exact analytical and approximate numerical methods. By its very nature, this project also involves several areas of mathematics.

Sponsor: National Science Foundation

PIs: Jacques Perk, Helen Au-Yang

Tunable Microlaser Using Semiconductor Nanoparticles

The objective of this project is to demonstrate feasibility and begin development of a microsphere whispering-gallery-mode laser. The gain medium will be a thin polyelectrolyte coating containing semiconductor (HgTe) nanoparticles, optically pumped by a cw Ti:sapphire laser. Tunable single-mode lasing in the 1400-1700 nm range is expected, and will be coupled out into an optical fiber.

Sponsor: Oklahoma Center for the Advancement of Science and Technology

PI: Albert T. Rosenberger

Whispering-Gallery Microlaser with Nanocomposite-Film Gain Medium

Low-threshold laser action in the whispering-gallery modes (WGMs) of fused-silica microspheres will be investigated. A microsphere, coated with a thin polyelectrolyte film, including HgTe nanoparticles, will be pumped in a WGM around 800 nm using a tapered optical fiber. Lasing around 1400-1700 nm will be coupled out of the microlaser using the same tapered fiber.

Sponsor: National Science Foundation

PI: Albert T. Rosenberger

Biophotonics: Collaborative Research: Photoactivated Coupling of Nanoparticle Multilayers and Nerve Cells

In this project, a multidisciplinary and multi-university research team is investigating the dynamics and mechanisms of the live/lifeless matter interaction in a model system consisting of a thin film composed of nanoparticles and cultured nerve cells. Specifically, the objectives of the project are the following: 1) preparation and optimization of biocompatible nanoparticle multilayers that can be attached to nerve cells, and 2) registration and characterization of the photoinduced nerve cell membrane currents and potentials following optical excitation of the interface as function of nanoparticle and biological structures.

Sponsor: National Science Foundation

PIs: James P. Wicksted,

Department of Chemistry: Nicholas A. Kotov, Warren T. Ford

REU Site-Optical Materials, Lasers, and Their Application in Optical Sensing

This program provides undergraduates with research experience in the experimental and theoretical study of the physical properties of optical and laser materials and their application as sensors.

Sponsor: National Science Foundation

PI: Timothy Wilson

Picosecond Relaxation, Heating & Ablation Dynamics of Biomolecules

The long-term objective of this project is to investigate the structural basis and functional roles of energy flow in proteins. The technique of subpicosecond infrared pump probe system using tunable infrared free electron lasers is being developed to study the rates and channels of energy flow in proteins and nonlinear protein dynamics. Energy flow in proteins is expected to be sensitive to structural fold and to meet the functional needs of individual proteins. A variety of proteins, which are folded into different secondary and tertiary structures and perform different biological functions (such as bacteriorhodopsin, photoactive yellow protein, and myoglobin), as well as amino acid homopolymers, are being studied.

Sponsor: Office of Naval Research (ONR)

PI: Aihua Xie

Novel Superconductivity in Two-Dimensional Electron System

This project involves the study of a possible new superconducting state in a two-dimensional electron system in the absence of an external magnetic field. One major goal

is to establish the physical conditions where this new superconducting state is experimentally accessible. Researchers will use both analytic and numerical calculations to achieve this goal.

Sponsor: U.S. Department of Energy

PI: Xincheng Xie

Implantable Nanoparticle-Based Sensor for *In Vivo* Optical Monitoring of Analytes

Sponsor: University of Texas Medical Branch/Galveston

PI: James Wicksted/Neil Purdie

Activation Mechanism of a PAS Domain Photoreceptor

Sponsor: OCAST

PI: Aihua Xie

Sensors: Optical Whispering-Gallery Modes for Diverse Sensing Applications

The objectives of this project are: 1) to further develop and advance previously demonstrated methods of WGM evanescent-wave sensing of trace gases in the atmosphere and chemicals in solution; 2) to extend earlier applications of WGM microsensors in measuring thermal and absorptive properties to the characterization of transparent thin films; 3) to apply to WGM microresonators methods of surface preparation that have proved useful in fiber sensors for gases, chemicals, and biological agents; and 4) to pursue novel techniques that enable the multiplication of sensitivity enhancements by combining effects such as modal interference with WGM microsensing.

Sponsor: National Science Foundation

PI: Al Rosenberger

Microsphere-Based Evanescent-Wave Optical Sensor

The overall goals of this project are to improve the scientific understanding of the sensor operation and to enable the development of prototypes. This will be done by improving the coupling of laser light into the microsphere, measuring the properties of the sphere that determine the detection sensitivity, investigating various system configurations, applying different and more sensitive detection methods to the microsphere system in gases and in liquids, advancing the relevant theory, and ruggedizing the sensor.

Sponsor: OCAST

PI: Al Rosenberger

Exploratory Development of Smart Textiles for Chemical Detection

The goal of this project is to develop a smart textile prototype that can detect small amounts (ppm to ppb level) of toxic chemicals within seconds. In this smart textile, chemical detection sensor components will be integrated into textiles, such that the fabric will serve as the platform for the sensors to detect toxic chemicals. This smart textile will be subsequently integrated into the protective clothing matrix to sense the environment as well as to determine the integrity of protective clothing depending on the location of the smart textile.

Sponsor: National Science Foundation

PI: Huantian Cao, James Harmon

CHES: C. Wei

EPSCoR Research Infrastructure Improvement Plan

Sponsor: National Science Foundation, EPSCoR

PI: Warren Ford, James Wicksted

Whispering-Gallery-Mode Microsensors and Microlasers

The goal of this project is to further develop and advance previously-demonstrated methods of whispering-gallery-mode evanescent-wave sensing of trace gases in the atmosphere and chemicals in solution. This includes improvement of control and coupling techniques, redundant characterization of WGMs expansion of numerical modeling, and implementation of wavelength-modulation spectroscopy.

Sponsor: Nomadics

PI: Al Rosenberger

Center for Semiconductor Physics in Nanostructures

The goal of this project is to propose a direct method to measure the spin coherence time for carriers at the Fermi surface using transport. Also crossover between diffusive and ballistic spin transport and study of 0.7 anomaly in InSb quantum point contact will be considered.

Sponsor: University of Oklahoma

PI: Xincheng Xie

Growth and Characterization of Photorefractive Crystals for Visible and Near-IR Applications

The objective of this work is to tailor sillenite (BSO and/or BGO) crystals for photorefractive applications in the near-IR and visible spectral ranges.

Sponsor: Aneton Corporation

PI: Joel Martin

Computational Modeling of Inorganic Nanowires

A major emphasis of the initial study will be to examine trends of how the electronic properties, particularly the one-electron levels near the Fermi level, change as we go from small diameters toward larger diameters. Also theoretical calculations will be done of the anisotropic optical cross sections using an Ehrenreich-Cohen approach, [12,13] with the results of these calculations used to interpret the expected optical anisotropy of the nanostructures under consideration.

Sponsor: NASA/EPSCoR

PI: John Mintmire

Natural Dose-Rate Measurement with a A1203; C Dosimeters in Permafrost

The objective is to initiate a research collaboration with Dr. Chris McKay at NASA Ames on the determination of the accumulated radiation dose from naturally occurring radioactive elements in frozen life forms. The project is part of a larger study of life in extreme environments.

Sponsor: NASA, EPSCoR

PI: Regina Kalchgruber, Steven McKeever

Charge and Spin Transport in Low-Dimensional Systems

The four topics discussed in this proposal are: 1) the zero resistance state, 2) "0.7

conductance anomaly” in a quantum point contact, 3) spin transport in low-dimensional systems, and 4) spin entanglement in three quantum dots systems.

Sponsor: U.S. Department of Energy

PI: Xincheng Xie

Theoretical Research in Weak, Electromagnetic, and Strong Interactions

The proposed research covers a wide range of topics in the theory and phenomenology of elementary particle interactions. They fall into four broad categories: 1) model-building and unification in extra dimensions; 2) collider physics; 3) neutrino masses, unification, and nucleon stability; and (4) supersymmetric model building and flavor physics.

Sponsor: DOE

PI: S Nandi, K. Babu

REU Program in Physics

This program provides provisional funding for activities involving the training of individuals in research techniques. It introduces outstanding young scientists into the field.

Sponsor: EPSCoR Regents

PI: Tim Wilson

REU Program in Physics

This program provides provisional funding for activities involving the training of individuals in research techniques. It introduces outstanding young scientists into the field. This grant provides funding for two individuals.

Sponsor: EPSCoR, Regents

PI: Tim Wilson, Warren Ford

Photocatalytic Degradation of Energetic Materials, Phase III

The central focus of the current research effort determines the parameters of the photocatalytic transformation of TNT. This will involve the measurement of rates of destruction under different conditions, including temperature, pH, light intensity, wavelength of light used, and the nature of the catalyst used involving the use of mixtures of different porphyrins as well as the synergistic effects of titania.

Sponsor: Sverdrup Technology, Inc.

PI: James Harmon

POLITICAL SCIENCE

New Methods in Environmental Remediation, Monitoring, and Life Cycle Assessment

This project is an impact assessment component responsible for the conduct of face-to-face interviews of 30 stakeholders in each of the two communities in Oklahoma in which SEER projects will be evaluating the effectiveness of pollution abatement technologies.

Sponsor: University of Oklahoma, Environmental Protection Agency

PI: Will Focht

A Nutrient Management Decision Support System for the Eucha Basin

The purpose of this study is to assess the effectiveness and acceptability of Eucha-

Spavinaw watershed impact management policy. In the first year of this three year study, an expert model of Eucha-Spavinaw will be developed based on interviews of relevant experts. The visualization of the expert model will be developed with Visio 2002.

Sponsor: University of Arkansas, United States Department of Agriculture

PI: Will Focht

PSYCHOLOGY

American Indians into Psychology Program

Project objectives for outreach and recruitment are as follows: each year to provide summer mentoring experiences for 12 American Indian undergraduates, to support two additional graduate students in psychology programs, and to place two Indian students as interns/practicum students in tribal mental health facilities. Part of the recruitment effort will also include a Psychology Career Day for Indian students. Nine American Indian students will be enrolled in graduate psychology programs at Oklahoma State University during the grant period. At the conclusion, experienced mental health professionals who work with Indian people will conduct a formal outside evaluation.

Sponsor: PHS, Indian Health Services

PI: John Chaney

Neurocognition, Nicotine and Polysubstance Abuse

Study focuses on the development and debriefing and relaxation therapies to be used after nicotine administration as well as the review of clinical information obtained in screening. In addition, data analysis and interpretation, presentations at scientific meetings, and participation in manuscript writing will be components of the study.

Sponsor: University of Oklahoma Health Sciences Center

PI: Frank Collins

Psychomotivational Determinants of Retirement Planning

This project is designed to explore the psychomotivational determinants of financial planning for retirement by examining the extent to which personality factors influence savings participation rates. Two personality variables—"financial risk tolerance" and "future time perspective"—will serve as predictors of pre-retirement savings activity. Participants will be 280 working adults, 25-45 years of age, sampled from across the United States. The theoretical goal of the research will be to examine the relative strength of influence "future orientation" and "risk tolerance" have on savings practices.

Sponsor: National Institute on Aging

PI: Douglas A. Hershey

High-Risk Alcohol Use Prevention among College Students

The long-term objective of the project is to reduce alcohol-related negative consequences and drinking behaviors among college students using social marketing to increase accuracy of perceptions of campus drinking. The project utilized a stepped-care approach, moving from social marketing to direct-mail motivational feedback to small-group alcohol skills training based on response to earlier steps.

Sponsor: Oklahoma Center for the Advancement of Science and Technology

PI: Thad Leffingwell

Exploring Quantitative Analysis: A Basic Introduction

Project includes an academy for ninth and tenth grade students to learn quantitative methods, including statistics and research methods. The overall goal of the academy is to enhance students' mathematical and scientific reasoning abilities.

Sponsor: Oklahoma State Regents for Higher Education

PI: Melanie Page

Oklahoma Infant Parenting Project

Study includes provisions for two graduate clinical and research assistants to conduct clinical and research activities with the Department of Pediatrics, Center on Child Abuse and Neglect.

Sponsor: Department of Pediatrics, Center on Child Abuse and Neglect

PI: Melanie Page

Summer Academy: Exploring Human-Animal Interaction and Bonding Processes

The academy for ninth, tenth, and eleventh graders provides hand-on learning experiences with animals in an attempt to bring science and mathematics "to life." It teaches behavioral and social sciences models, biological concepts, research methodology, statistics, and communication skills. These multidisciplinary skills encompass a variety of domains. The overall goal of the academy is to foster a desire to attend college and pursue such careers.

Sponsor: Oklahoma State Regents for Higher Education

PI: Melanie Page

Increasing Science Education through the Study of Scientific Psychology: A National Science Foundation Research Experience for Undergraduates

This project provides an 8-week summer program to train 12-14 undergraduates in research. Students learn all aspects of the research process, including formulating hypotheses, integrating and analyzing scientific literature, study design, data collection, data analysis, and oral and written presentation of findings. Students receive a \$3000 stipend in addition to on-campus housing in new suite-style dorms, a travel stipend, and a research stipend to cover such costs as photocopying, computer disks, paying subjects.

Sponsor: National Science Foundation

PI: Melanie Page, Charles Abramson

Group Treatment for Children with Sexual Behavior Problems Practicum Agreement

This practicum will include training in the evaluation and treatment of children affected by child maltreatment. This practicum will integrate training in clinical service, research, and teaching.

Sponsor: University of Oklahoma Health Sciences Center

PI: Larry Mullins

Child Study Center Clinical Operations Account Practicum Agreement

This award is for providing two graduate clinical psychology doctoral students for practicum training with OUHSC.

Sponsor: University of Oklahoma Health Sciences Center

PI: Larry Mullins

OUHSC Departmental Account Practicum Agreement

This award is for providing two graduate clinical psychology doctoral students for practicum training with OUHSC.

Sponsor: University of Oklahoma Health Sciences Center

PI: Larry Mullins

Fetal Alcohol Syndrome Practicum Agreement for FY04

This award is for work on the Fetal Alcohol Syndrome Practicum, with provisions for three graduate students.

Sponsor: University of Oklahoma Health Sciences Center

PI: Larry Mullins

The Effects of Flavors or Theanine in Chewing Gum on Nicotine Withdrawal

The specific aims of this study are: 1) to demonstrate that chewing gum is effective in reducing nicotine withdrawal during a voluntary 48-hour abstinence, and 2) to demonstrate the effectiveness of two gum additives, both individually and in combination, in enhancement of the chewing gum effect. The additives are vanilla flavor and l-theanine.

Sponsor: Texas Tech University

PI: Frank Collins

DHHS/UCLA/OUHSC Practicum for Laura Knight

This award is for provisional funding for research.

Sponsor: University of Oklahoma Health Sciences Center

PI: Larry Mullins

Smoke-Free Homes Project

The proposed study seeks to substantially reduce the amount of ETS young children are exposed to by comparing the effectiveness of a currently used intervention utilizing a risk reduction strategy to a comprehensive cessation strategy for families of hospitalized newborns. Biochemical measurement of nicotine in the home of the child will be used to provide objective validation of the caregiver's reported levels smoking and to enhance reporting accuracy.

Sponsor: The Robert Wood Johnson Foundation

PI: Frank Collins

A 10-Year Follow-up of Children with Sexual Behavior Problems Using Justice, Child Welfare, and Self-Report Data

This award supplies funding to provide one graduate clinical and research assistant for clinical and research activities with the Section of Developmental Pediatrics.

Sponsor: University of Oklahoma Health Sciences Center

PI: Larry Mullins

SPEECH COMMUNICATION

The Effects of Communication Interventions on the Career Decision Process

This is a project to provide 40 students per year with the opportunity to complete the Johnson O'Connor Aptitude Tests and to determine if that test had an effect on the career development process for the students.

Sponsor: Fourjay Foundation
PI: Mary Mandeville

STATISTICS

Testing for Marginal Independence between Two or More Multiple-Response Categorical Variables

The purpose of this research is to develop new approaches focused on testing for a special kind of independence, called marginal independence, in the presence of two or more multiple response categorical variables. A modified version of the Pearson chi-square test statistic was derived to test for marginal independence. Asymptotic and bootstrap methods were used to estimate the statistic's sampling distribution. Generalized loglinear models and generalized linear mixed models were fit using maximum likelihood estimation and likelihood ratio tests were constructed.

Sponsor: National Science Foundation
PI: Christopher Bilder

Animal Models of Cold Air-Induced Airway Disease

The goal of the project is to test the hypotheses that unconditioned air penetrates to the level of the bronchi in sled dogs breathing cold air during strenuous exercise, resulting in peripheral airway injury and inflammation.

Sponsor: NIH
PI: Mark Payton
Physiological Sciences: Michael Davis

THEATRE

What the Butler Saw

Provide included stage direction and sound design, scene design, costume design, technical direction, and light design for the departmental production of *What the Butler Saw*.

Sponsor: Department of Theatre
PIs: B. Peter Westerhoff, Heidi Hoffer, Judith Picard Cronk, David Wlodarski, Jessica Rano

The Cherry Orchard

Project included stage direction, scene design, costume design, technical direction, light design, and sound design for the departmental production of *The Cherry Orchard*.

Sponsor: Department of Theatre
PIs: Kevin Otos, Bruce Brockman, Judith Picard Cronk, David Wlodarski, Obadiah Harvey, Tracy Aksamit

The Triumph of Love

Project included stage direction, scene design and technical direction, costume design, light design, sound design, and Dramaturg for the departmental production of *The Triumph of Love*.

Sponsor: Department of Theatre
PIs: Ronal Stepney, David Wlodarski, Valerie Payne, Heidi Hoffer, Justin Schumann,

Chris Shultz

West Side Story

Project included stage direction and choreographer, scene and light design, costume design, technical direction, sound design, orchestra conductor, and vocal conductor for the departmental production of *West Side Story*.

Sponsor: Department of Theatre

PIs: B. Peter Westerhoff, Heidi Hoffer, Judith Picard Cronk, David Wlodarski, Justin Schumann, Richard Prior, Dirk Garner

ZOOLOGY

Development of a Wetland Monitoring Program for the Iowa Tribe of Oklahoma

The Wetland Protection Development Grant Program will be used to assess, monitor, and measure the biological condition of several wetlands located on both Iowa Tribal land and elsewhere within the state of Oklahoma. Objectives include comparing the response of macroinvertebrate, plant and bird communities across a number of wetland that exhibit a range of disturbance, evaluating each of the assemblages based on sensitivity to perturbation and technical requirements for effective monitoring, and increasing Tribal capacity to manage wetlands program through the provision of trainings, workshops, and educational activities.

Sponsor: Office of the Secretary of Environment

PIs: Joseph Bidwell, Craig Davis

Toxicity Identification Evaluation of an Industrial Effluent

Toxicity Identification Evaluations (TIE) are an integral component of the Toxicity Reduction Evaluation process. TIEs couple acute bioassays with chemical manipulations and analyses to determine the source of toxicity in industrial or municipal effluent. The TIE consists of three separate phases: 1) the initial toxicity evaluation, 2) component identification, and 3) confirmation. This project is centered on phase one—initial toxicity evaluation.

Sponsor: Terra Nitrogen, LP

PI: Joseph Bidwell

Effects of Mountain Biking Activity on Foraging and Nesting Behavior of Golden-Cheeked Warblers

This study assesses whether mountain biking adversely affects the foraging and incubation behavior of Golden-cheeked Warbler in two separate sites. Two comparisons have been made: 1) between study sites with and without mountain biking, and 2) among territories that receive high versus low levels of mountain biking activity

Sponsor: United States Geological Survey

PI: Craig Davis, David Leslie

Heterogeneity on Rangelands: Effects of Biodiversity and Productivity

The overall goal was to evaluate the importance of heterogeneity on structure and function of mixed and tallgrass prairie across several spatial and temporal scales by applying localized fires and allowing free selection of livestock between burned and unburned patches.

Sponsor: United States Department of Agriculture

PIs: Craig Davis, David Leslie

Invertebrate Response to Wetland Management Practices, Land-Use Practices, and Restorations in the Rainwater Basin Region (RWBR)

The objectives of this study of the Rainwater Basin Region in Nebraska were to determine aquatic invertebrate responses to different management practices implemented on RWBR wetlands, to examine the effects of environmental factors on aquatic invertebrate communities inhabiting RWBR wetlands, evaluation of landscape-scale effects on aquatic invertebrate communities inhabiting RWBR wetlands, and evaluation of responses of aquatic invertebrates to restored RWBR wetlands.

Sponsor: Nebraska Game and Wildlife Commission

PI: Craig Davis

Response of Non-Game Birds and Terrestrial Invertebrates to Restoration and Management of Upland Grasslands in the Rainwater Basin Region

The objective of this study is to determine the effect of restoration and management techniques on grassland birds and invertebrates in the Rainwater Basin Region of south-central Nebraska by determining grassland bird habitat-use and nest productivity, evaluating the response of the grassland bird community and terrestrial invertebrate community to the restoration of uplands, evaluating the response of grassland bird and invertebrate communities to different management practices, and providing management recommendations for grassland bird species that use the Rainwater Basin Region uplands.

Sponsor: The Nature Conservancy

PI: Craig Davis

Validation of a Rapid Progesterin-Based Endocrine Disruption Screening Assay

Phase I of this research resulted in the development and standardization of an assay to test substances that might disturb reproductive and developmental processes in animals by interfering with the endocrine system. The primary goal of the research was to validate and commercialize the *Xenopus laevis* oocyte maturation germinal vesicle breakdown (GVBD) model as a system for rapid evaluation of endocrine disrupting chemicals found in the workplace or the environment.

Sponsor: Fort Laboratories

PI: Joseph Bidwell

Assessing the Scientific Basis for Standards/Practices at Multiple Spatial Scales – East

This project includes a planned evaluation of relationships between measures of forest structure and biological diversity using data from three previous large-scale studies conducted in highly forested landscapes in Arkansas, South Carolina, and West Virginia. The three sites encompassed a range of vegetation types, structures, and physiographic settings across the southeast. The current project will build upon those previous studies through two primary activities: 1) a series of two workshops, and 2) a synthesis/analysis of data.

Sponsor: National Council for Air and Stream Improvement, Inc.

PIs: Stanley Fox, Paul Shipman

Modeling Wildlife-Habitat Relationships for Birds, Amphibians, and Reptiles in the Ouachita Mountains, Arkansas

The objective of this research was to validate the predictive accuracy of bird, amphibian, and reptile habitat relationship models derived from data collected on the original four watersheds during 1995-99 and modification of models in preparation for application in the post-treatment phase.

Sponsor: Weyerhaeuser Company, United States Department of Agriculture, NCASI

PIs: Stanley Fox, Paul Shipman

Validation of Amphibian and Reptile Habitat Relationship Models for the Ouachita Mountains, Arkansas

The objective of this research is to validate the predictive accuracy of amphibian and reptile habitat relationship models derived from data collected on the original four watersheds during 1995-1999. Using the same sampling protocols to those used in the first four years, sampling of Amphibians and reptiles on one or more new watersheds will be conducted for two years. Data derived from these surveys will be compared to predicted community structure to determine the accuracy of our initial models.

Sponsor: Weyerhaeuser Company, National Council for Air and Stream Improvement, Inc., United States Department of Agriculture, NCASI

PIs: Stanley Fox, David Leslie, Paul Shipman

Abundance and Habitat Associations of the Swift Fox (*Vulpes velox*) in Oklahoma

The purpose of this study was to intensively mark-recapture and/or the mark-resighting surveys of swift foxes in several areas throughout the range of the swift fox in Oklahoma to determine density in representative habitats, to relate the estimates to indices of relative abundance developed from track surveys, and to use data on absolute and relative abundance in conjunction with habitat and landscape data to model habitat suitability for swift fox across the fox distribution in the Oklahoma Panhandle.

Sponsor: Oklahoma Department of Wildlife Conservation

PIs: Eric Hellgren, David Leslie

Conservation Ecology of the Texas Horned Lizard: Comparative Effects of Summer and Winter Burning

The purpose of this project has direct conservation significance to the Texas horned lizard and other herpetofauna in the South Texas Plains. Burning is an increasingly popular land-use practice in the range of the Texas horned lizard and this project sheds light on how summer and winter prescribed burns affect ecology and population status.

Sponsor: Rob and Bessie Welder Wildlife Foundation

PI: Eric Hellgren

Ecology of the Texas Horned Lizard in Tinker Air Force Base, Oklahoma

The objectives of this research were to conduct a survey of the distribution of the Texas horned lizard in known historical areas in the southwestern portion of Tinker Air Force Base, to determine micro- and macro-habitat use by the Texas horned lizard using radiotelemetry, to determine locations and characteristics of hibernation sites, to develop methodology to monitor population trends and status of the lizards, and to communicate results of the study through publications and presentations.

Sponsor: Tinker Air Force Base

PI: Eric Hellgren

Analysis of Bobwhite Demographics, Ranges, and Mobility on the Packsaddle Wildlife Management Area

The objectives of this study were to evaluate survival and cause-specific mortality rates, reproductive ecology and behavior, home ranges and mobility, mortality of chicks, and effects of certain management practices such as supplemental feeding on bobwhite populations.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: David Leslie

Development of Plant Community Trajectory and Prediction of Species Diversity across the Range of Disturbances at Fort Sill, Oklahoma

This project at Fort Sill, Oklahoma is designed to assess the plant and animal component of training area that change with increasing disturbance from training activities. Many small plots on different sites were sampled across a gradient of disturbances from none to severe. The data was analyzed to determine the threshold at which disturbance converts sites from typical mixed prairie-tallgrass prairie to communities more typically associated with severe disturbance or cultivation. The results of this study will have an immediate application to land management problems.

Sponsor: United States Geological Survey

PIs: David Leslie

Department of Plant and Soil Sciences: David Engle

U.S. Army Engineering Research and Development Center: Jeffery Fehmi

Landscape-Level Assessment of the Status of Northern Bobwhites in Eastern Oklahoma

In year two of this assessment, research continued to acquire and interpret imagery necessary to assess landscape fragmentation, analysis of the Breeding Bird Survey, and Oklahoma Department of Wildlife Conservation for bobwhites and other target species in eastern Oklahoma. Protocols and metadata standards for landscape classifications were finalized and the population trends of bobwhites and other target species relative to regional patterns and changes in vegetative cover and land use were evaluated.

Sponsor: Oklahoma Department of Wildlife Conservation

PIs: David Leslie, Craig Davis

Population Characteristics and Movements of Elk outside the Wichita Mountains Wildlife Refuge

This study will be used to determine seasonal movements and habitat use of elk outside the Wichita Mountains Wildlife Refuge, Oklahoma; to assess movement into and out of the refuge; and to determine population status, including estimates of size, calf production and survival/recruitment, population dispersion, and age structure, of elk outside the refuge.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: David Leslie

The Spatial Patterns of Plants and Soil in Relation to Military Disturbances at Fort Sill, Oklahoma

This research was undertaken to determine primary linkages among plant community

dynamics and function with soil properties, site use, and history, to determine the strongest correlations of plant community predictors. It also evaluated causative factors in relation to military disturbances and evaluated hypotheses related to the relations among site history, soil properties, and plant communities.

Sponsor: United States Geological Survey

PI: David Leslie

Evaluation of Eastern Fence Lizards, *Sceloporus undulatus*, and Western Fence Lizards, *Sceloporus occidentalis*, as Reptile Models for Assessment of Endocrine-Mediated Toxicity

The goal of this proposed research is to establish fence lizards as a reptilian laboratory model for ecological risk assessment of endocrine-mediated toxicity. This will be achieved by examining four distinct populations of fence lizards for their overall ability to breed in laboratory conditions and evaluating a comprehensive suite of endocrine-dependent responses useful for assessing toxicant-induced effects on reproduction, growth, and development. The final outcome of this proposed research will be the development of several draft protocols employing the most useful endpoints evaluated in each life stage of fence lizards for use in the ecological risk assessment of endocrine disrupting chemicals.

Sponsor: American Chemistry Council

PI: Larry Talent

Survival, Growth, and Recruitment of Larval Striped Bass in Lake Texoma

This study examined striped bass reproduction, recruitment, and early life history in Lake Texoma in relation to environmental factors in each river system using field studies, mesocosm experiments, and laboratory experiments.

Sponsor: United States Geological Survey

PI: Dana Winkelman

Instream Flow Studies in a Key Southeastern Oklahoma Stream

This project mapped and modeled the instream flow habitat for mussels, including endangered species in the Kiamichi River, Oklahoma that is being considered for water diversion in the hopes of supplying the state of Texas with future water sources.

Sponsor: United States Geological Survey

PIs: William Fisher

Development of Rapid Bioassessment Protocols for Non-Wadable Streams and Rivers

Oklahoma is currently lacking formal Rapid Bioassessment Protocols (RBPs) to assess the overall health of aquatic communities in non-wadable streams and rivers. Although such protocols exist for wadable streams in Oklahoma, non-wadable rivers present unique challenges for sampling aquatic biota, particularly fish. Among the issues addressed by this study are reviewing established RBPs for large, non-wadable rivers, development of a quality assurance project plan, as well as development and testing of field protocols.

Sponsor: Oklahoma Water Resources Board

PIs: William Fisher, Joseph Bidwell

Aquatic Habitat Inventory of Eastern Oklahoma Streams

There is little available information on habitat characteristics at the stream reach level in

Oklahoma. Such information is needed to plan habitat restoration projects and manage sport fisheries. The objective of this project is to inventory aquatic habitat and provide quantitative information on fish habitat conditions in selected eastern Oklahoma streams.

Sponsor: Oklahoma Department of Wildlife Conservation

PIs: William Fisher

Geology: Richard Marston

Digital Atlas of Oklahoma Fishes

General information on the distribution and abundance of fishes in Oklahoma is available in various databases and books; however, this information is not currently accessible on the Internet. The objective of this project is to develop a database of Oklahoma fish collections based on specimens housed in the Oklahoma State University Collection of Vertebrates and to combine this with the database of fish collections from the Sam Noble Oklahoma Museum of Natural History to produce a GIS-based digital atlas of fish in Oklahoma.

Sponsor: Oklahoma Department of Wildlife Conservation

PIs: William Fisher, Anthony Echelle

A Socio-Economic Evaluation of the Lower Illinois River Trout Fishery

The lower Illinois River trout fishery is impaired by low dissolved oxygen concentrations from Tenkiller Reservoir. To improve this fishery, minimum flow releases are needed from the reservoir, as well as information on the use and economic value of this fishery. The objective of this project is estimate angler catch, harvest, and effort associated with the lower Illinois River trout fishery and to estimate the economic impact of the fishery on the local and regional economies.

Sponsor: Oklahoma Department of Wildlife Conservation

PIs: William Fisher

Agriculture Economics: Tracy Boyer

Review and Summarization of Literature Pertaining to the Ecosystem Flow Requirements for the Kiamichi River above Hugo Lake and Little River Watershed in Oklahoma

Water withdrawals are proposed from the Kiamichi River and the Little River in southeastern Oklahoma for sale to the state of Texas and to Oklahoma City. Information is needed on the ecosystem flow requirements of biota and habitats in these rivers before contractual agreements are made. The objective of this project is to summarize the available body of knowledge on the natural flow regime, the ecosystem flow requirements of the fish and mussel assemblage, the riparian system, and the physical and chemical characteristics of the stream channel for rivers in southeastern Oklahoma.

Sponsor: Oklahoma Department of Wildlife Conservation

PIs: William Fisher, Joseph Bidwell, Craig Davis

Forestry: Donald Turton

Fluvial Geomorphology Analysis of the Kiamichi River, Oklahoma

The Kiamichi River is one of the most ecologically intact rivers in Oklahoma. It has 28 mussel species, including seven imperiled or vulnerable species, and more than 100 fish species. The objectives of this project are to: 1) characterize current landscape, geomorphic, flow regime, and sediment regime conditions of the portions of the Kiamichi

River above Lake Hugo, and 2) identify and quantify deviations from the morphologic form and river function in the perturbed portion of the Kiamichi River below Jackfork Creek compared with the unperturbed portion above Jackfork Creek.

Sponsor: Oklahoma Department of Wildlife Conservation

PIs: William Fisher

Geology: Richard Marston

Validation of an Amphibian Lifecycle Test Method for Measuring Endocrine Disruption

The primary objective of the proposed research program is to inter-laboratory validate and commercialize a *X. tropicalis* lifecycle test method for evaluating the chronic impact of EDCs on amphibian reproduction and development. The accelerated nature of the proposed project will focus on final test method development and validation.

Sponsor: Fort Environmental Laboratories, Inc.

PI: Joseph Bidwell

Development of a Pilot Monitoring Program to Determine Beneficial Use of Wetlands in Oklahoma

The overall objective of this project is to develop sampling methods that can be used to ascertain beneficial use support for aquatic life in wetlands with specific emphasis on the temporal variability in parameters that often characterize these systems.

Sponsor: Oklahoma Conservation Commission

PI: Joseph Bidwell

Grassland Bird Response to Disking/Interseeding of Legumes on Conservation Reserve Program Lands in Northeast Nebraska

The objectives of this project are: 1) evaluate grassland bird response to disking and interseeding in years 2004 and 2005; 2) improve large blocks of grassland habitat (80-640 acres) through disking and interseeding on CRP and affect 25-50% of CRP acres within focus area by spring 2004; and 3) conduct educational efforts on study sites and through the media to explain efforts and to describe results annually through 2005.

Sponsor: Nebraska Game and Parks Commission

PI: Craig Davis

Evaluation of Invasive Species in the Rainwater Basin WMD

The objectives of this study are: 1) to determine the spatial distribution of invasives (reed canary grass, river bulrush, cattail) in the RWBR using GIS, 2) to evaluate landscape characteristics (e.g., wetland size, management history of the wetland, land-use history of surrounding landscape, soil type) of both invasive-dominated wetlands and wetlands with relatively low densities of invasives using GIS, and 3) to evaluate possible relationships between invasive plant communities and the chemical and physical properties of the soil.

Sponsor: U.S. Fish and Wildlife Service

PI: Craig Davis

Invertebrate Response to Wetland Management Practices, Land-Use Practices, and Restorations in the Rainwater Basin Area Supplement

This award provides additional funding for a project which was initially funded by the Nebraska State Wildlife Grant Program

Sponsor: U.S. Fish and Wildlife Service
PI: Craig Davis, Joseph Bidwell

Dissertation Research: Ecological and Evolutionary Significance of Locomotor Performance in Collated Lizards

Although an operational paradigm is established for determining how morphology affects performance, which in turn affects fitness, there has been no completion of all three links in a single study. Our study attempts to address this for the first time. We will determine how performance affects fitness in a territorial lizard species, while simultaneously considering alternative hypotheses.

Sponsor: National Science Foundation
PI: Stanley Fox

Critical Thinking in the Biological Sciences

One of the goals of this project is to create a system that identifies areas of student misunderstandings by tracking the correct and incorrect answers given by students to test questions. The objective of this project is to improve student understanding of challenging biological concepts via an expert learning model.

Sponsor: Howard Hughes Medical Institute
PI: Margaret Essenberg, Donald French

Develop Laboratory Protocols for Amplification and Scoring of Microsatellite Loci

The objectives of this project are: 1) to develop laboratory protocols for amplification and scoring of microsatellite loci; 2) to prepare and provide agency with collection kits to obtain blood samples from lesser prairie chickens, and 3) to store blood samples until a preliminary assessment of genetic diversity and geographic structure of LPC can be performed.

Sponsor: Department of Game and Fish, State of New Mexico
PI: Ronald Van Den Bussche

Pupfish Genetics

The purposes of this project are to assess the genetic status of refugium and wild populations of desert pupfish and Quitobaquito pupfish and develop an applied management protocol to exchange genetic material among populations of each species. A final report will be prepared on the research.

Sponsor: U.S. Department of the Interior, Fish and Wildlife Service
PI: Anthony Echelle, Alice Echelle

Survival, Growth, and Recruitment of Larval Striped Bass in Lake Texoma

This study examined striped bass reproduction, recruitment, and early life history in Lake Texoma in relation to environmental factors in each river system using field studies, mesocosm experiments, and laboratory experiments.

Sponsor: Oklahoma Department of Wildlife Conservation
PI: William Fisher

Development of Fish Sampling Protocols for Large Non-Wadeable Rivers in Oklahoma

Project will develop sampling protocols for surveying fish populations in large, non-

wadeable rivers in Oklahoma.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: William Fisher

In Support of Fish and Wildlife Partners Collaborative Habitat Projects and Internet Map Service

Project will assist the Wildlife Management Institute with the transfer of information in support of their Fish and Wildlife Foundation project, Fish and Wildlife Partners Collaborative Habitat Projects, and Internet Map Service with National Wildlife Project Registry.

Sponsor: Wildlife Management Institute

PI: David Leslie

Plant and Soil Sciences: Sam Fuhlendorf

Population Status of the Mountain Plover and Long-billed Curlew in the Oklahoma Panhandle

Project will assess the distributions and habitat affinities of the Mountain Plover and the Long-billed Curlew by systematic searches in Cimarron and Texas counties in the western half of the Oklahoma Panhandle, with particular focus on establishing population estimates for the Mountain Plover and distribution of the Long-billed Curlew.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: Tim O'Connell

Abundance and Composition of Black Bears in Southeastern Oklahoma

The objective of this project is to assess status and distribution of black bears in southeastern Oklahoma using two methodologies to estimate population abundance and sex ratio.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: Eric Hellgren, David Leslie

Genetic Variation within and among Natural and Captive Populations of Alligator Snapping Turtles in Oklahoma

Previous studies have shown strong genetic differentiation among populations of alligator snapping turtles occurring in different river drainages. Since the potential negative impacts of restocking alligator snapping turtles into different river drainages exist if strong genetic differentiation is detected, the purpose of this study is to assess levels of genetic variation in the following scenarios: within and among river drainages, within the captive population, and between river drainages and the captive population of alligator snapping turtles.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: Ronald Van Den Bussche, David Leslie

Instream Flow Modeling for Mussels and Fishes in Southeastern Oklahoma Rivers

Project will map and model instream flow habitat for mussels, including endangered species, in the Kiamichi River, Oklahoma.

Sponsor: Oklahoma Department of Wildlife Conservation

PI: William Fisher, Joseph Bidwell

