POSTER ABSTRACTS

The following 96 abstracts are ordered by poster number which was assigned to projects randomly. To locate a specific abstract, refer to the Table of Contents in the **Poster Presentations** handout which groups the abstracts by their primary federal funding agency. The poster number will be located to the left of the project's title.

Electronic Copy

A downloadable copy of these abstracts will be made available after the conference on our website at: www.kyepscor.org

Funded by: NIH /NSF

Poster # 1

Genetic Susceptibility to PCB-induced Developmental Neurotoxicity

Emily Altenhofen, Amber Evans, Rikki Floyd, Breann Hays, Cellestine Kamau-Cheggeh, Sarah Kraemer, Andrea Mynhier, and Ashton Samuels, Northern Kentucky University

Polychlorinated biphenyls (PCBs) are well known developmental neurotoxicants which affect learning, memory, motor function and dopamine levels in humans and laboratory animals. CYP1A2 is an enzyme capable of sequestering PCBs in the liver, and basal enzyme levels vary ~60-fold in the human population. The aryl hydrocarbon receptor (AHR) is a ligand-activated transcription that regulates induction of CYP1A2. Mice have two versions of the gene: Ahrb with high affinity for ligands such as dioxin and planar PCBs and Ahrd with poor affinity for those ligands. The AHR is also polymorphic in the human population with similar differences in inducibility of AHR-regulated genes. Our previous studies showed that AhrbCyp1a2(-/-) mice were most susceptible to PCB-induced learning and memory deficits while mice with a functioning CYP1A2 enzyme were protected. We have extended those studies to include a newly developed line of mice, AhrdCyp1a2(-/-) to examine the importance of Ahr genotype. To determine if the learning and memory test results could be explained by confounding factors, we also expanded our neurobehavioral battery to include tests of motor function, anxiety, depression and the response to stress. For all studies, pregnant mice were gavaged with an environmentally relevant PCB mixture or the corn oil vehicle at gestational day 10 (GD10) and postnatal day 5 (PND5). Offspring were tested at 60 days of age. Collectively, our data indicate that Ahr and Cyp1a2 genotypes are both important in genetic susceptibility to PCB-induced developmental neurotoxicity.

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Funded by: other

Poster # 2

Future electric power system research

Yuan Liao, University of Kentucky

This poster presents the activities sponsored by an EPSCoR CRIG grant. The objective is to form a multi-disciplinary research team to identify promising research areas in power systems. We have held seminars, visited research centers, and had frequent meetings for idea generations and exchanges. We successfully formed a research team consisting of researchers from University of Kentucky, East Kentucky Power Cooperative and Kentucky State University.

Full Funding Acknowledgement:
The author gratefully acknowledges the collaborative research initiation grant, CRIG-011-08 from Kentucky EPSCoR.

Funded by: NSF

Poster # 3

Pattern Recognition for Single-Cell Diagnostics

A. A. Fletcher, E. V. Moiseeva, and C. K. Harnett, University of Louisville

As part of the “Cellular and Molecular Engineering Platforms” NSF EPSCoR focus area, a low-cost portable cell counter is under development at the University of Louisville. This device uses electrical signals to detect the presence of cells flowing in a microfluidic channel. This research project stems from the need to process the data acquired from impedance based microfluidic flow cytometer devices. Data in the form of electrical signals and cell images are collected from the cytometer electrodes and a microscope camera, respectively. We will present details about the design, development, and testing of a MATLAB graphical user interface (GUI) to process the data acquired from many cytometer experiments. The main goal of this GUI is to classify the signals and images acquired during experiments using both pattern recognition and machine vision techniques, respectively. The GUI created will be presented as well as a discussion of how to operate the GUI, the features that are available, and plans for future expansion. Miniaturization of the cytometer test setup will also be presented including printed circuit boards created to trigger on cell detection events for both DC and AC applications. Details on the design, development, and testing of a Lock-In Amplifier printed circuit board for the AC signal processing applications will also be presented.

Full Funding Acknowledgement:
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Poster # 4

Mgrf-Based Change Detection Using Sift-Based Multi-Spectral Registration Of Remote Sensing Images

Aly A. Farag, Mostafa A. Abdelrahman, Mike Miller,Aly Abdelrahim, Eslam Mostafa, and Cambron Carter CVIP Laboratory, University of Louisville, Louisville, KY, USA

In this poster, we present our current research in remote sensing images. In particular, we focused on presenting a robust change detection algorithm to detect changes in multi-spectral remote sensing images. The proposed algorithm is based on four main steps: First, multi-spectral scale-invariant feature transform (M-SIFT) is used to extract a set of correspondence points in the given multi-spectral data, then Random Sample Consensus (RANSAC) is used to remove the outliers from this set. To insure an accurate matching, uniqueness constrain in the correspondence is assumed. Second, the resulting inliers matched points is used to register the given images. Third, changes in registered images are identified using by statistical analysis of image differences. Finally, Markov-Gibbs Random Field (MGRF) is used to model the spatial-contextual information contained in the resulting change mask. Experiments with synthetic multiband images, and LANDSAT5 Images, confirm the validity of the proposed algorithm.

Full Funding Acknowledgement:
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Poster # 5

Gold nanoparticles with chitosan coatings for photothermal therapy of hepatocellular carcinoma cells

Guandong Zhang, Justin Howell and Andre M. Gobin Bioengineering Department, University of Louisville, Louisville, KY, 40292

Hepatocellular carcinoma (HCC) is the primary malignant tumor of the liver, causing a large number of cancer deaths worldwide. In this work, gold nanoparticles (Au NPs) with desired near infrared (NIR) absorption and biocompatible surfaces were developed for the laser ablation of the HCC cells. Au NPs with plasmonic NIR absorption were prepared by the reaction of HAuCl4 with Na2S2O3, and their absorbances were well controlled to match the wavelength of the ablation laser source (820 nm). Chitosan, carboxymethylated chitosan and their blended coatings were assembled onto the Au NPs surface respectively. The toxicity was evaluated by incubating these Au NPs with an HCC cell line (HepG2) and control cell line of human dermal fibroblast (HDF) for 24 and 48h, without laser activation. The extent of laser ablation for the two cell lines and cell mixtures were analyzed at optimized laser treatment conditions (5 W/cm2, 2min). Both results were evaluated by live/dead stain images, silver stain images and cellular mitochondrial activity assay. The results show that Au NPs are more toxic to cancer cells than to normal cells, and surface coating plays a key role. By modifying coating components and surface charge, the stability and dispersion of Au NPs in the biological media were greatly improved. Blended chitosan coatings allow Au NPs uniformly binding to the cells, increasing laser ablation degree. With suitable NIR laser activation, Au NPs kill cancer cells, with very little damage to normal cells. The Au NPs with photothermal technique is a promising method for HCC therapy.

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Poster # 6

The Use of PEG Hydrogels to Analyze Angiogenic Processes In Vitro

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Statement of Purpose: Angiogenesis is the process by which new blood vessels arise from the pre-existing vasculature. Endothelial cells are known to be involved in three cellular processes during angiogenesis: Cell proliferation, survival of apoptosis, and degradation of the extracellular matrix during cell migration. Vascular endothelial growth factor (VEGF) is a cytokine which has been shown to facilitate angiogenesis. VEGF upregulates these processes during angiogenesis, thus increasing the amount of blood vessel formation. Although these processes are well known in the literature, a synthetic system with exact control over the signals of angiogenesis has yet to be developed. Our goal is to develop a polyethylene glycol-based hydrogel system, which can be tailored to contain covalently grafted VEGF and adhesion peptides for precise assessment of VEGF-induced angiogenic processes on endothelial cells in vitro. Results: Results indicate that VEGF which has been grafted in the hydrogel is capable of inducing the same increases in cell proliferation as compared to VEGF in the media at equal concentrations for HMEC and HUVEC, respectively. These findings suggest that covalently grafting VEGF into the hydrogel does not lower its biological activity in terms of cell proliferation. The ability of VEGF to induce increased cell survival when cells undergo intrinsic and extrinsic apoptosis, respectively. In each case, VEGF which has been grafted into the hydrogels is as effective as VEGF which has been suspended in the media at inducing apoptosis survival. HUVEC migration on hydrogels. The data suggest VEGF which has been grafted in the hydrogel is as effective as VEGF suspended in the media at inducing increases in cell migration. Conclusions: Based on our findings, VEGF which has been covalently grafted into a PEG hydrogel system is shown to be as effective as free VEGF in inducing key angiogenic processes in human endothelial cells in vitro.

Full Funding Acknowledgement:
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Funded by: NSF

Poster # 7

Bi-Directional Knudsen Pump Using a Thermoelectric Material

Kunal Pharas, Shamus McNamara. Department of Electrical and Computer Engineering, University of Louisville,KY

The abstract reports on the first use of a thermoelectric material to drive a bi-directional gas pump based on thermal transpiration phenomenon. Pumps based on thermal transpiration are called Knudsen pumps which operate when the gas flow in the channel is in the free molecular regime and the channel is under a longitudinal temperature gradient. Under these conditions flux of molecules on the cold side of the channel is greater than that of the hot side and gas flow takes place from cold to hot side. Maintaining a significant temperature difference between the ends of a short channel is a challenge and the temperature gradient obtained for a certain channel length has to be optimized for maximum gas flow rate. Previously reported Knudsen pumps were all unidirectional where the hot side was heated actively and the cold side was connected to a heat sink for passive cooling. By using a thermoelectric material whose one face gets hotter and the other face gets colder due to transfer of charge carriers with the flow of current through the material, it is possible to control both the hot and cold side temperatures of the pump's channel. This helps in maintaining the temperature gradient within a shorter channel length which increases the flowrate and thereby the overall efficiency of the pump. Simultaneously, due to the symmetry of the pump design, it can operate in bi-direction mode. This pump achieves high flow rates in both directions, is easy to fabricate, and generates a continuous pneumatic pressure. The measured pump efficiency is the highest reported to date for a Knudsen pump.

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Poster # 8

Tufa Mineralogy of the Barstow Formation in California

Christopher Toney: Western Kentucky University Jennifer Cole: Lamont-Doherty Earth Observatory, Columbia University, NY & Western Kentucky University Aaron J. Celestian: Western Kentucky University

Lacustrine deposits known as tufa provide a paleoclimatological history of natural waters, including hyper-saline lakes, based on their mineralogical and chemical composition. These mainly calcite formations of the Cenozoic Era (Miocene 14-16 Mya 1) hold key differences to the mineralogy and aqueous chemistry of the time and environments in which they formed. The objective of this study is to quantify mineralogical changes, crystallographic orientation, nucleation growth patterns, and crystal morphologies in calcite primarily using Raman spectroscopic mapping techniques. In addition, Ca/Mg ratios can also be measured and used for future models as paleoclimate proxies. Preliminary results indicate that the tufa is composed of a broad range of calcite crystal morphologies, which are indicative of varying conditions of formation. Between growth bands of calcite are organic particles that cap the radial clustering of the acicular calcite crystals. This organic cap may indicate a change in source water composition or local hydrology, as the calcite underlying the cap shows signs of dissolution of crystal faces and edges. Blades of calcite are also observed to grow within the layers which suggests a slower crystallization process. However, it is unclear whether these bladed crystals exhibit primary or secondary mineralization as many of the crystals extend into growth bands throughout the finer grained radial distribution of acicular calcite. Continued studies are investigating the variations of Ca/Mg ratios for each morphological type (e.g. bladed, acicular, shrub, etc.), which could serve as a possible paleo-climatic proxy.

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Thank you to KY-NSF-EPSCoR for partial funding of the Thermo DXR Raman microscope.

Funded by: NSF

Poster # 9

Kentucky Initiative in Ecological Genomics

Christopher L. Schardl, Jerzy W. Jaromczyk, Abbe Kesterson, Jennifer S. Webb, Jolanta Jaromczyk, and Neil Moore, University of Kentucky

The Kentucky Initiative in Ecological Genomics (KIEG) supports infrastructure and staff support for high-throughput sequencing at the University of Kentucky Advanced Genetic Technologies Center (AGTC), as well as financial support for new faculty and their students working in the area of ecological genomics. This program has funded the purchase of a Roche/454 Titanium pyrosequencer and ancillary equipment, plus approximately $50,000 of computer hardware and $5,000 in software to handle data generated on the pyrosequencer, whole genome and whole transcriptome assemblies, a Chado database, and GBrowse sites for ongoing genomics projects. The grant supports two full-time graduate research assistants per year, a bioinformatician and the AGTC senior facilities manager. Supported research projects at regional universities include those of Patrick Calie at Eastern Kentucky University, working on native plant phylogenetics, and Hazel Barton at Northern Kentucky University, working on microbes of caves and other low-nutrient ecosystems. Since acquiring and installing the Roche/454 pyrosequencer in March 2009, the instrument has been employed for 15 projects from 13 users (10 at UK, one at a local company, one at Northern Kentucky University, and one at Westfaelische Universität Muenster, Germany). So far, 28 complete plate runs have been conducted on this instrument. These projects range from genome shotgun sequencing, to paired-end sequencing of 3-kb, 11-kb, and 20-kb fragments, to sequencing transcriptomes and metatranscriptomes, to sequencing PCR-amplicons for phylogenomic and phylogeographical studies. Draft genome sequences have been generated for three fungi (Claviceps purpurea, Claviceps paspali, and Neotyphodium coenophialum), a stramenopile (Peronospora tabacina), an apicomplexan (Sarcocystis neurona), and two Pseudomonas bacterium species. Other projects involve transcriptome sequencing of plants, insects, and insect gut symbionts.

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Poster # 10

The conserved PAM-1 aminopeptidase somatically regulates a germline Ras/MAPK signaling cascade to promote pachytene exit in C. elegans.

Chris Trzepacz, Department of Biological Sciences, Murray State University, Murray, KY. Katelyn Fulcher, Department of Biological Sciences, Murray State University, Murray, KY.

The nematode Caenorhaditis elegans combines many fundamental cellular and molecular functions and the characteristics of more advanced metazoans in a tractable experimental model, and therefore serves as a paradigm for studying the complex genetic and biological relationships involved in many aspects of cell biology, embryogenesis, and organogenesis. We are using C. elegans as a model organism to examine the coordinate and interdependent interactions between the somatic and germline tissues that are required for reproductive success. Previous studies have described a role for PAM-1, the C. elegans ortholog of the human puromycin sensitive aminopeptidase, in governing embryogenesis. Mutations in pam-1 result in reduced brood sizes and a highly penetrant embryonic lethal phenotype. We have observed that homozygous pam-1 mutations also result in a disruption in the maturation of the C. elegans germline: specifically, the adult pam-1 hermaphrodites display an expanded region of pachytene-arrested germ cell nuclei. The transition out of pachytene is regulated by a conserved Ras/MAPK signaling cascade, and the pachytene defect in pam-1 mutants is exacerbated by compromised Ras/MAPK signaling or inactivation of the related complementary aminopeptidase PAM-2. Transgenic expression of a native pam-1 promoter-driven GFP::PAM-1 transgene localizes to the gonadal sheath cells and rescues the mutant pam-1 phenotypes, indicating PAM-1 functions in the somatic tissues of the gonad. Our data suggest that in addition to its embryonic responsibilities, PAM-1 executes an evolutionarily conserved role in the somatic gonad to govern germline meiotic transitions by regulating the Ras/MAPK pathway. While the specific structural components of worm reproductive tissues are not conserved in humans, the specialized relationship between the genes and proteins associated with this and other signal transduction cascades related to fecundity are comparable. The examination of the molecular mechanisms regulating germline maturation in C. elegans can produce novel insights into our own reproductive processes.

Full Funding Acknowledgement:
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Funded by: NIH

Poster # 11

Polybacterial Challenge of HIV-latently Infected Macrophages and Dendritic Cells

CB HUANG*, YV ALIMOVA, JL EBERSOLE Center for Oral Health Research, College of Dentistry, University of Kentucky

Latent HIV infection in HIV+ patients remains a substantial health concern and challenge for managing this as a chronic infection. Furthermore, the impact of co-infections and polymicrobial infections of HIV+ patients, on HIV reactivation in latently-infected cells remains unclear. Objective: This study was designed to test the hypothesis that a polybacterial challenge of latently-infected macrophages and dendritic cells results in a "synergistic" HIV reactivation compared with the monomicrobial stimuli. Methods: The BF24 macrophage (Mf) model of HIV promoter activation and THP89GFP Mf model of HIV-latent infection were used to examine the characteristics of Mf and dendritic cell (DCs) responses to polybacterial challenge with oral bacteria. HIV promoter activation was determined via CAT-ELISA and reactivation of the virus was determined using GFP expression and p24 synthesis. Results: Oral Gram-negative bacteria elicited significantly greater HIV reactivation, compared to Gram-positive bacteria in both Mf and DCs. The data showed that Aa synergized with Pg in HIV promoter activation in Mf. Numerous Gram-negative pairs of bacteria demonstrated synergistic stimulation of the HIV-promoter in immature DCs. This was particularly noted with Aa/Pg and Pg/Fn challenge of the cells. In mature DCs, there was no synergism in HIV promoter activation. Also, none of the Gram-positive bacteria showed any synergism in inducing HIV reactivation in these model systems. Conclusions: These findings support the importance of determining the characteristics and impact of polybacterial challenge on cells to better understand the potential immune interactions that can occur in the oral cavity and the potential effect on HIV reactivation. Supported by P20 RR020145.

Full Funding Acknowledgement:
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Funded by: NASA

Poster # 12

A Continuing Campaign of Radio Monitoring Observations of Blazars with the Morehead State University 21-Meter Space Tracking Antenna

Caleb K. Grimes, Nathan D. Fite, Emily J. Goff, Josh M. Tussey, Thomas G. Pannuti, Mentor, Department of Earth and Space Sciences, Morehead State University

We present the latest results from our on-going campaign of radio monitoring observations of radio-loud blazars with the Morehead State University 21-Meter Space Tracking Antenna (STA). With its medium aperture and location in a radio-quiet rural environment, the STA is a unique research instrument suitable for undergraduate research projects in radio astrophysics. One project which lends itself easily to participation by undergraduate students is monitoring observations of radio-loud blazars: with this goal in mind, we have been conducting such observations at the frequencies of KU band and L-band of a sample of approximately five radio-loud blazars. We illustrate this work with a discussion of our observations made of the blazar 3C 454.3 throughout the 2009-2010 calendar years: initial results will be presented and discussed.

Full Funding Acknowledgement:
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Funded by: NSF

Poster # 13

Low Temperature Dielectric Measurements in K and Li Doped BaMnO3

Julius Schoop, Kevin Harmon, John Gruenewald, Bill Crummett; Centre College

Students at Centre College spent four weeks attending lectures on the physics of dielectric materials. For the remainder of the term, they gained laboratory experience. They assembled new equipment and gained experience using it. Each student learned to prepare samples for data collection, attach platinum wires, and mount the crystal in the sample holder. The crystals were supplied by the Center for Advanced Materials at the University of Kentucky. This work was in preparation for two students (KH and JG) to work for two months this summer at CAM.

Full Funding Acknowledgement:
Kentucky EPSCoR Track One Grant

Funded by: DOD/NSF

Poster # 14

Landmine Detection and Context-Dependent Fusion

Hichem Frigui -- University of Louisville
Lijun Zhang -- Emory University

We present a novel method for fusing the results of multiple land mine detection algorithms which use different sensors, features, and different classification methods. The proposed multi-sensor/multi-algorithm fusion method, called Context-Dependent Fusion (CDF), is motivated by the fact that the relative performance of different sensors and algorithms can vary significantly depending on the mine type, geographical site, soil and weather conditions, and burial depth. CDF is a local approach that adapts the fusion method to different regions of the feature space. The training part of CDF has two components: context extraction and algorithm fusion. In context extraction, the features used by the different algorithms are combined and used to partition the feature space into groups of similar signatures, or contexts. The algorithm fusion component assigns an aggregation weight to each detector in each context based on its relative performance within the context. To test a new alarm using CDF, each detection algorithm extracts its set of features and assigns a confidence value. Then, the features are used to identify the best context, and the aggregation weights of this context are used to fuse the individual confidence values. Results on large and diverse Ground Penetrating Radar and Wideband Electro-Magnetic data collections show that the proposed method can identify meaningful and coherent clusters and that different expert algorithms can be identified for the different contexts. Typically, the contexts correspond to groups of alarm signatures that share a subset of common features. Our extensive experiments have also indicated that the context-dependent fusion outperforms all individual detectors and the global fusion that uses the same method to assign aggregation weights.

Full Funding Acknowledgement:
DOD-EPSCOR KY-EPSCOR

Funded by: NSF

Poster # 15

Instrumentation to Measure Velocity and Sediment Discharge Using Turbidity and Bend Sensors to Obtain Real Time Data at the Watershed Scale

R. Stewart, J. Fox, W. Ford, A. Thompson (all from Univ of Kentucky)
C. Harnett (Univ of Louisville)

Sediment is one of the major causes of impaired streams in the United States. Total suspended solids have been difficult to quantify and sensor networks that provide real time data at a frequency high enough to measure sediment discharge have not been practical to implement. We describe a sensor network that enables a real time watershed monitoring system to be implemented quickly and in remote locations. Low-cost pressure, temperature, turbidity and velocity bend sensors are connected in a wireless sensor network. Results include calibration and data mangement methods developed for new, inexpensive velocity and turbidity sensors. Full implementation of the project is ongoing at this time and includes collaboration between civil engineers at UK and electrical engineers at the University of Louisville. Results are expected to provide accurate data of suspended sediment load derived from the watershed that can be used to calibrate hydrologic and suspended sediment transport models. The sediment monitoring network will be set up at a location where sediment fingerprinting is occurring which will help provide insight into the source of the sediment. A major goal is to distribute instructions to build instrumentation that can be quickly set up in any watershed to capture and upload the hydrologic and sediment flux data in real time.

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Funded by: NASA

Poster # 16

Rotating Disk Microfluidic Platforms Prepared by Three-Dimensional Printing

Jessica L. Moore Murray State University Department of Chemistry Isaac Mittendorf Murray State University Department of Chemistry Austin McCuiston Murray State University Department of Chemistry Rudy Ottway Murray State University Department of Industrial

Rotating microfluidic discs, in which fluid propulsion is achieved by “centrifugal” pressure, have been applied to a variety of analyses. These devices traditionally are prepared by CNC machining of rigid plastics or by mold replication in soft plastics like PDMS. Three-dimensional/solid-object printing has been proposed as a suitable alternative to these microfabrication techniques for preparing microfluidic systems. To date, however, this approach has been used nearly exclusively for mold production and, in those cases, required post-printing processing steps to mitigate the inherent roughness obtained. This poster focuses on the direct preparation, with minimal post-printing processing, of centrifugal microfluidic devices by 3D printing. Due to the mechanics of printing, i.e., the object is assembled via the deposition of extruded polymers, devices prepared by this technique have a precisely-structured series of surface ridges. These ridges factor into the behavior of the devices, specifically the use of capillary valves to provide temporal control of fluid flow. In addition to other factors, capillary valving is dependent on liquid-polymer contact angle. In the case of printed devices, surface ridges result in anisotropic contact angles, i.e., contact angles that differ depending on whether they are measured parallel or perpendicular to the ridges. The effect of fluid behavior in contact with these ridges, as well as device characteristics such as valve geometry, on the performance of fabricated capillary valves has been studied and compared to accepted models for capillary valve behavior. Results from these studies are presented herein.

Full Funding Acknowledgement:
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Funded by: NSF

Poster # 17

Novel Deployment Methods and Modifications of InterproScan

Tingjian Ge, Daniel Harris, Jerzy W. Jaromczyk, Christopher L. Schardl,
University of Kentucky, Lexington, KY, USA

The large scale of genomic projects, such as the Epichloë festucae Genome Project, has yielded an enormous amount of genetic information that is processed with bioinformatic tools that must be intelligently deployed on available computing resources to respond to the high computing demands. One of the tools, InterproScan, is a multi-database scanning application that provides a single front-end for the sequence analysis of twelve Interpro member databases, such as PROSITE, HAMAP, Pfam, and SMART. Even our typical InterproScan queries demand substantially more resources than current laboratory computers can provide, so alternatives utilizing supercomputing and distributed-computing are needed. Supercomputing power is provided by an IBM HS21 Blade-Cluster with shared resources, while distributed-computing power is achieved with Apple's Xgrid technology allowing the creation of a distributed-computing grid within existing Apple laboratories where jobs are submitted and executed during the lab's unused idle hours. For both platforms of computation, a customized queue system is implemented to help with the extreme amount of resources required by InterproScan queries; if the query was dispatched in one large chunk, it would never finish in a reasonable amount of time. However, a query that cooperates with a queue is capable of processing itself if divided into smaller pieces. For our Xgrid implementation, sequences in the queue are distributed to idle machines in the lab; for our supercomputer implementation, chunks of sequences in the queue are scanned in parallel. In effect, the Xgrid implementation makes the best use of idle computing resources, while the supercomputer implementation makes the best use of shared, active computer resources. Additionally, our implementations are used to investigate how to reconcile the dual view of InterproScan as a database front-end and as a search-engine where a precisely-ranked and prioritized search-result list is desired, which people have grown to expect in the age of Google.

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Funded by: EPA /KY EPSCoR /other

Poster # 18

Winter bluebirds, vagrant robins, and breeding warblers: The response of migratory birds to global change

David Brown, Todd Weinkam, Shannon Tegge, Gregg Janos, Gail Miller
Department of Biological Sciences, Eastern Kentucky University

Global change presents unique challenges to migratory organisms. We are working on three projects designed to increase our understanding of how migratory birds respond to global change. 1) Working with wintering bluebirds, we are studying how events in one season, such as weather and food availability, carry-over to affect bird behavior and performance in subsequent seasons. Models suggest that the relative intensity and frequency of severe weather is increasing. Better understanding the effects of these events will help us develop management approaches to protect migratory species. In the past year, our research has focused on the influence of weather on habitat use, diet, and social interactions of bluebirds. Presently we are studying reproductive success in this system and we plan to relate this measure of performance to winter behaviors. 2) Continent-wide bird population monitoring programs suggest that the winter distributions of many species of migratory birds have shifted north in recent decades. To better understand the mechanisms of this shift we are using band-recoveries and individual-based migration tracking devices to investigate the patterns and causes of range shifts in American Robins. Preliminary data suggests that alternative migratory behaviors (year-round residency vs. migration) contribute to the observed shift in the winter distribution of American Robins. 3) Finally, we are developing predictions for the impact of an invasive insect, hemlock woolly adelgid, on bird communities in Kentucky forests. The adelgid insect will likely kill most of the hemlock trees in Kentucky, thus altering forest composition and structure. Based on the relative abundance of bird species in hemlock forest compared to other forest types, we developed a list of six species with strong positive associations with hemlock forest. This research contributed to the decision by the Kentucky Department of Fish and Wildlife Resources to list one of these species as a conservation concern.

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Poster # 19

Catalase loaded biodegradable hydrogel for the prevention of bacterial diversification

Justin Byarski, Paritosh Wattamwar, Dipti Biswal, Nitin S. Satarkar, J. Zach Hilt and Thomas Dziubla Department of Chemical and Materials Engineering University of Kentucky, Lexington, KY 40506

Osteomyelitis is a bone infection caused by bacteria, mycobacteria, or fungi. Osteomyelitis is mainly caused by the contiguous spread from infected tissue or infected prosthetic joint, bloodborne organisms, and open wound from contaminated open fractures or bone surgery. Due to poor blood perfusion in bone tissue, which limits antibiotic delivery, permitting the establishment of biofilms, these infections are often very difficult to treat. Further complicating treatment, this suboptimal delivery and biofilm formation can often lead to the eventual emergence of antibiotic drug resistance. Among the methods available to bacteria, endogenous oxidative stress can increase bacteria diversification among biofilm communities, resulting in enhanced antibiotic resistance emergence. It was shown that bacteria diversification could be inhibited by suppression of this oxidative stress signaling. It is hypothesized here that through the co-delivery of antioxidant enzymes and antibiotics, it will be possible to locally treat osteomyelitis while simultaneously inhibiting antibiotic resistance emergence. Specifically, poly (β amino esters), which are synthetic, hydrolytically degradable, biocompatible polymers, were developed with degradation properties that can be easily tuned by controlling the hydrophilicity of the polymer. In this work, catalase-loaded biodegradable hydrogels of poly (β amino ester) were synthesized by free radical polymerization method. The degradation rates and catalase activity studies were carried out on the hydrogels by varying the ratio of the different types of poly (β amino ester) macromers.

Full Funding Acknowledgement:
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Funded by: NASA

Poster # 20

A multi-wavelength study of the galactic supernova remnant CTA 1

Emily Goff, Caleb Grimes, Joshua Tussey, Nathan Fite, Dr. Thomas Pannuti, Mentor, Department of Earth and Space Sciences, Morehead State University

We present a multi-wavelength study of the galactic supernova remnant (SNR) CTA 1. Our analysis focuses on X-ray and radio emission from this SNR as detected by observations made by the Chandra X-ray Observatory and the Morehead State University 21-Meter Space Tracking Antenna, respectively. The radio emission from the SNR is in the form of a crescent-shaped shell with a gap toward the northwest while the X-ray emission is localized to a central thermal X-ray plasma and a central pulsar. Our analysis has searched for both X-ray emission from the eastern shell of the SNR as well as variations in the spectral properties (such as temperature) of the central X-ray emitting plasma. The results of this analysis are presented and discussed. Funding for this research project was received through the Kentucky NASA Experimental Program for Competitive Research (KYEPSCoR)and the Kentucky Space Grants Consortium.

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Funded by: NASA /other

Poster # 21

Development of an Astronomy and Space Science One Carnegie Unit Course for High School Students Derived from the Kentucky Space Program

Benjamin K. Malphrus (Morehead State University Space Science Center)
Jennifer B. Carter (Fleming County High School)

Space science is a highly interdisciplinary and technology-intensive discipline which encompasses space physics, astrophysics, satellite telecommunications, astronautical and electrical engineering, space systems design, mathematics, and computer science. The Kentucky Space Program recognizes the educational value of immersing students in a systems-level approach to engineering, particularly in space systems development. The Kentucky Space Program is a collaborative effort of public and private partners throughout the state of Kentucky focused on small satellite development and access to space for scientific payloads. KySpace was formed under the leadership of the Kentucky Science and Technology Corporation (KSTC), a private nonprofit corporation committed to the advancement of science, technology and innovative economic development in Kentucky. KySpace encompasses four space regimes: edge of space (high altitude balloons), sub-orbital space (Space Express), low earth orbit (KySat-1 orbital), and deep space. The concept of operations (Conops) of KySat-1 (Kentucky Space's first orbiting satellite) is designed in part for education and public outreach. These operational capabilities allow substantial participation for students ranging from K-16 in space activities, representing an exceptional opportunity for Kentucky students. The Kentucky Space Program simultaneously has developed curriculum and training materials and a college-level course in Space Systems. The goal of this project is to synthesize these materials and others (including material from MSU astronomy courses) into a one Carnegie unit astronomy and space science course for high school students. The project represents a hybrid including elements of the KSGC graduate fellowship and E/PO projects. The deliverables include the development of course materials (initial award) which will serve to facilitate planning and implementation of the course (continuation) and will serve as recruitment materials for the Kentucky Space Program student pipeline. During Phase II, a prototype version of this course at Fleming Co. High School during the 2009-2010 academic year. Materials produced during Phase II will serve as the basis for editing and modifying the course and its ultimate final product, a complete course package intended for wide distribution.

Full Funding Acknowledgement:
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Funded by: NASA /other

Poster # 22

Earth-Based Calibration of the Synthetic Aperture Radar onboard NASA's Lunar Reconnaissance Orbiter

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The Lunar Reconnaissance Orbiter (LRO) is a NASA Lunar Precursor Robotic Program (LPRP) mission whose intent is to create a comprehensive atlas of the Moon's features and resources to aid in the design of a lunar outpost. LRO reached lunar orbit on June 23, 2009. The LRO payload, composed of six instruments and one technology demonstrator, will provide key data to enable a productive human return to the Moon. Among the science experiments is the Miniature Radio Frequency Technology Demonstration (Mini-RF), an advanced synthetic aperture radar that operates in both the X and S bands of the radio spectrum. It is used to image the polar regions and search for water ice. In addition, it will demonstrate the ability to communicate with an Earth-based ground station utilizing this comprehensive system serving both as SAR science instrument and spacecraft communication system. The mini-RF baseline modes include: two frequencies—S-band (13 cm) and X-band (4 cm); two resolutions—baseline (150 m/75-m pixels) and zoom (15 m/7.5-m pixels); and dual-polarization—transmit on one and receive on like and orthogonal polarizations. This project involved calibration and end-to-end performance characterization of the spacecraft's X-Band system. The 21 m Space Tracking Antenna at Morehead State University was configured with a transmitter (Tx) system capable of transmitting a high power X-band signal at 7,139.5 MHz with extreme polarization purity. The hardware development was supported by the mini-SAR team at Johns Hopkins Applied Physics Laboratory (which operates the mini-SAR experiment). Undergraduate and graduate student researchers were involved in engineering, implementing, testing and calibrating the GSE instrumentation, in operating the X-Band spacecraft calibration experiment, and in analyzing the data produced. On May 7th-11th 2010, NASA, the mini-SAR team, and the faculty and students of the Space Science Center used the 21-meter to successfully calibrate the higher of two radar frequencies of the LRO/Mini-RF instrument. LRO will produce information and data important to the discovery and use of in situ lunar resources, and ultimately support future human exploration of our solar system.

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Poster # 23

Insights into the generic relationships within the family Sarraceniaceae (Ericales)

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1=Eastern Kentucky University
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The flowering plant family Sarraceniaceae contains three genera: the North American Sarracenia (11 species) and monotypic Darlintonia, and the South American Heliamphora (upwards of 16 described species). A relative paucity of informative morphological characters has rendered efforts at resolving evolutionary relationships in the group problematic. Prior efforts by others involving molecular data involved the nuclear ITS region and the plastid rbcL gene, with some conflicting results. We are utilizing a different molecular data set in an effort to resolve the evolutionary relationships among the three genera and to provide insights into the possible biogeographic origin of the group (i.e. either western North America, the southeastern United States, or South America). Three loci have been successfully amplified through the PCR from genomic DNA samples of Darlingtonia californica, four Heliamphora species, six Sarracenia species, and one sample each of the outgroups Actinidia (Actinidiaceae) and Roridula (Roridulaceae). An analysis of the P-distances of available Sarraceniaceae GenBank sequences, using PAUP*, demonstrated that the most useful loci would be the nuclear 26S rRNA large-subunit (LSU) gene (1.5–4.1% sequence variability in pairwise comparisons), the plastid intron maturase-encoding gene matK (7.5–10.5% variability) and the mitochondrial maturase-encoding gene matR (1–3.3% variability). Our current data set consists of the entire matR (1700 bp) and matK (1900 bp) genes, and approximately 92% of the 26S rRNA gene (3000 bp). Our initial analyses using Maximum Likelihood approaches through the software program Mobyle@pasteurinstitute supports Darlintonia as being closest to the ancestral state for the family, a result that is congruent with prior studies using molecular data but in conflict with analyses using morphological data.

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Poster # 24

Electrode-based detection technique for microfluidic devices

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We report on a droplet-producing microfluidic device with electrode-based detection techniques. The microfluidic devices are made of polydimethylsiloxane (PDMS) and glass. Immiscible fluids containing the hydrophobic and hydrophilic phases are injected into the microfluidic device using syringe pumps. When a particle passes between a pair of electrodes in a medium having different electrical conductivity, the resulting impedance change signals the presence of the particle for closed-loop feedback during processing. The circuit produces a digital pulse for input into a computer control system. The detected signal can be used for evaluating droplet size, droplet shape, and droplet formation frequency. The detector also allows estimation of a droplet's arrival time at the microfluidic chip outlet for dispensing applications. Electronic feedback provides the ability to count, sort, and direct microfluidic droplets. Microelectrode-based techniques should find several applications in digital microfluidics and in three-dimensional printing technology for rapid prototyping and biotechnology.

Full Funding Acknowledgement:
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Funded by: DOE

Poster # 25

Large Area Conical Carbon Nanotube (CCNT) Arrays: Field Emission and Thermionic Emission Characteristics

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David Mudd, Gami

Thermionic energy conversion requires a low work function cathode in contact with a heat source emitting electrons and collected by a cold anode separated by a small vacuum gap. CCNT has a unique structure, tapering from micron-sized base to nanometer scale tips with central hallow core consisting of a multiwalled carbon nanotube. Due to the conical geometry and high aspect ratio these conical carbon tube arrays are expected to yield excellent field emission characteristics. However, for all the applications, large area synthesis of these arrays on flat substrates has been challenging. Here, we report synthesis of conical carbon tubular arrays on graphite and other metallic foils using microwave plasma enhanced chemical vapor deposition reactor. The field emission characteristics for a CCNT array sample with a tip radius of 5 nm, density of 108/cm2 and having the highest aspect ratio exhibited a low turn-on electric field (< 0.7 V/μm) and a high field enhancement factor (β > 7,500). Thermionic emission studies at temperatures up to 1200 0C reveals reduced work function of CCNTs compared to graphite and confirmed with Ultra violet photoemission (UPS) studies. Diamond nanocrystals have been synthesized at the tips of CCNT and successfully doped with Boron.

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Poster # 26

A Swiss Army Knife Technology for Altering Plants

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Human food security and agricultural productivity and sustainability depend extensively on the gene pools we reserve and the efficient discovery of useful genes for crop breeding. Here, we show the development of a Swiss army knife technology for altering plants by small RNA directed gene silencing. We used this technology to silence numerous genes in Arabidopsis and so the plant development and traits are changed, which can be extended for plant genetic engineering.

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Poster # 27

Development of High-Temperature Shape Memory Alloys for Aerospace Applications

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High Temperature Shape Memory Alloys (HTSMAs) with the ability to operate at temperatures above 100 □C could be utilized in a broad range of applications such as; clearance control in the compressor and turbine sections of an aircraft engine, variable geometry inlets and fan nozzles, self-damping components in fuel line clamps and actuators close to engine parts. Among these potential HTSMAs, due to its low cost, medium ductility and high work output Nickel-Titanium-Hafnium (NiTiHf) seems to be the most promising in the 100-250 ºC temperature range. Yet, as with any material exposed to high temperatures, high temperature SMAs (HTSMA) also suffer from low strength of material for dislocation formation that results in transformation induced plasticity and the deterioration of the shape memory behavior. One method to alleviate the dimensional instability problem is precipitation hardening. Extensive thermal, microstructural and mechanical characterization studies have been conducted to determine the shape memory behavior of aged NiTiHf single and polycrystalline alloys. Effects of heat treatments, orientation, stress and temperature on transformation strain, stress and hysteresis as well as cyclic stability are revealed. It has been determined that precipitation hardening is a very effective tool to increase the material strength resulting in stable superelastic and shape memory behaviors with low transformation hysteresis. Moreover, the transformation temperatures are found to be highly heat treatment dependent in these Ni-rich NiTiHf alloys

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Poster # 28

Green Tea Polyphenols Mediated Apoptosis in Intestinal Epithelial Cells By a Fadd-Dependent Pathway

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BACKGROUND: Colorectal cancer is the most common malignant complication in patients with chronic inflammatory bowel disease (IBD). In addition, these patients are at risk for developing painful complications during chemotherapy due to cytotoxic effects of drugs currently in use. Past studies have suggested a protective effect of tea consumption on gastrointestinal (GI) malignancies. Green tea polyphenols (GrTP) inhibited carcinogen-induced GI tumors in rodents and induced apoptosis in various carcinoma cell lines. In this study we hypothesized that GrTP and its polyphenolic compounds regulate apoptosis in the intestinal epithelia. Methods: The effects of GrTP and its polyphenolics on apoptosis was evaluated in intestinal epithelial, IEC-6, cells grown to 85% confluency. Results: GrTP (400-800mg/ml) induced DNA fragmentation in a dose dependent fashion. Higher concentrations (>800mg/ml) induced a mixed apoptosis and cytolysis. Epithelial cells exposed to GrTP and a major polyphenol, EGCG, but not EGC or EC, increased caspase activities in a time and dose dependent manner. The caspase inhibitors rescued cells from GrTP and EGCG-induced cell death. Concomitantly, GrTP resulted in activation of fatty acid synthase (Fas)-associated protein with death domain (FADD) and recruitment to Fas/CD95 domain 30 minutes following treatment. While GrTP also blocked NF-□B activation, an NF□-B inhibitor (MG132) only promoted cytolysis. Conclusions: These data demonstrated GrTP and EGCG induced apoptosis in intestinal epithelia mediated by caspase-8 through a FADD dependent pathway. Future investigation may warrant preventive as well as therapeutic strategies for GrTP in GI malignancy.

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Poster # 29

Fabrication Process of Micro-Scaled Photon Actuated Structures to Serve as Artificial Myocytes

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Cardiac myocytes form the foundation of the mammalian heart. When functioning properly, a human heart is able to beat continuously for many decades. However, when even a small portion of this tissue is damaged, the operational lifetime is often severely diminished. It is with this in mind that a process for producing micro-scaled photon actuated structures to serve as artificial myocytes is being explored. The design of the artificial myocytes is based on the observation that when two metals are bonded together and both are heated or cooled, the bars will expand or shrink at different rates. The different rates of change will cause the bimetallic unit to bend in a single direction. Ultimately, many thousands of these artificial myocytes will be created, aligned, and suspended in a polymeric silicone substance, and heat will be applied. From this, the overall length of the unit will shorten due to the additive bending of each of the units. Heat will be specifically focused by a laser of near-infrared wavelengths. A fabrication process is investigated so that these artificial myocytes can ultimately be produced. Through many Finite Element Method analyses using the SolidWorks® Simulation suite, a combination of Aluminum and Tantalum bars was selected to compose the bimetallic artificial myocyte units because of their ability to maximize bending during simulations. In addition to material selection, single bar sizes of 300μm x 5 μm x 5μm were chosen, which yielded a total artificial myocyte unit thickness of 10μm. Bars will be formed by independently sputtering the metals onto a mold. The resultant castings will be joined together and placed in a second mold and sealed. With the addition of heat, the two metals will bond. These bars will be stored for use in subsequent fabrication steps which still require further examination.

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Poster # 30

2009 LSAMP Student Research Symposium

Ingrid St. Omer University of Kentucky,
Kentucky - West Virgina Alliance for Minority Participation

The Kentucky – West Virginia Alliance for Minority Participation is a collaboration among ten academic institutions, the KY-NSF EPSCoR, the WV-NSF EPSCoR, two state agencies, and the initial stage of a developing industrial support base. The partnership institutions are: Bluegrass Community & Technical College, Lexington, KY; Centre College, Danville, KY; Kentucky State University, Frankfort, KY; Marshall University, Huntington, WV; University of Kentucky, Lexington, KY; University of Louisville, Louisville, KY; Western Kentucky University, Bowling Green, KY; West Virginia State Community & Technical College, Institute, WV; West Virginia State University, Institute, WV and West Virginia University, Morgantown, WV. The signature Alliance-wide activity is the annual Student Research Symposium. The Symposium offers students a low-pressure opportunity to present their research, and it also includes professional development workshops and speakers on such topics as the benefits of graduate school, preparation for graduate school, research career options, and interviewing skill. The 2009 conference was hosted by two of our partners, West Virginia State University and West Virginia State Community and Technical College at the Stonewall Resort in Roanoke, WV. The Kentucky NSF EPSCoR provided RSP funds for travel and lodging expenses for Kentucky student participants.

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Poster # 31

The Future of Artificial Muscles in Medical Devices

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Several conductive polymers, known as electroactive polymers (EAPs), can undergo unusual mechanical response when an electrical potential is applied, causing an expanding and contracting electromechanical response like muscles. The EAP biocompatibility is essential for its use in medical devices. Hydrogels are biocompatible hydrophilic polymers chiefly structured with cross-linked networks with swelling and shrinking properties. However, the limitation thus far has been in combining electroactive and hydrogel elements together. We are developing these artificial muscles in by combining these elements through multiple synthesis techniques and step-by-step production to provide a strong chance of success in bringing these new materials to development.

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Poster # 32

Kentucky Space

James Lumpp, Space Systems laboratory,
University of Kentucky

This poster will overview the recent missions of the Kentucky Space Program.

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Poster # 33

Physical Processes in the Rosette Nebula

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University of Louisville

In support of the science goal in the NASA Strategic Plan to discover the origin, structure, evolution, and destiny of the universe, and to search for Earth-like planets, we are studying the Rosette Nebula, a massive star-forming region in our own galaxy. The Rosette is apparently spherical, and at a distance of approximately 5000 light years, its roughly 170 light year diameter spans approximately 2 degrees of sky. Larger and much less luminous than the nearby Orion nebula, its faintness and angular size have made examination of the physical processes driving its shape, structure,and dynamics difficult. The spatial morphology of the nebula, which interacts with a nearby giant molecular cloud, is obscured by the interstellar dust produced by previous generations of star formation. Our research seeks to construct a multispectral data set for the nebula and its environment, and through that to develop an observationally informed three dimensional model for the gas and dust densities, temperature, composition and motion. The distinctive ring of the Rosette is thought to be caused by radiation and winds from a central cluster of recently formed hot (OB) stars. The interaction of these stars with the nebula may be modeled based on physical first principles with CLOUDY and CLOUDY3D, thereby yielding a self-consistent understanding of the flow of energy from its stars and its appearance across the full spectrum from the ultraviolet to the radio. In these data and the model, we are searching for evidence of prior episodes of star formation, and an understanding of the development of the heavy elements, molecules, and dust that are precursors to Earth-like planet formation. We have gathered narrow band imaging data and long-slit spectroscopic data using wide-field instrumentation at Moore Observatory of the University of Louisville as the first step, and preliminary results are reported here.

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Poster # 34

Interactions Among Ammonium Transporters of Ustilago maydis

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Fungal proteins that sense carbon and nitrogen availability interact with conserved signaling pathways to regulate mating and the transition from budding to filamentous growth. Ammonium transporters (e.g., Mep1,2,3 from Saccharomyces cerevisiae and Ump1 and Ump2 from the corn smut, Ustilago maydis) are important for uptake of ammonium as a nitrogen source. Moreover, Mep2 and Ump2 can sense low ammonium availability and transmit this signal to trigger the dimorphic switch. Interestingly, we have found that U. maydis cells over-expressing the ump2 gene grow filamentously in carbon- and nitrogen-replete conditions. Similar findings in Candida albicans and S. cerevisiae suggest that ammonium limitation per se might not be required for induction of the dimorphic switch in response to ammonium. We used split ubiquitin to further explore possible interactions among Ump1, Ump2, and their putative signaling pathway(s). The results suggest that U. maydis transporters Ump1 and Ump2 physically interact with themselves and with each other. Moreover, they appear to have weak interaction with a Rho1 homologue, thus suggesting an avenue for the signaling cascade. We are also investigaing the ammonium transporter homologues in another smut fungus, Microbotryum violaceum. One of the genes, mepA, complemented the transport function in the S. cerevisiae mep1,2,3 triple deletion mutant; however, it was not able to complement the filamentation defect on low ammonium for either this or the ump2 mutant of U. maydis. Predicted amino acid sequence of a second homologue, MepC, reveals various levels of similarity to other well studied ammonium transporters and is currently under investigation to evaluate its possible roles in transport and filamentation.

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Poster # 35

A Search For X-Ray Counterparts To Known Optical And Candidate Radio Supernova Remnants In The Nearby Galaxy Ngc 2403

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Supernova remnants (SNRs) are the expanding shock fronts resulting from the deaths of either massive stars or white dwarf stars in binary systems in supernovae explosions. This study is intended to analyze data from archived observations made by the Chandra X-ray Observatory of the nearby (approximately 3.2 Megaparsecs distant) spiral galaxy NGC 2403 in order to identify X-ray counterparts to SNRs identified by prior optical and radio searches (Matonick et al 1997, Turner & Ho 1994 respectively). Four observations were obtained from the Chandra archive with a total observation time of approximately 190 kiloseconds. The data from each observation was reduced with the CIAO 4.0 software package and the CIAO tool “wavdetect” was utilized to detect sources and measure photon counts (from which flux densities and luminosities were calculated). Out of the thirty-six SNRs detected by prior optical and radio surveys of this galaxy, we found four coincident discrete X-ray sources detected by Chandra. A summary of our results and properties of these X-ray counterparts will be presented and discussed.

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Poster # 36

Efficacyof Countermeasures to Cardiovascular Deconditioning in Men and Women During Simulated Moon Explorations

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FB Moore, (Alter-G Corp, Menlo Park CA);
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The long-term goal of this project is to develop an easily administered countermeasure to mitigate human cardiovascular adaptations to microgravity during missions to the moon and Mars. In collaboration with JSC and Ames, we are conducting studies focused on: 1) the efficacy of compression stockings to counteract the cardiovascular deconditioning resulting from exposure to reduced gravity, 2) use of the AlterG device to model cardiovascular responses to standing in mars and lunar gravities, and 3) a spinoff project to noninvasively assess human autonomic neuropathy in diabetic patients. Findings from these studies indicate:A. Breast high compression garments prevented the increased incidence of orthostatic intolerance seen in models of spaceflight. Mechanisms of action included smaller tilt-induced decreases in systolic blood pressure and stroke volume accompanied by smaller increases in heart rate and vasomotion. The net effect of compression garments was through a return of more blood to the heart, requiring less need for activation of sympathetic neural reflexes. B. The Alter G can be used to return the output of the heart to supine levels, thereby providing a realistic model for cardiovascular regulation in reduced gravity fields. AlterG control of lower body positive pressure offers the opportunity to return standing stroke volume to supine levels, requiring less activation of neural sympathetic reflexes. C) Diabetics with autonomic neuropathy can be identified using noninvasive measures developed in our EPSCoR studies. These indices pinpoint a failure of cardiovagal reflex regulation of blood pressure in diabetic neuropathy. In the upcoming year, we will assess: A. the Alter G combined with hypovolemia to quantify space flight-induced cardiovascular deconditioning effects on activity, and B. the hypovolemia model of deconditioned cardiovascular responses to the g profiles experienced in a lunar/Mars mission using NASA Ames' 20G Centrifuge.

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Poster # 37

Bi-Stable Thermal Actuators

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Brian Goessling (University of Louisville)
Evgeniya Moiseeva (University of Louisville)
Cindy Harnett (University of Louisville)

Conventionally, most MEMS devices are constructed and remain within the plane of the wafer. Presented are devices that have been released from a silicon wafer and generate a profile that can be electrically manipulated above the wafer surface. The advantage of this profile are devices that can be employed in a gaseous or liquid flow parallel to the wafer surface to capture trace elements or gaseous vapor of interest for either liquid or gas analysis. Additionally, the selection of particular thin films and their thicknesses can benefit from differing thin film stresses to control the shape and profile of the released structures. Electrical manipulation of the devices by varying applied voltages can alter the shape of the devices due to thermal heating and differences in the thermal coefficients of expansion of the selected materials. Actuation of the devices can enable possibilities of motion of the device (i.e. walking) or transfer of items from device to device. Presented herein is the fabrication process, the relationship of the shape of the devices based upon the fabricated pattern, thin film metal selection, film thicknesses, with SEM images of the electrically manipulated devices.

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Kentucky NASA EPSCoR

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Poster # 38

Real Time Monitoring of Endothelial Cell Permeability Using Trans Endothelial Electrical Resistance

Justin Poag, Bill Merke, Dr. Kim Anderson, Dr. Thomas Dziubla, Dr. Richard Eitel, University of Kentucky

Under normal physiological conditions, vascular endothelial cells (ECs) are exposed to a variety of flow conditions and shear rates. These natural flows greatly augment cellular phenotype, as classically exhibited by the flow adapted configuration that is seen in large vessel endothelial cells under steady state shear conditions. However, despite this understanding, the majority of EC cell culture studies are conducted under static conditions. The reason for this isn't due to the importance of static models, but rather the relative lack of reproducibility and expense associated with establishing a flow system for studying ECs. The goal of the current study is to develop a microfluidic device that monitors the permeability of an endothelial cell monolayer using "real-time" measurements. Specifically, low temperature co-fired ceramic (LTCC) materials were used to construct the device containing a viable cell culture grown on gold electrodes. The use of LTCC materials and processing methods allows for a durable, rigid, uniform substrate with a high precision, reproducible fabrication techniques. This device also incorporates trans-endothelial electrical resistance (TEER) measurements allowing for "real time" monitoring of cell permeability during growth and during treatment with cell-permeability modifying agents. Results have demonstrated that human umbilical vein endothelial cells (HUVECs) grow and reach confluency on the gold electrodes adsorbed with fibronectin. TEER measurements in the microfluidic device as a function of cell growth and after treatment with permeability-modifying agents will be presented and compared to results obtained using a static assay.

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Poster # 39

A Search For Alkali Metals In The Atmospheres Of Exoplanets

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University of Louisville

The discovery of more than 450 extra-solar planets (exoplanets) over the past 15 years has confirmed that the Sun is not unique among stars in hosting planets. However, this discovery is only a starting point in the quest to determine if life exists beyond our solar system. By far, most exoplanets have been discovered using the radial velocity technique, which employs spectroscopy to measure small variations in a star's radial velocity induced by an orbiting planet. The second most successful technique, planetary transit, is able to detect planets that have orbits passing directly through the line of sight from Earth to the host star, causing a slight apparent dimming of the star during transit. Radial velocity detections indicate the planet's mass while transit detections indicate the planet's radius. The combination provides constraints on the planet's bulk composition.

As a planet transits its host star, part of the star's light passes through the atmosphere of the planet. The resulting spectrum observed from Earth is the stellar spectrum combined with the transiting planet's atmospheric transmission spectrum. By comparing the out-of-transit pure stellar spectrum with the in-transit star+planetary atmosphere spectrum, the planetary atmosphere transmission spectrum is revealed. However, due to the ratio of the apparent sizes of the planet and its host star, the atmospheric contribution is a factor of ~10^-3 - 10^-4 below the continuum for close-in extra-solar giant planets (CEGPs). Thus, strong atmospheric absorption lines and very high levels of SNR are required to detect the subtle excess absorption. Alkali metals such as Na and K produce appropriate atomic absorption lines in the optical. We are aware of detections of only two exoplanetary atmospheres in the literature (HD 209458 b and HD 189733 b). The initial ground-based detections were of the atomic Na D resonance doublet from 8 m class telescopes (spectrophotometric detections) with additional features reported in follow-up studies.

By studying the characteristics of exoplanet atmospheres, we can begin to understand if conditions exist outside our solar system that can support life as we understand it here on earth. We are studying atmospheric characteristics of 5-6 known bright ($V \leq 11$) transiting CEGP systems that have favorable planet-to-star radius ratios. We are conducting this research primarily utilizing half-meter class, research-grade telescope facilities at Moore Observatory near Louisville, Kentucky and Mt. Kent Observatory near Toowoomba in Queensland, Australia. The combination of the northern and southern hemisphere sites provides complete sky coverage, and the telescopes are available essentially full time for this project. We are collaborating with the University of Southern Queensland and Northern Kentucky University to provide remotely operable and robotic telescopes at the Mt. Kent facility.

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Funded by: NASA

Poster # 40

Nanomaterials in Electronic Nose Technology

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Western Kentucky University

An electronic nose (e-nose) is a biologically inspired device that identifies and analyses chemical compounds in gaseous environments. An electronic nose consists of a mechanism for chemical detection, such as an array of electronic sensors, and a mechanism for pattern recognition, such as a neural network. The sensor array consists of broadly tuned, non-specific sensors that are treated with a variety of odor-sensitive biological or chemical materials. Odors are composed of molecules, each of which has a specific size and shape. Each of these molecules has a correspondingly sized and shaped receptor in the human nose. When a specific receptor receives a molecule it sends a signal to the brain and the brain identifies the smell associated with that particular molecule. Electronic noses based on the biological model work in a similar manner, substituting sensors for receptors and transmitting the signal to a program for processing, rather than to the brain. Currently, research is focused on making the devices smaller, less expensive, and more sensitive. It became possible thanks to the application of nanostructures in electronic nose technology. In this chapter we discuss the possibilities of sufficient improvement of sensitivity and selectivity of electronic noses using novel nanomaterials. We start from an overview of basic principles driving the sensing capabilities of electronic noses.

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Poster # 41

Development of porphyrin catalysts for the degradation of biomass in ionic liquid solvents

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In order to fully utilize biomass resources we must overcome recalcitrance issues with the processing of lignocellulosic material. Combining the ability of the ionic liquid solvent to dissolve lignin with the reactivity of metalloporphyrins could overcome many of these challenges. Efforts on the synthesis and characterization of several novel porphyrin ligands containing ionic liquid functionalization will be presented. These novel metalloporphyrin/ionic liquid complexes would function as both catalyst and solvent and therefore have the potential to significantly improve the efficient production of valuable bioproducts from lignocellulosic biomass.

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Poster # 42

A Numerical Approach to Calculating the Flux Experienced by a Young Star in an Embedded Cluster

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Planets are believed to form out of the disks of gas and dust that are known to surround newly formed stars. In turn, most stars in our galaxy are born in clusters of between thirty and two thousand members within cloud-like structures of molecular gas. The interaction between the members of these clusters can significantly affect planet formation. Specifically, the most massive stars within these clusters can produce enough ultraviolet light to evaporate the disks of gas and dust surrounding the other stars before planets can form. A proper analysis of this physical mechanism requires an understanding of how stars orbit within their cluster environment. Unlike the two-body problem (for which orbits are known to be elliptical), the orbits of stars moving within a cluster can be complex. In order to simplify the problem, we consider the interaction of a single star with an extended mass distribution where the distribution is used to model the density of the entire system as a continuous function. Others have investigated the spirographic orbits that arise in this scenario. While most of the recent work has focused on one particular form for the spherically symmetric mass distribution, we consider more general forms. In addition, we use these results to calculate the average flux that impinges upon the orbiting star from the centrally located massive star (which is the dominant source of ultraviolet light in these environments) in order to determine whether its surrounding disk can form planets before being evaporated by the UV light.

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Poster # 43

High Throughput Localization Of Secreted Proteins During Penetration And Invasive Growth Of The Rice Blast Fungus Magnaporthe oryzae

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Plant pathogenic fungi secrete many proteins with diverse roles in plant-microbe interactions. However, information on the temporal and spatial patterns of protein secretion during fungal infection of plants is extremely limited, so in most cases it is not clear which proteins are expressed/secreted at different infection stages. Likewise, it is not known if secretion occurs at specific locations within invasive hyphae, or if the secreted proteins are targeted to different regions of the pathogen-host interface. To address these gaps in understanding, we are performing high throughput localization of Magnaporthe oryzae secreted proteins during penetration of, and growth inside, rice leaf sheaths. An analysis of M. oryzae predicted genes using stringent criteria identified 939 genes that are predicted to code for secreted proteins. Fusions to green and/or red fluorescent protein (GFP/RFP) are generated using the Gateway system and the resulting constructs are introduced into M. oryzae via Agrobacterium-mediated transformation. Transformants are inoculated onto rice leaf sheaths and live-cell imaging with epifluorescence and confocal microscopy is used to detect protein localization during penetration and invasive growth. To date, we have studied the localization patterns of over 120 proteins and another 400 are at various stages of the pipeline. We have found that RFP is much better than GFP for detecting proteins in Magnaporthe and we have shown that fusions generated using the Gateway system yield localization patterns that are equivalent to those obtained with direct fusions. At least 15 distinct localization patterns have been identified and examples are presented.

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Poster # 44

Studying Germline Stem Cells using the Fruit Fly as a Model Organism

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Stem cell biology is a promising area of research which is likely to advance medicine and human health. We are using the fruit fly Drosophila as a model system to study the germline stem cells. Germline cells give rise to sperm and egg and are responsible for generating entirely new organism from an early embryo. In particular, we are focusing on the structural and functional characterization of proteins that determine germline cells and make them different from other types of cells. Using proteomic approaches, we have identified several polypeptides and shown that they associate inside the germline cells and participate in the assembly of large germline organelles (germ granules). Analysis of identified proteins indicate that germline stem cells form dynamic subcellular granules needed for control of protein synthesis, energy production, and protection of germline stem cell DNA from mobile genetic elements.

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Poster # 45

The Response Of Arctic Headwater Streams To Permafrost Degradation And Thermokarst Formation

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Recent research has documented changes in arctic climate that influence permafrost degradation and the incidence of thermokarst formation. In 2009, we examined several thermokarst failures on headwater streams near Toolik Lake, AK, USA. We quantified significant differences between reference (upstream) and impacted stream reaches affected by two different thermokarst features. Sediment deposition, measured with sediment traps, showed that there were no differences in the organic fractions; however, the inorganic fraction was ~2x higher ($P < 0.05$) in the impacted reaches. The pattern of benthic organic matter and fine sediment (stovepipe core) generally showed a 2x increase in the impacted reaches which may increase resources for primary consumers. Significant increases of ammonium ($P < 0.05$) and benthic chlorophyll a ($P < 0.01$, rock scrubs) were significantly higher in the impacted reaches and increased sharply downstream of the thermokarst indicating that there was a fertilization effect, especially in late summer. Despite increases in potential food resources, benthic macroinvertebrate communities showed a decrease in abundance and biomass in the impacted reaches and may indicate that benthic habitat quality was decreased. The response in functional feeding groups was variable between the thermokarst impacted streams and reaches. Collector-gatherer groups showed little change in abundance and biomass, whereas scraper biomass showed a 3x decrease and shredders showed a 2-5x increase in the impacted reaches. Initial findings suggest that there is a variable response between a fertilization effect (i.e. nutrients, organic matter) and sediment/shading effect that decreases in-stream habitat quality. Research is on-going to determine downstream attenuation of sediment loading and the responses of primary and secondary production.

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Poster # 46

Improving genome browser infrastructure

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We present various improvements to the Epichloë festucae genome browser, as well as new projects based on this browser. The browser is available at: http://csbio-a.csr.uky.edu/ef/gbrowse We developed scripts to easily deploy new genome browser instances, along with their supporting software and databases. These scripts allowed us to quickly evaluate six new versions of the new Epichloë festucae assembly to select a final version. Furthermore, in addition to the Epichloë festucae project, we have used these scripts to create browsers for other genome projects as well, including Claviceps paspali and Peronospora tabacina (blue mold). Furthermore, we made significant performance improvements to our feature display and search pages. Many of these pages must convert among different coordinate systems. Previously, each such conversion invoked a database query; now, each page performs only a single query to find the locations of all relevant features (typically a few thousand rows), then saves this information for subsequent use within the page. Because the overhead of submitting a query is much larger than the actual search time, this has greatly improved performance. For example, the feature search page originally took two minutes to render the first 256 results; after this change, it takes a few seconds. Finally, we have added support for MAKER to our genome browser. MAKER is a genome annotation pipeline that runs a number of bioinformatics programs, combining their results to predict and annotate genes within a genome. We installed MAKER, perfomed a number of runs on E. festucae, and compared and evaluated the results. We additionally developed scripts to import MAKER annotations into our database, as well as web pages to render these annotations, color-coded to indicate introns, coding sequences, and untranslated regions. MAKER annotations are available for view in the E. festucae genome browser, and more user-interface improvements are under development.

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Poster # 47

Brushy Creek Watershed: Assessment of a Karst Drainage Basin Using Geospatial, Geochemical, and Microbial Approaches

Alice L. Jones and Terry R. Huff
Eastern Kentucky University

Brushy Creek Watershed: Assessment of a Karst Drainage Basin Using Geospatial, Geochemical, and Microbial Approaches Alice L. Jones Terry R. Huff Eastern Kentucky University USDA-CSREES National Research Initiative Competitive Grants Program Award 2008-35102-19217 The Brushy Creek watershed lies in a karst region of Kentucky where the level of groundwater-surface water interaction is suspected to be high, but is largely unknown. Cattle grazing is the primary land use and economic activity. . A 2007 study determined that best management practices (BMPs) aimed at reducing water pollution from these cattle operations had little effect on water quality at the larger watershed scale, and suggested that a major hindrance to BMP effectiveness was the absence of karst as a consideration in the BMP prescriptions for individual cattle operations. During the first year of the study water quality was monitored at 17 surface water sites throughout the Brushy Creek watershed nine times between Feb – Oct 2009. Physical, chemical, and pathogenic parameters were examined at each of the sites. In addition, fish samples were collected and biological integrity scores calculated for 14 of the 17 sites. To date results suggest that Brushy Creek and its tributaries remain impaired by nutrients and bacteria loading. Measurements taken showed that pH varies within normal ranges (7.8 – 8.0), conductivity readings are within normal ranges (150 – 400 µhos), E. coli levels were uniformly high (2400/100 ml) with little seasonal variation and little dilution associated with change in flow, fecal coliform levels were somewhat higher in most karstic reach, and fish IBI scores varied independent of fecal coliform, and were generally better downstream with no scores in the “poor” or “very poor” ranges. Year two research objectives will include continued field monitoring, qPCR analysis to differentiate between bovine and human sources of fecal coliform. In the Spring of 2010 dye tracing began at eleven groundwater sites to characterize the groundwater-surface water interaction in the watershed; and. and macro-invertebrate samples have been collected to relate water quality to insect species.

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Yes

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Poster # 48

Assessing Climate-Hive Interaction on Eastern Kentucky Surface Mines

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Energy discussion is generally dominated by natural resources such as coal and natural gas. However, because food is one of our greatest energy sources and about one mouthful of food in three is acquired from honey bee pollination, honey bees are part of the growing energy concern. In the attainment of other energy sources, such as coal, the habitats of pollinators are often damaged. According to The Appalachian Regional Reforestation Initiative (ARRI 2006), "since 1980, an estimated 1.2 million acres were permitted for coal mining representing nearly 5% of the state's total land area." In effect, current surface mining methods create vast "pollen and nectar" deserts for the surviving area pollinators. In order to address this issue, Eastern Kentucky Environmental Research Institute in collaboration with James River Coal and Pine Branch Coal Company, are planting pollinator forage plants and trees in a three season bloom cycle. In my project, hives will be weighed once a week and photographic documentation kept of two hives set up in these reclaimed sites in order to track their foraging habits, nectar flow, and overall hive health. These records will then be submitted to a national database collected by NASA. With the information gathered from volunteers all across the country, NASA may be able to use hive weights to track and predict global climate changes as well as update previous forage maps for beekeepers across the nation. Using honey bees to understand changes in global climate patterns may lead to a greater understanding of the potential changes we may need to make in our food system to meet our energy needs.

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Poster # 49

Development of the Kentukcy Appalachian Rural Rehabilitation Network

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Hunter, B. - Cardinal Hill Rehabilitation Hospital;
Kuperstein, J. - University of Kentucky

Of the 420 counties that comprise Appalachia, the counties located in eastern Kentucky are some of the poorest. Approximately 80% of these Kentucky counties having a shortage of designated Health professionals and healthcare resources. This shortage is a particular burden to individuals with neurological impairment, who require a collaborative interprofessional approach in order to achieve long-term improvement in health outcomes and quality of life. The Kentucky Appalachian Rural Rehabilitation Network (KARRN) has been established as a collaborative team including individuals impacted by neurological impairments, providers who serve them, members of communities in which they live, advocates, and researchers who investigate these impairments. A preliminary study was conducted that examined the health and quality of life related supports and challenges from the perspective of individuals with spinal cord injury (SCI) and their families and healthcare providers who treat these individuals. Multiple themes were established with respect to barriers and supports to healthcare in rural KY. From the groups that participated in the initial study, as well as other key persons, a network was developed that formally met and conducted an assessment of available community assets (Asset Mapping). The asset mapping focused on the following areas: institution, organization, individuals, environment, and economic/political. In addition, a formalized shared mission for the network was developed. Results from the first studies were used to develop short-term and long-term goals for the group. Short term goals include developing mentor programs for individuals and for providers, developing a network website for information sharing and developing a data base of people impacted by SCI. Longer term goals include developing a foundation for future programs and research projects for KARRN, advocacy, and ultimately improving the quality of life and health outcomes for people living with SCI in these counties.

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Poster # 50

TLR2 and TLR9 activation by periodontal pathogens induce HIV-1 reactivation

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Background: Although oral co-infections (e.g. periodontal disease) are highly prevalent in HIV-1+ patients and appear to positively correlate with viral load levels, the potential for oral bacteria to induce HIV-1 reactivation in latently infected cells has received little attention. We showed that periodontal pathogens enhanced HIV-1 promoter activation in T-cells, monocytes/macrophages and dendritic cells; however the mechanisms involved in this response remain undetermined. Objective: To determine the role of Toll-like receptors (TLR) in HIV-1 reactivation induced by periodontal pathogens. Methods: BF24 monocytes/macrophages stably transfected with the HIV-1LTR promoter driving CAT expression, and THP89GFP cells, a model of HIV-1 latency, were exposed to oral bacteria, including P. gingivalis and F. nucleatum, S. gordonii and S. sanguinis. HIV-1 reactivation was determined by CAT-ELISA, fluorescence microscopy, flow cytometry and fluorometry. Levels of p24 and pro-inflammatory cytokines in supernatants were determined by ELISA. Antagonists and neutralizing antibodies against TLRs and cytokines were also used. Results: The oral Gram-negative but not Gram-positive bacteria enhanced HIV-1LTR activation in BF24 cells. TLR9 activation by F. nucleatum and TLR2 by both Gram-negative bacteria were involved in this response, however TLR4 activation had no effect. Use of NFκB or Sp1 specific chemical inhibitors suggested that these transcription factors are positive and negative regulators of bacterially-induced HIV-1LTR activation, respectively. HIV-1LTR activation and viral replication were similarly induced in THP89GFP cells. Finally, production of TNFα was enhanced by Gram-negative bacteria and its neutralization reduced HIV-1 reactivation. Conclusions: These results suggest that TLR2 and TLR9 activation by P. gingivalis and F. nucleatum, as well as TNFα produced in response to challenge enhance HIV-1 reactivation in monocytes/macrophages. Increased bacterial growth and emergence of periodontopathogens or their products accompanying chronic oral inflammatory diseases could be risk modifiers for viral replication and transmission, systemic immune activation and AIDS progression in HIV-1+ patients.

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Poster # 51

Dynamics of Soil State Variables and Related Processes Across a Land Use Gradient in Spatial and Temporal Transition

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Land use system and management intensity have huge impacts on soil water, carbon and nitrogen dynamics in the upper meter of the vadose zone, and on soil structure and related processes in the surface soil layer, such as quality and dynamics of soil carbon, gas exchange, water infiltration, and soil aggregate dynamics. The type and intensity of land use, vegetative cover and biomass development are closely interrelated. There is a need for multidisciplinary research on spatial processes and temporal dynamics for various soil ecological state variables and their relation to each other but a greater understanding of process dynamics in time and space during land use transitions is of crucial importance with respect to long-term environmental quality and land use planning. The purpose of this project is to monitor relevant soil ecological and vegetative processes in two established land use systems for one year, followed by evaluation of the same processes during transitions from both pasture to agricultural cropland and cropland to pasture. Initial processes are monitored and the several significant consequences of these land use transitions will be better understood. The objectives of this study are: i) to improve understanding of the spatial and temporal behavior of important soil state variables characterizing water and gas transport, biological activity, nitrogen and carbon dynamics, their interrelations with each other and biomass development in two established land use systems, and during transitions between these two land uses; ii) to determine the spatio-temporal association between soil and vegetative state variables and derive model parameters that are relevant for transport- and transformation processes in soils; and iii) to identify the spatial and temporal covariance of soil and vegetation dynamics in order to characterize their variability at different scales according to their measurement resolution and sampling domain size.

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Poster # 52

Antioxidant Polymers to Suppress Oxidative Stress Injury

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Vascular oxidative stress (VOS) is a physiological response, where the imbalance between the free radical production and antioxidant defenses leads to excess reactive oxygen species (ROS) and reactive nitrogen species (RNS). VOS represents a primary and/or a secondary mechanism in ischemia/reperfusion injury (as a result of combat wound). Methods proposed to alleviate oxidative stress during an ischemic attack include attempt to restore antioxidant defenses of the endothelium by delivering antioxidant enzymes (e.g. catalase and superoxide dismutase) or small molecule antioxidants (e.g. Vitamin E, vitamin C, catechins, etc.). In this work we have synthesized biodegradable antioxidant polymers having native antioxidant activity, biodegradation of which will result in release of active antioxidants, thereby attenuating the oxidative stress injury. Trolox, a water soluble analogue of Vitamin E, was polymerized and formulated into nanoparticles. Ability of poly(trolox) to suppress oxidative stress injury was studied in an in vitro model. Also, other antioxidants (e.g. eugenol, curcumin, chrysin, etc.) were polymerized using β-amino ester chemistry. Synthesized poly(antioxidant β-amino esters) were characterized for their degradation rate and antioxidant activity.

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Poster # 53

Characterizing the Influence of Estrogen on Mirna Expression During Cardiac Hypertrophy

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MicroRNAs (miRNAs) are highly regulated during cardiac hypertrophy. Some miRNAs such as miR21, 195, and 208 promote hypertrophy, whereas other miRNAs such as miR1 and 133a inhibit hypertrophy. To date no comparison of sex dependent cardiac miRNAs has been described. Estrogen has been shown to play a protective role in left ventricular hypertrophy and heart failure in both humans and rodent models. To determine sex specific regulation of miRNAs during cardiac hypertrophy we compared levels of miRNAs in a surgical mouse model for cardiac hypertrophy. Male and female C57BL6 mice underwent surgery to band their aortas, transaortic constriction. Banding results in pressure overload, which leads to left ventricle hypertrophy. Five weeks post surgery hearts were weighed and total RNA was extracted. The female hearts exhibited a lesser degree of hypertrophy in response to pressure overload. Real-time PCR Analysis has revealed sex specific patterns of miRNA expression in left ventricular hypertrophy. An understanding of sex specific regulation of miRNAs in the heart could have a far-reaching impact on the diagnosis and treatment of heart disease in both women and men.

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Poster # 54

ABO Blood Group Genotyping by PCR-RFLP

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Traditional blood typing involves mixing a blood sample with antibodies A and B and observing any antigen – antibody reactions (agglutination). Blood borne diseases, ranging from HIV to Hepatitis make blood typing in a classroom setting risky. The purpose of this research is to design a DNA based ABO blood typing protocol that does not require the use of blood. DNA can easily be obtained through a cheek swab. Blood type can be determined by the presence or absence of glycosyl transferase genes, whose protein products add carbohydrate antigens to proteins and lipids on the surface of erythrocytes. Analysis of the known gene sequences of the ABO glycosyl transferase genes revealed detectable sequence differences found in exons 6 and 7. We amplified exons 6 and 7 of the ABO genes via the Polymerase Chain Reaction (PCR). We then digested the amplimers with sequence specific restriction endonuclease and separated resulting DNA bands by agarose gel electrophoresis (RFLP). Based on predicted DNA band sizes, we have been able to successfully determine blood types through PCR-RFLP of genomic DNA.

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Poster # 55

Dynamics of 17 populations of sunflowers (Helianthus annuus - Asteraceae) in central Kentucky

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Native sunflowers (Helianthus annuus – Asteraceae) are commonly found on disturbed calcareous substrates (such as road and highway embankments) in central Kentucky. We have been observing a marked decline in numbers of plants in up to 17 spatially distinct populations through a six year longitudinal study (2004 – 2009). This decline is notable in that the species is rather adventitious, colonizing disturbed habitats in a landscape highly impacted by human activity. All examined populations have exhibited either marked declines in numbers of individual plants, or complete extirpation from 2004 – 2008. A set of 7 populations was examined as follows. First, isoyme analysis was utilized to determine if a lack of genetic diversity could be a contributing factor of this decline. Second, seed germination studies were conducted to assess levels of reproductive potential. Of 13 isozymes examined polymorphisms were observed for 10 enzyme systems, with interpopulation variability exceeding intrapopulation variability. In randomly sampled sets of viable seeds germination rates in a controlled environment ranged from 32%-41%, with a mean value of 39%. Remarkably, four populations that exhibited declines over the prior five years of this study experienced marked increases in the final year of this study, the most dramatic being an increase of 7 individuals in 2008 to 1,462 in 2009 in a single population. We attribute this marked change to local precipitation patterns, as there is a coincidental increase in the amount of total annual rainfall in 2009 over the prior five years.

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Poster # 56

Copper And Arsenic Concentration And Speciation In Soil Adjacent To Chromated Copper Arsenate (Cca) Treated Lumber Fence Posts Along A Topohydrosequence

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Arsenic (As) and Copper (Cu) are ubiquitous in soils as a result of anthropogenic and geogenic processes. The fate of As and Cu in the environment is largely governed by their speciation, which is influenced by soil physiochemical properties. This study investigated the influence of soil physiochemical properties and landscape position on As and Cu concentration and speciation in soils adjacent to Chromated Copper Arsenate (CCA) treated lumber fence posts. Concentration gradients showed elevated total As and Cu adjacent to the three fence posts, which decreased with increasing distance from the posts. In addition, As and Cu had higher concentrations in the surface soil samples than the subsoil samples possibly due to enhanced weathering of the CCA treated posts at the surface. Concentrations of As and Cu were similar among the Maury and Donerail silt loam, however, they were closer to the background concentration in the Newark silt loam, a partially hydric soil, indicating mobility of the metals. Extended X-ray Absorption Fine Structure (EXAFS) spectroscopy indicates As(V) is the predominate species which is principally complexed with Fe and Al whereas, Cu(II) is complexed with soil organic matter. Overall, the use of CCA treated lumber as a metal source can help determine how soil properties influence mobility and speciation of As and Cu across the soil landscape.

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Poster # 57

Nanoscale bubble valves on CNT membranes for chemical energy storage

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Shifting to renewable energy resources such as solar and wind will require dramatic new approaches in energy storage. Chemical energy storage is appealing due to a very large energy density. However this requires stable electrodes with low over potential, fast mass transport, and a valve system to stop diffusion while in the storage mode. Carbon nanotube membranes are an exciting platform for energy storage since the mass transport through CNT cores is a thousand fold faster than pores of conventional materials, graphite is highly conductive and stable, and CNT surfaces can be functionalized with catalyst metals or complexes for a low over potential. However an effective valve to turn off the membrane during storage time needs to be developed. Presented here is a novel electrochemical method to generate nm-scale bubbles at the tips of CNTs that can temporarily block the membrane. 90% blocking efficiency is achieved when the bubbles are stabilized in a 30-60 nm diameter 'wells' at the tips of CNTs. This well is formed by the electrochemical oxidation of the conductive CNTs partially into the polymer matrix of the membrane. The nanoscale bubbles can be removed with 0.004 atm pressure to recover the transport through the CNTs membrane.

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Poster # 58

Catalytic Activity of Ultrathin Pt Films on Aligned Carbon Nanotube Arrays

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Due to increasing energy demands and the possibility of significant methanol production via biomass conversion, there is active research focused on direct methanol fuel cells for electricity generation. The theoretical energy density of methanol fuel cell can reach 6.1 kWh/kg, which is 10 times higher than that of Li battery. However, the methanol reaction rate is several orders of magnitude lower than that of hydrogen oxidation. Methanol fuel cell fabrication thus requires catalytic Pt loading onto the surfaces of electrodes to have useful methanol oxidation rates. Aligned array CNTs substrates for chemically stable methanol fuel cell anodes have been fabricated by 'flip trick', which have high active area (785 cm2 active surface area per 1 cm2 substrate area). Electrochemical treatment of the CNTs by diazoniumbenzoic acid was applied to introduce the uniform carboxyl functional groups on the surface. Pt was deposited on CNTs with/ without surface modification under the same conditions. SEM, EDS, TEM were used to characterize the structure and composite of Pt deposited the aligned CNTs with/without the treatment. The results demonstrated that surface modification of the CNTs prevent the large Pt crystallites forming and allow to ultrathin Pt film coated on them. The mass activity of the Pt nanostructure can reach 400 A/g at a scan rate of 20 mV/s and in a solution of 1 M CH3OH/0.5 M H2SO4. Furthermore, a programmed pulse potential with recovery time at 0 V nearly eliminated the effects of carbon monoxide poisoning. The mass activity of Pt for methanol oxidation can be maintained at 300 A/g for more than 3000 s, which is 19 times of that under a constant potential of 0.7 V (vs Ag/AgCl).

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Poster # 59

Osteocyte Characterization on Polydimethylsiloxane Substrates: Quantification of Functional Communication

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MM Saunders, University of Kentucky

Osteocytes are bone cells that reside within lacunae, lenticular shaped cavities within mineralized bone. These cells are linked to each other and surface-residing osteoblasts via physical channels known as gap junctions. Current knowledge suggests that the osteocytes are able to sense mechanical load applied to bone and the communication networks may be critical in this process. Microsystems development of these activities may help to uncover the mechanisms by which this phenomenon occurs. In this work we lay the foundation for utilizing polydimethylsiloxane (PDMS) substrate, a common microsystems substrate, for growing osteocytes and quantifying the effect on functional communication. Parallel experiments were run with osteocytes seeded on glass; all experiments were repeated three times in triplicate. Surfaces were coated with rat tail collagen type I at a 5 μg/cm2 concentration and cells were seeded at a density between 1-2x104 cells/cm2 and maintained in culture at least 72 hr prior to experimentation. Immunocytochemistry revealed the gap junction protein, connexin43, was found in the osteocytes grown on glass and PDMS. The ability of these channels to enable functional communication was quantified with fluorescent dye assays in which donor cells labeled with membrane-bound, fluorescent DiI and fluorescent calcein AM were dropped onto unlabeled cells. If gap junctions were established calcein was transferred to the unlabeled cells. Experiments were repeated with a topical inhibitor of channel opening to further verify functionality. The results showed that osteocytes were highly communicative in culture regardless of substrate. That is, 63-64% of osteocytes grown on both surfaces were communicating. Topical channel inhibition significantly inhibited cell communication regardless of substrate; on glass 14% and on PDMS 13% of the cells were communicating. Thus we believe that osteocytes may be used successfully on PDMS for microsystems studies involving bone cell communication.

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Poster # 60

Osteocyte Characterization on Polydimethylsiloxane Substrates: Viability, Proliferation and Sclerostin Production

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Polydimethylsiloxane (PDMS) is a polymer material commonly used as a substrate in microfluidic and micro total analysis systems. While these devices are proving advantageous for biomedical applications in general, the bone field has yet to routinely adopt these tools and technologies. In this work we lay the foundation for utilizing PDMS in bone microsystems research by characterizing the effect of PDMS on osteocyte cell viability, growth and sclerostin production out to 120 hr in culture with plating density of 1-2x104 cells/cm2. Viability was assessed using lactate dehydrogenase staining, proliferation was quantified with manual cell counts and sclerostin production was verified by immunochemistry and quantified by optical density measurements. Parallel experiments were run with osteocytes seeded on glass; all experiments were repeated three times in triplicate. Intense staining for LDH indicated that the osteocytes were viable throughout the 120 hr culture period. Similar staining intensity between the osteocytes on PDMS and osteocytes on glass was observed. From proliferation studies, osteocytes seeded on PDMS and glass steadily increased in number during the 120 hr culture period with baseline values taken at 4 hr. For glass there was a 222% increase in osteocyte number; for PDMS there was a 257% increase in osteocyte number over the 120 hr culture period. Proliferation increases on both substrates was statistically significant ($p < 0.001$). Sclerostin production was converted to optical density for quantification using image analysis techniques. For glass there was a 45% increase in sclerostin production; for PDMS there was a 31% increase in sclerostin production over the 120 hr culture period. Sclerostin production on both substrates was statistically significant ($p < 0.001$). Our results suggest that osteocyte morphology is not adversely affected by the PDMS and that osteocytes regardless of substrate exhibited extensive dendritization. Thus we believe that osteocytes may be used successfully on PDMS for microsystems applications.

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Poster # 61

MicroCT Assessment of Bone Organ Culture Viability and Development in a Neonatal Rat Femur Model

KM Gurley, University of Kentucky; AS Gobin, University of Louisville; MM Saunders, University of Kentucky

The goal of this study was to assess the validity of whole bone organ cultures as models for use in mechanotransduction research. Whole bone organ cultures are particularly useful for mechanotransduction research because they maintain the milieu and the 3D communication networks present in bone, providing a more physiologically relevant model than isolated in vitro systems. This work specifically seeks to determine the long-term viability of these organ cultures by comparing midshaft properties of neonatal bones from immediately post-harvest to paired bones maintained in culture out to 4 weeks. Twenty-eight femoral pairs were harvested from 5-day-old neonatal Wistar rat pups and maintained in culture for 1 (n=9), 2 (n=9) or 4 (n=10) wk, then analyzed using a MicroCT-40 computed tomography system (Scanco Medical, Basserdorf, Switzerland) and compared to their day 1 counterpart controls. By evaluating the bones at the 3 time points, a chronological comparison of bone growth and development was obtained. Bones were scanned using source settings of 55 kV, 145 □A and high resolution. Each scan produced 50, 2048 x 2048 2D axial slices in the midshaft of the bone (0.4 mm). Inertial, areal, volumetric and density properties were determined. Results from 1 wk culture studies have been completed. Specifically, over the 1 wk culture period, polar moment of inertia increased 64.3%; bone volume/total volume increased 16.9%; section modulus (bending resistance) increased 59.0%; and, density increased 86.6%. All results were statistically significant ($p < 0.001$) and suggest that the bones were adequately nourished by diffusion and remained viable in culture. By proving that these bones can remain viable for prolonged periods of time, such models can be validated for use in biomimetic mechanotransduction research, as well as other osteogenic studies in which continuing bone growth and development are required.

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Poster # 62

Mechanical Characterization of Polydimethylsiloxane for Microsystems Applications

JR Martin, University of Kentucky; S Sripada, University of Louisville; P Sethu, University of Louisville; MM Saunders, University of Kentucky

Polydimethylsiloxane (PDMS) is a polymeric material that has found many uses in the field of microfluidics. The material's many diverse properties, such as elasticity, optical clarity, low-cost, non-toxicity, and ease of fabrication make it well suited for utilization in microsystems. Although PDMS has not been widely used in bone cell mechanotransduction, its properties make it an attractive candidate. To be useful for this purpose, mechanical characterization of the material is necessary. In the current work we examine the thickness dependency of its Young's Modulus and investigate its relaxation characteristics. To examine these mechanical properties, PDMS samples were fabricated using a 10:1 ratio of elastomer to curing agent (Sylgard 184, Dow Corning) and a rudimentary spin-coater then baked to expedite the hardening of the material and preserve its uniform thickness. The PDMS sheets were cut into strips and tested in a small-scale loading machine developed in-house. Aluminum friction clamps were fabricated to secure the test samples in the machine. Young's Moduli results revealed dependence on specimen thickness. At a thickness of 1.5-2.0mm, the Young's Modulus ranged between 1-1.2MPa. At a thickness of 0.15-0.30mm, the Young's Modulus ranged between 1.5-2.1MPa. The Young's Modulus was relatively independent of sample size at large thicknesses, but displayed an inverse exponential relationship with sample size at thicknesses less than 200μm. In examining the response of PDMS to stress relaxation testing, the internal stress of the samples at 25% strain was measured over five and sixty min time spans. A 10% and a 15% drop in stress were observed for the 5 and 60 min intervals, respectively. These results suggest acceptable mechanical performance of PDMS in microsystems applications requiring precise mechanical loading. The employment of standard testing procedures along with the generation of reproducible results between sample analyses further strengthens this argument.

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Poster # 63

HPC User Interface, Sparse Matrix, Autonomous Sensory Network

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In my Project I am creating web based user interface for cluster computing. After having tested connecting a basic web interface to a cluster to run an MPI program and output the results to a browser I am building support tools, the main control center for users, Ajax connections, download and upload, as well as visualization tools. One of the main goals of current cyber infrastructure is to increase the number of people using it. Both the user interfaces and the detail of building custom software prove to be a hurdle for researchers who don't have access to quantity or quality computational human resources. Visualization and transformation of data into usable information is also a hurdle to this. This requires large amounts of time to be spent analyzing the results and finding ways to effectively visualize them in their research. Making these things easier to use for non computer researchers would ncrease the usage of existing resources and software. Making completed programs accessible via the web saves resources by encouraging researchers to reuse existing code. An Ajax based user interface would solve many interface demands for research on parallel systems. Ajax and web technologies require only that the user has a web browser. This allows for easy upgrade of features and bug fixes without any effort on the end user, making it superior interface systems based on Java, C++, VB, etc. HPC programs would be independent of the web connection and thus the writer of the program would need minimum involvement in the interface design. Multiple platforms (Windows, linux, Mac OSX, mobile phones) would all be able to use the application. Case studies and instructions could be included to promote use. The application could be easily used with most if not all types of hardware. Visualization can be done on the user side using the presentation capabilities of a web browser, which are very powerful today for data, graphics, video and 3D modeling. Nowadays due to the explosion of information, the demand for more accurate and efficient information retrieval technology has increased dramatically. And it is a great challenge to productively and systematically utilize the vast source of information the tremendous source services. Text document are usually modeled as a term-document matrix which has high dimensional and space vectors. To reduce the high dimensions, one of the various dimensionality reduction methods, concept decomposition, has been developed. The invention of this method is based on document clustering techniques and least-square matrix approximation to approximate the matrix of vectors. This method has been indicated to be comparable accurate as it from Latent Semantic Indexing. But the numerical computation is expensive, as an inverse of a dense matrix formed by the concept vector matrix is required. The new algorithm of using a series of simple sparse matrices to approximate the dense concept is being studied. K-mean algorithm is also introduced to our research process. And we will study the sparsity pattern strategies. The new algorithm has been tested on some small datasets, such as CISI, CRAN and MED and the results are ideal in recall test, storage costs and query time. And we will modify the algorithm to improve its accuracy and efficiency. And we will also test the new algorithm on some large datasets such as LISA to see its performance and behaviors. And the parallel algorithm based on the new method will be designed and run on high performance computer.

The goal of my project is to create a sensor network of autonomous robots that will complete cooperative tasks. Static wireless networks are used to collect data from remote locations. Unlike a static sensor network, a mobile autonomous sensor network would be able to explore an environment, make decisions and adapt to situations (using fuzzy logic). In addition, the robots would work together to improve the efficiency of completing a task.I plan to develop, test, and compare various algorithms for the sharing of data between the robots to maximize the efficiency of completing tasks.

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Poster # 64

Data Visualization of Kentucky Lake

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Abstract -A critical aspect of software development is investigation into the design requirements prior to the implementation of code. Areas of investigation include user requirements, design requirements, development of a system model, and prototype development. A sensor network collects and stores extremely large volumes of time-varying data to be analyzed. A visualization tool to handle very large datasets requires high-performance computer technology in order to produce quality graphical representations of information, otherwise not apparent through physical examination of data. Within this thesis is a proposed model for a multidimensional visualization application that is scalable to account for hardware enhancements, robust to reliably visualize sensor and simulation data, and uses abstractions to hide system and software complexities from the users. A prototype application is presented as a proof of concept program that demonstrates a small-scale graphical implementation of a sample dataset. Future work involves gathering information from the user population regarding user-interface requirements, developing a user-interface in the form of a ubiquitous Java applet, investigating the implementation of Paraview software as a visualization engine, and utilizing CORBA in middleware development.

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Poster # 65

Generalized Bathtub Models for Binary-Transformed Climate Data

Stuart Foster, James Polcer* and Jonathan Quiton,
Western Kentucky University

In this poster, we present our current research on modeling binary-transformed climate data. In particular, we focused on wind speed data where we transformed the original data into low or high-energy states based on an arbitrary wind speed threshold. Under a binary-transformed data, our main objective is to find stochastic models that can characterize the duration of the low and high energy states. Our present modeling approach is through a hazard-based specification in an alternating recurrent event setting. Initial results led us to the search for a general class of bathtub models flexible to site and season changes. Survivor functions for the low and high states are obtained using least squares or maximum likelihood methods. Finally, we will demonstrate the performance of some bathtub models using selected wind data provided by the Kentucky Mesonet.

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Poster # 66

Two Climate Modeling Approaches Using Hazard-based Stochastic Processes

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Stuart Foster, James Polcer and Jonathan Quiton*, Western Kentucky University

In this poster, we present two modeling approaches based on hazard-based stochastic processes from which we model Q recurrent and cyclic events. We assume that subjects or units are observed under a fixed monitoring period and the initial state of the subjects are known. In the joint modeling approach, we postulate that the gap times are independently distributed generated by one of the Q distinct hazard functions, while in the full likelihood modeling, we assume that the gap times share a common baseline hazard function. Parametric and semi-parametric estimators are shown and applied to alternating binary-transformed wind data provided by the Kentucky Mesonet. Finally, we will show our current status on our web-based computing initiative to bring adaptive prediction tools to prospective clients.

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Poster # 67

Synthesis of Polymer-Layered Silicate Nanocomposites using One-Step Prepared Organoclays

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Polymer-layered silicate nanocomposite materials where polymer matrices are reinforced by nanoscopically dispersed organically modified layered silicates have attracted increasing research interest as such materials exhibit enhanced mechanical, thermal and gas impermeability properties. In this project, we investigated the synthesis of polymer-layered silicate nanocomposites using one-step prepared organoclays containing either amino groups (Mg-APTES) or alkyl groups (Ethyl: Mg-ETES, n-Butyl: Mg-BTES). Mg-BTES and Mg-BTES were combined with polystyrene (PS), and Mg-APTES was combined with polyvinylpyrrolidone (PVP). Nanocomposites were prepared using two processes: 1) A solution process where the organoclay is added to a polymer solution in various amounts (1, 5, 10, 25%wt). 2) A melt process where the polymer is melted in presence of the organoclay. We found that grinding the organoclay prior to its addition to the polymer improved the transparency of all the nanocomposite films prepared by solution process. For both processes, a better organoclay layer dispersion and a complete exfoliation were observed with the organoclay functionalized with the longer alkyl chains (Mg-BTES). Significant differences in texture and strength between the pure polymer and the nanocomposites were also observed.

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Poster # 68

Exploring Synthetic Parameters for the Preparation and Properties of Functional Organoclays

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A fair amount of interest has been given to organosilicate materials due to their unique combination of organic and inorganic properties and potential in various environmental and industrial applications. Among these hybrid materials, layered organosilicates have remained rather unexplored. Our research interests have been on the preparation of talc-like organoclays by direct alkaline co-polymerization between MgCl2 and organosilanes, (RO)3Si-X, where R = CH3 or C2H5 and X = (CH2)3SH (MTMS) or X = (CH2)3 NH2 (APTES). In this work, we particularly investigated some synthesis parameters that may affect the structure and/or the properties of these organoclays. We found that substituting fractions of organosilane with a non-functionalized alkoxysilane (e.g. Tetraethoxysilane, TEOS, (C2H5O)4Si) tends to increase the hydrophilicity of the materials, but also resulted in the loss of the layered structure. No noticeable structural differences were observed in the organoclays prepared at room temperature, under reflux or hydrothermal conditions indicating that the synthesis temperature has little effects, if any, on the material structures. Varying the hydroxide to magnesium mole ratii led to different results depending on the nature or the organosilane precursor. When MTMS was used as a precursor, the layer stacking and the order within the layers improved as the OH-/Mg2+ mole ratio increased, while an opposite trend was observed with a more disorganized overall structure when APTES was used a precursor.

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Poster # 69

Hybrid materials containing polyoxometalates and ruthenium(II) complexes

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The synthesis of hybrid materials containing polyoxometalates (POMs) and ruthenium polypyridyl complexes have received recent attention due to their photocatalytic ability on splitting water. POMs have potential applications as photocatalysts. However, POMs absorb only UV light, which consists of a small portion of solar energy. In order to make polyoxotungstate ions to work in the visible region, we have studied the use of visible-light absorbing metal-organic complex as sensitizers as they are expected to inject electrons to POMs through varies bonding such as hydrogen bonding and coordination bonds. Here, we describe two new organic-inorganic hybrid compounds of polyoxometallates, which have been hydrothermally synthesized and been characterized by elemental analysis, UV-Vis, fluorescence, thermogravimetric analysis and single-crystal X-ray diffraction studies.

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Poster # 70

Novel organic-inorganic hybrid materials using polyoxometalates and tetrapyridylporphyrin as building units

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Because of their possible application in a variety of areas including photocatalysis, exploration of the structural potential of complex compounds containing polyoxotungstates has been the subject of much recent study. This particular effort uses nature's photosynthetic pathway as a model to attempt the incorporation of polyoxotungstate clusters into a photocatalytic compound for the reduction of water to produce hydrogen gas. Tetrapyridylporphyrin, which belongs to the porphyrin family found employed by photosynthetic organisms, has the ability to form a variety of structural frameworks and to coordinate to metal ions, which in turn can bind to polyoxometalates. Three molecular building blocks, then, were employed in the synthesis of this new hybrid inorganic-organic compound: tungstosilicic acid hydrate of the family of Keggin clusters, meso-tetra-(4-pyridyl) porphine of the porphyrin family, and copper (II) nitrate hemipentahydrate. The resulting product was characterized structurally using single X-ray diffraction, powder X-ray diffraction, elemental analysis, and thermogravimetric analysis techniques. Fluorescence spectra and UV-vis reflectance spectra were also obtained for further characterization of the compound.

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Poster # 71

Ca3(Ru1-xCrx)2O7: A new paradigm for spin valves

O.B. Korneta, S. Chikara, L.E. DeLong, G.Cao, (University of Kentucky, Department of Physics and Astronomy, Center for Advanced Materials), P.Schlottmann (Florida State University)

The spin valve effect is thought to be a delicate quantum phenomenon that depends upon precision deposition and nanoscale patterning of artificial thin-film heterostructures whose quality and performance are difficult to control. Here we demonstrate that a novel, strong spin valve effect exists in single-crystal (Cr-doped) ruthenates having an anisotropic, layered crystal structure. This discovery opens new avenues to understand the underlying physics of spin valves, and fully realize its potential in practical devices.

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Poster # 72

Pressure-induced insulating state in rare earth ion (Eu, Gd) doped BaIrO3

O. Korneta, S. Chikara, L. E. DeLong, G. Cao, (University of Kentucky, Department of Physics and Astronomy) S. Parkin (University of Kentucky, Department of Chemistry)

BaIrO3 is a novel insulator with coexistent weak ferromagnetism, charge and spin density wave. Dilute RE doping for Ba induces a metallic state whereas application of modest pressure (<12.1 kbar) readily restores an insulating state characterized by a three-order-of-magnitude increase of resistivity. A pressure-induced insulating state is not common, and has never been observed in 5d-electron materials. The profoundly dissimilar responses of the ground state to light doping and low hydrostatic pressures signal an unusual, delicate interplay between structural and electronic degrees of freedom in BaIrO3.

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Poster # 73

Anomalous metal-insulator transition in Sr2IrO4

O. Korneta, S. Chikara, G. Cao (University of Kentucky, Department of Physics and Astronomy, Center for Advanced Materials)

Stoichiometric Sr2IrO4 is a novel Mott insulator driven by strong spin-orbit coupling. We report that slight oxide depletions in single-crystal Sr2IrO4-d with d < 0.04 critically alter the magnetic and transport properties of this compound, inducing an anomalous low-temperature metallic state exhibits. The novel properties of Sr2IrO4-d derive from strong spin-orbit coupling that drives coexisting phases incompatible with any metallic states.

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Poster # 74

Giant magneto-electric effect in the Jeff=1/2 insulator Sr2IrO4

S. Chikara, O. Korneta, L.DeLong, T. Qi, B. Thapa, K. Butrouna, G. Cao (Center for Advanced Materials, Department of Physics & Astronomy, University of Kentucky), W.Crummet (Centre College, Science Division), P.Schlottmann (Florida State University)

Our magnetic, electrical, and thermal measurements on single-crystals of the Jeff = 1/2 Mott insulator, Sr2IrO4, reveal a novel giant magneto-electric effect (GME) arising from a frustrated magnetic/ferroelectric state whose signatures are: (1) a strongly enhanced electric permittivity that peaks near a newly observed magnetic anomaly at 100 K, and (2) a large (~100%) magneto-dielectric shift that occurs near a metamagnetic transition. The GME hinges on a spin-orbit gapping of 5d-bands, rather than the magnitude and spatial dependence of magnetization, as traditionally accepted.

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Poster # 75

Antiferromagnetic metallic state and spin valve effect in (Ca1−x Ax)3 Ru2 O7 (A = Sr, Ba) single crystals

S. Chikara, O. Korneta, T. Qi, B. Thapa, K. Butrouna, G. Cao (Center for Advanced Materials, Department of Physics & Astronomy, University of Kentucky), Wenhai Song (Institute of Solid State Physics, Hefei, China)

The spin valve effect is thought to be a delicate quantum phenomenon that depends upon precision deposition and nanoscale patterning of artificial thin-film heterostructures whose quality and performance are difficult to control. Here we demonstrate that a novel, strong spin valve effect exists in single-crystal (Sr, Ba-doped) ruthenates having an anisotropic, layered crystal structure. This discovery opens new avenues to understand the underlying physics of spin valves, and fully realize its potential in practical devices.

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Poster # 76

Cr doped perovskite ruthenate Ca2RuO4: structurally driven Mott transition.

Qi, S. Chikara, O.B. Korneta, G. Cao (Center for Advanced Materials, Department of Physics, University of Kentucky)

We report results of a structural, magnetic and transport study of single crystal Ca2Ru1-xCrxO4. Ca2RuO4 is a Mott system with a structurally driven metal-insulator transition at TMI=357 K and Neel temperature at TN=110 K. Slight substitution of Cr on Ru site in Ca2RuO4 drastically reduces TMI (metal-insulator transition temperature) and the electrical resistivity. Cr substitution enhances the magnetic ordering temperature considerably while suppressing the TMI. Cr doping provides an opportunity to study the metal-insulator transition in this system. We present magnetization and resistivity data and future directions on this ongoing project.

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Poster # 77

Photochemistry and Photophysics of estrogens

Kit-Yan Chan, Bridget Gavaghan, Nicholas Georgescu, Karla Irizarry, and Patrick M. Hare
Northern Kentucky University

Natural estrogens can act as potent endocrine disruptors when they make their way into surface waters. Understanding their photodegradation is required if their persistence in surface waters is to be modeled. A strong solvent-dependence of the photophysics and photochemistry is suggested by a number of studies, but the cause and extent of it is unknown. Steady-state and time-resolved spectroscopy and computational chemistry are being used to determine the relative importance of the paths taken by the estrogens following absorption of UV light- emission, vibrational relaxation, and photochemical reactions, and how intermolecular interactions with the solvent environment change the relative importance of those paths. The effects of solvent polarity and hydrogen-bonding ability on the shapes and intensities of the absorption and emission spectra of the estrogens have been determined by steady-state absorption and emission spectroscopy. The lifetime and population dynamics of the excited states have been determined for the estrogens in a variety of solvents using time-resolved absorption and emission spectroscopy. Determining how intermolecular interactions affect the photophysical and photochemical yields following UV absorption in the estrogens will allow their fate in surface waters to be modeled.

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Poster # 78

Integration of Thick Film PZT Devices with Commercial LTCC Electronic Packaging Materials and Processing

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There is increasing interest in the development of highly integrated microscale electromechanical systems incorporating active piezoelectric elements with features on the order of one to several hundred microns. Features of this length scale are difficult to achieve by either traditional bulk ceramic forming/machining processes or thin film deposition and patterning technologies. An additional challenge has been formulating piezoelectric compositions which can be integrated/cofired using common ceramic packaging materials and methods. Modern thick film and 3D packaging technologies, now widely used in portable communications and handheld electronics, suggest a path to fill this critical macro to nanoscale gap. The current work reports the development of low fire thick film Pb(Zr,Ti)O3 based piezoelectric materials and processing methods which enable integration of active piezoelectric elements with commercially available low temperature cofired ceramic (LTCC) materials. The selection of suitable sintering aids has enabled cofiring of active PZT elements within an LTCC package using standard LTCC firing profiles. High performance piezoelectric elements are obtained following cofiring with LTCC at 870oC for 1 hour. These materials have been has to fabricate integrated PZT/LTCC devices including micropumps and microbalances. The performance these devices has been optimized using finite element modeling and confirmed experimentally.

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Poster # 79

Time-resolved spectroscopic studies of surface-immobilized proteins

Rodrigo S. Wiederkehr, Nathan A. Webster, and Sergio B. Mendes/ Departmnent of Physics and Astronomy, University of Louisville

Fast, time-resolved, optical absorbance is an important analytical tool to investigate structural dynamics of biological materials through spectroscopic changes of intrinsic molecular transitions. In particular, studies of fast dynamics in surface-adsorbed proteins can help understand their functional and structural behavior at the immobilized state; such knowledge can play a significant role on several technologies including biosensors, biomedical implants, catalysis, and affinity chromatography. In this work, we present preliminary data on transient absorbance in the nano- to milli-second time regimes of a surface-adsorbed protein film of cytochrome c. We use an intensified CCD with nano-second resolution to investigate the spectroscopic properties of a cytochrome c submonolayer film deposited on a side-polished fiber. Besides supplying a planar solid support for protein adsorption, the side-polished optical fiber provides an enhanced optical interaction length between the exposed evanescent field of the guided light beam and the surface-adsorbed protein molecules. A tunable, nanosecond, pulsed laser is used as a pump light beam to induce short-lived excited states on the surface-adsorbed biomolecular species, which are then detected as spectroscopic changes by the probe beam at different time delays between pump and probe beams.

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Poster # 80

Microfluidic systems for evaluation of cardiac endothelial cells exposed to pulsatile and continuous flow

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Ventricular assist devices (VADs) are mechanical circulatory devices used to partially or completely replace the function of a failing heart. There are two main categories of VADs; pulsatile pumps, that mimic the natural pulsing action of the heart, and continuous flow pumps. Continuous flow pumps are smaller, more efficient and can be easily implanted. However, the mode of flow results in non-physiological conditions within the heart and the vascular system. Currently, tissue biopsies are the only option available to study the effects of change in flow conditions at the cellular level. To better understand molecular signaling mechanisms differentially triggered by the implantation of these devices, in vitro models that accurately mimic the mechanical and fluidic loading conditions of the heart are necessary. To achieve this, we have constructed a Microfluidic Cardiac Cell Culture System for stimulation of cardiac endothelial cells. Using this system, cardiac endothelial cells can be cultured under mechanical loading and fluid flow conditions seen in the heart following VAD transplantation. We have successfully cultured a mouse cardiac endothelial cell line within this system (Fig. 1) and subject these cells to conditions associated with pulsatile (peak: pressure of 120 mm of Hg, 20% stretch, 80 bpm, 15 dynes/cm2 shear stress) and continuous flow VADs (constant: 80 mm of Hg pressure, 10% stretch and 10 dynes/cm2). Evaluation of changes in molecular expression is in progress.

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Poster # 81

Biosensing Systems that Explore Conformational Changes in Antibodies

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The quest for ideal biosensors has been ongoing for recognition of analytes in a selective and sensitive manner. In that regard we report the development of a biosensing system based on conformational changes in antibodies. This method is universal as it can be employed for any biomolecule of interest provided that there is an antibody capable of binding it. For that, we take advantage of the unconventional nucleotide-binding site that resides between the light and the heavy chains of the variable domain of the antibody. An environment-sensitive fluorophore was covalently attached through a nucleotide probe to the unconventional nucleotide binding site of the antibody. The bound probe does not affect the binding of target analyte to the antibody, but causes a change in the microenvironment of the nucleotide binding site, which in turn results in a change in the fluorescence of the probe. The observed changes in the fluorescence intensity of the nucleotide conjugated probe can, therefore, be employed to monitor the concentration of analyte in the samples. Hence, this universal approach allows for the development of a highly sensitive, selective, simple, and reagentless biosensing system for target analytes.

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Poster # 82

Evaporation-driven Synthesis of Photoactive Semiconducting Films with Oriented Cylindrical Nanopores

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In our group, we have pioneered a self-assembly approach to the preparation of thin metal oxide films with close-packed nanopores (4-12 nm in diameter) that are oriented orthogonal to the film. The strategy is a “bottom up” synthesis based on the spontaneous assembly of commercially available surfactant molecules and small precursors to metal oxides. When the synthesis solutions are cast into thin films by spin or dip coating, loss of solvent drives the assembly of the surfactants into cylindrical aggregates (micelles) which pack together into liquid crystal-like structures surrounded by metal oxide precursors. Continued aging and curing of the films followed by removal of the surfactant micelles leads to metal oxides with ordered, well defined nanopore arrays. One of the main innovations in our group was to show that by chemically modifying the surface of the substrate with materials based on either the surfactant or a random copolymer with a similar composition to the surfactant, the nanopore arrays in the final material can be oriented orthogonal to the substrate. The nanoporous films thus can be prepared either as supported membranes or as functional transparent layers. We are tuning our evaporation-driven approach to prepare titanium dioxide films with orthogonally oriented nanopore arrays as low-cost solar cell components. When the pores are infiltrated with a p-type semiconducting polymer, they are hypothesized to act as efficient solar cells due to the high surface area of contact, straight channels, and short conduction paths in the hybrid films.

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Poster # 83

Theoretical estimation of the electronic structure and properties of GaSbxN1-x alloys

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GaSbN alloys with dilute antimony are investigated for the electronic structure and properties. Calculations are performed using the first principles DFT calculations using the LDA+U method in CASTEP program. A huge band gap bowing is observed at dilute antimony concentrations similar to the observed bowing in the dilute nitrogen content region. The initial results are encouraging and project GaSbN as a potential material for a variety of electronic and opto-electronic applications.

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Poster # 84

Growth Mechanism and Properties of Ternary InxGa1-Xn Alloys On GaN Nanowires

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Ternary III-V materials are promising candidates for photoelectrochemical water splitting and high efficiency solar cells. High indium content alloys needed for these applications are however unstable and phase segregation is commonly observed. Nanowires, with their better strain relaxation properties, can reduce phase segregation. Here, we report the results of our initial effort of the MOCVD synthesis of InxGa1-xN alloys on GaN nanowire substrates. Detailed studies of synthesized materials, including structural and chemical characterization of single nanowires in a transmission electron microscope will be discussed. In particular, Energy Dispersive X-ray (EDX) spectroscopy was used to measure the indium concentration in InxGa1-xN alloys and Selected Area Electron Diffraction (SAED) to determine their lattice parameters. The orientation relationship between the alloys and nanowire substrates, the structural quality of the alloys, and structural defects were investigated by means of High Resolution Transmission Electron Microscopy (HRTEM). Our preliminary results confirm that InxGa1-xN can grow epitaxially on GaN nanowires and the growth mechanism will be discussed. Our study indicates also that the lattice parameters of InxGa1-xN increase nonlinearly with the increase of the indium content.

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Poster # 85

Surface properties of SnO2 nanowires for enhanced performance with dye-sensitized solar cells

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Our recent studies showed that tin oxide nanowire based dye-sensitized solar cells (DSSCs) exhibit over 250 mV higher open circuit potentials (Voc) compared to that using tin oxide nanoparticles.1 In this study, the electron transport and surface properties of nanowires and nanoparticles are investigated to understand the reasons for the observed higher photovoltages with NW based solar cells. Results suggest that the low work function of SnO2 nanowires compared to nanoparticles, in addition to slow recombination kinetics, significantly contributes to the higher Voc with the nanowire based DSSCs.2 Tin oxide is a widely available, large bandgap material, with appropriate band edges for use as the anode material in dye sensitized solar cells (DSSCs). Also, due to its large bandgap, it is more stable against UV degradation.3 However, the open circuit potentials for SnO2 nanoparticle-based DSSCs have been observed to be much less than 400 mV, making them less attractive as anode materials for DSSCs. Typically, the Voc values for SnO2 nanoparticle based cells have been on the order of only 300 mV but vary over a wide range (>250 and <400 mV).4 The observed, low open circuit potentials were attributed to high recombination kinetics with the electrolyte.5 Our earlier study showed that DSSCs based on tin oxide nanowires exhibited high open circuit voltages (520-560 mV), faster electron transport and slower electron recombination characteristics compared to tin oxide nanoparticle counterparts.1 However, in the above stated study, many questions remained unanswered regarding the origin of the differences between nanowire and nanoparticle based systems. These include whether the higher VOC of the nanowire based DSSCs was due to a difference in their work functions or due to their slower recombination characteristics compared to nanoparticles. It has been observed in many nanoparticle systems, that recombination kinetics increased with faster electron transport.6 This, however has been found to be different in the case of one dimensional materials like zinc oxide nanowires in which, faster transport did not have any effect on the recombination kinetics.7 In this study, the surface composition and electronic properties of both nanowires and nanoparticles are investigated and are discussed within the context of their photoelectrochemical properties. Several techniques such as UV-Vis absorption spectroscopy, UV photoelectron spectroscopy (UPS), photoluminescence and Kelvin probe were used to understand the observed differences in transport, recombination and Voc characteristics between nanowires and nanoparticles.

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Poster # 86

Kentucky Virtual Observatory and Ecological Informatics System (VOEIS) Cyberinfrastructure (CI): NSF-EPSCoR Track 2 Update

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In 2009, Kentucky was awarded an EPSCoR-Track 2 Cyberinfrastructure grant. The grant is a collaborative effort among a consortium of universities in Kentucky (Murray State, Eastern Kentucky, the University of Louisville, the University of Kentucky), Montana (University of Montana, Montana State University), the National Center for Supercomputing Applications (NCSA), and Cisco Systems to improve cyberinfrastructure for environmental science and technology in Kentucky and Montana. VOEIS cyberinfrastructure is providing an end to end framework for data acquisition, analysis, model integration, and display of data products from workflows including geospatially explicit models, graphs from statistical analyses, GIS displays of classified ecological attributes on the landscape, and 3-D visualization models of waterscape and landscape processes. The information system developed through this project is designed to manage vast amounts of historical data as well as new data generated by lake and stream sensor networks. Deployment of lake buoys and meteorological/watershed sensors on Kentucky Lake is taking place on instrumented “platforms” consisting of fixed and deployable buoys and similarly instrumented meteorological/watershed sites. New types of sensors for studying sediment dynamics are in development. The VOEIS databases and plan will serve the ecological research communities of our regions, enhance the undergraduate and graduate educational curricula and research experiences at the participating universities, facilitate outreach to underserved and underrepresented members of society, provide relevant and contemporary ecological K-12 education, and offer web-based engagement with public interest groups. Training of students in the use of the cyberinfrastructure is an important part of this project and will develop local expertise in sensor development, deployment and simulation.

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Poster # 87

Developing an Interorbital Systems TubeSat at Morehead State University

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Space science students at the Astronautic Systems Lab (ASL) of Morehead State University (MSU) are developing one of the first TubeSats for Interorbital Systems (IOS) scheduled for launch in the last part of 2010. The TubeSat will be launched on an IOS Neptune 30 launch vehicle into a parabolic orbit of 310 km. The project is a collaboration between MSU and Aslan Academy, a private school near Los Angeles. The initial test flight is expected in the 2nd quarter of 2010 near IOS in the Mojave Desert, CA. The test flight will employ sensors to determine environmental and inertial data to prepare for a planned orbital launch. The orbital launch will utilize a 2U length TubeSat with the bus electronics provided by ASL and the propulsion systems designed by Aslan Academy.

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Under Bob Twiggs, I have led the TubeSat project effort at Morehead State University since the beginning of the Spring 2010 semester. Costs for the project include purchasing all materials necessary to develop and build a satellite at Morehead State University. The project has also been made possible by the development of a new student lab. The lab has all of the tools that students can use to work toward their space science goals.

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Poster # 88

Exploiting Osmosis for Size-based Separation of Blood Cells into Sub-populations using Microfluidics

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Microfluidic devices have shown great promise in cell separation. Size based separation protocols in particular are an attractive alternative to immuno-affinity protocols which cause undesirable activation. Sorting of white blood cells (WBCs) into sub-populations is challenging due to presence of red blood cells (RBCs) and existing size overlaps. To enable size-based sorting, the possibility of using osmotic exposure to deplete and/or create a differential size increase between WBC populations was investigated. WBC analysis was performed using a microfluidic device with 50 μm deep grooves at the bottom of the channel to trap and expose cells to hypotonic buffer. At inlet flow rate, Computer Fluid Dynamics (CFD) modeling shows that fluid flow in the main channel does not affect the bottom regions of the grooves and only recirculation occurs at low 50 μL/min velocity at the bottom of the wells. This ensures that trapped cells do not escape from the grooves during the experiment and mass transfer is efficient due to recirculation effects. This allows the study of cell size as a function of time when exposed to hypotonic deionized water. RBCs and different WBCs were introduced into the device, allowed to sediment into the grooves and evaluated for cell size increase. RBCs lysed within 15 seconds, at the 40 second time point ~ 65% of lymphocytes were lysed and the remaining 35% remained at the same size without lyses. At the 100 second time point monocytes were ~ 18 μm in diameters, granulocytes were ~ 15 μm in diameter and the remaining lymphocytes stayed at ~ 11 um in diameter providing an appropriate size difference for inertial sorting.

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Poster # 89

Hydrogen bonding in the superoxide-hydrogen complex

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The H2--O2- complex has been examined using the coupled-cluster theory at the CCSD(T)/aug-cc-pVXZ, X = 2, 3, 4, and 5 levels of calculations. Electronic structure calculations show that the global minimum energy structure corresponds to a planar bent geometry with a well depth of about 1550 cm-1. For this geometry, the distance between centers of masses of moieties of the complex is 2.57Å. The angles between the internuclear axes of the superoxide radical and the hydrogen molecule with respect to the axis that connects their centers of masses are 102º and 13º, respectively. These results indicate that the hydrogen molecule and the superoxide radical are held together by an unusually strong hydrogen bond within the complex. Results of the current work will be discussed and compared to results of our recent ab initio study of the H2--O2 complex1. 1The Intermolecular Potential Energy Surface of the Ground Electronic State of the O2—H2 Complex, Wafaa M. Fawzy, J. Chem. Phys. 131(4), 044318-1-04438-7 (2009).

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Poster # 90

Energy Efficient Opportunistic Trajectory Generation for a JPL Aerobot with NTG Methodology

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3, Dr. Alberto Elfes (NASA)

The 40th anniversary of Apollo 11 project with man landing on the moon reminds the world again by what science and engineering can do if the man is determined to do. However, a huge step can only be achieved step by step which may be relatively small at the beginning. Robotic exporation can provide man information needed to do the further step safely, with less cost, more conveniently. Trajectory generation for a robotic vehicle is an essential part of the total mission planning. To save energy by exploiting possible situation such as wind will assist a robotic explorer extend its life span and perform tasks more reliably. In this paper, we propose to utilize Nonlinear Trajectory Generation (NTG) methodology to generate energy efficient trajectores for the JPL Aerobot by exploiting wind. First, the Aerobot is dynamically controlled by three propellers which are respectively parallel to the local three Cartesian axes. Constraints for the Aerobot control are derived from Euler-Lagrange equations since the Aerobot satisfies with the Lagrange-D'Alembert principle. Secondly, the Aerobot model is decoupled into longitudinal and lateral dynamics with control inputs as elevator deflection δ_e, thrust demand δ_T, vectoring angle δ_v for the longitudinal motion, aileron deflection δ_a, rudder deflection δ_r for the lateral motion. The outputs are the velocities and orientation of the Aerobot. The Aerobot state space model parameters are obtained from experimental identification on AURORA Airship since the actual JPL Aerobot is similar to the AURORA Airship. In this paper, the results show that with the realistic and complex model, the proposed trajectory generation method can guide the Aerobot to take advantage of previously known wind profile to generate an energy-efficient trajectory.

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Poster # 91

Optical Biosensor based on a Dielectric-Metal Surface Wave Resonance

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The design, fabrication, and characterization of a waveguide resonance sensor from a dielectric layer (Al2O3) deposited on a noble metal (Ag or Au) film are presented. The optical structure operates similarly to a surface plasmon resonance (SPR) counterpart but provides for much improved limit of detection as an optical sensor, which is important for studies in ultra-thin films with potential applications in protein adsorption, biomaterials, chemical detection, and pharmaceutical drug development. Fused silica slides are initially coated with a 36-nm thick silver film and then with a smooth, highly transparent dielectric layer of Al2O3 (143 nm) created through atomic layer deposition. When loaded in the Kretschmann configuration, red light from a He-Ne laser (633 nm) is coupled into the dielectric layer and attenuated at the angle of resonance. The coupling and attenuation is manifested as a deep, narrow dip in the reflection of the structure taken as a function of incident angle. The position of the resonance angle is highly sensitive to the environment at the surface of the structure, and can therefore be used to accurately measure changes in the refractive index near to the interface. Our results are compared to the best previously reported in the literature, and show an improvement in the sensitivity on the order of 15 times.

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Poster # 92

Characterization and Modeling of High Temperature Polymer Matrix Composites (HTPMCs) for Aerospace and Space Applications

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High temperature polymer matrix composites (HTPMCs) used in aerospace and space applications are known to have limited lifetime due to environmental degradation. To date, the capability to predict the lifetime of HTPMCs has been elusive. The absence of robust techniques to characterize and model the spatial and temporal dependence of mechanical properties of the composite constituents has limited our ability to develop the next generation, affordable HTPMCs. The objective of the program is to investigate the dependence of the local mechanical behavior of HTPMCs at the constituent level on thermal aging/oxidation. The study will focus on understanding, 1) the coupling of mechanical stress and diffusion on thermal oxidation and local structural evolution, 2) the dependence of local mechanical behavior on the thermal oxidation, and 3) the development of a structure-based constitutive relation of HTPMCs with oxidation and degradation. To achieve the research objectives, thermal aging and nanoindentation will be used to characterize the local mechanical behavior of the NASA-Glenn newly developed PMR based polymers and composites at the constituent level. Comprehensive characterization of microstructure will be conducted to establish a deterministic link between the microstructure and the deformation behavior. Finite element analysis will be used to establish the structure-based constitutive relation to reveal the contribution of each individual constituent and the effect of thermal aging/oxidation. The microstructure-based constitutive relations will be validated with data from mechanical test and data from detailed characterization of the microstructure.

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Poster # 93

Fast 3-D AC electroosmotic pumps with non-photolithographic electrode patterning

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Electro-osmotic pumping is a promising battery-powered replacement for traditional pumping systems at the micro scale when dilute electrolytes are used. To avoid the drawbacks of pumping using DC, “ac electro-osmotic” (ACEO) pumps have been recently introduced. The advantages over DC electro-osmotic pumps include lower operating voltages at integrated electrodes, and absence of gas generation from electrolysis. The microchannels of these ACEO pumps consisted first of asymmetric, planar electrodes. A non-planar ACEO pump geometry was then introduced with electroplated three dimensional (3D) stepped electrodes. This design had a faster flow rate than the planar ACEO pump by an order of magnitude, but the fabrication process was complex. In this paper, we demonstrate a new fabrication method for these 3D interdigitated microelectrode arrays. The method eliminates the need for electroplating thick 3D electrodes; instead 3D interdigitated electrodes are created by shadow evaporation of thin films on 3D structures that could be injection molded. The pumps were characterized for flow speed versus applied voltage amplitude and frequency.

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Poster # 94

Data Dependency Based Intrusion Detection System: A New Data Mining and Cost Efficiency Analysis Model

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Finding an ideal database intrusion detection mechanism and the optimal configuration of the intrusion detection system is a difficult task. Although there are a few systems that can monitor the database activities and identify malicious transactions, the false positive and negative rates are relatively high. A multi-dimensional and multi-level database intrusion detection mechanism is proposed by this research. We also proposed a model that can be used to determine the economically optimal configuration of the data dependency based intrusion detection system.

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Poster # 95

University of Louisville Micro/Nanotechnology Center

Kevin Wash (UofL), Mark Crain (UofL), Joseph Lake (UofL), Curt McKenna (UofL)

This poster will provide an introduction to the University of Louisville Micro/Nanotechnology Center. Pictures and diagrams of the Belknap Research Building and the state of the art Microfabrication Cleanroom will be shown. The poster will also highlight many of the different areas of research currently in development in the Micro/Nanotechnology Center. Many of the different resources and equipment available at University of Louisville will also be listed. Finally, this poster names many of the personnel involved in the Microfabrication Cleanroom and shows many potential applications it will offer.

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Poster # 96

Kentucky Nanonet, Connecting Kentucky's Micro/Nano Research Community

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The KY nanoNET Initiative is a five-year program for the development of an infrastructure network and support system throughout Kentucky for the specific advancement of micro/nanotechnology and the many fields of research and education that utilize this pervasive technology. The KyNN is made up of three main components: the KyNanoNet web portal and associated tools, the KRUNCH shared software program and KORE, a statewide resource for lithography related services.

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