The GRADUATE SCHOOL
2013
Dr. Robert Zierolf
Interim Vice Provost and Dean of Graduate School

Dr. Margaret Hanson
Associate Dean of the Graduate School

Megan Tischner
Coordinator, Graduate Poster Forum
Friday, March 1, 2013

Participant Check-In  8:00 AM - 9:00 AM
MFA Art Gallery       9:00 AM - 1:00 PM
Poster Session 1     9:00 AM - 11:00 AM
Poster Session 2     11:00 AM - 1:00 PM
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<td>Dippy Aggarwal</td>
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<td>Computer Science &amp; Engineering, PhD</td>
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<td>Caroline Akinyi</td>
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<td>Abdulaziz Alsaqobi</td>
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<td>Xian Cao</td>
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<td>Maria Gomez</td>
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<td>Ranjani Ravi</td>
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Jennifer Mohler Geary 041
Special Education, EdD

Gary Motz 134
Geology, PhD

Gaurav Mukherjee 075
Mechanical Engineering, MS

Shikha Chaganti
Computer Science, MS

Nadeesha Nambukara Wellala 062
Chemistry, PhD

Nivedita Nivedita 081
Electrical Engineering, PhD

Brooke Norbeck 007
Physical Therapy, DPT

Florence Nyemba 027
Educational Studies, PhD

Ana Ozaki & Adam Hartke 091
Community Planning, MCP

Ganesh Moorthy Palanisamy 013
Pharmaceutical Sciences/Biopharmaceutics, PhD

Xing Pei 043
Electrical Engineering, PhD

Natasha Pierce 140
Geology, MS

Laura Pinelo 042
Chemistry, PhD

Kimberly Price 135
Health Education, PhD

Ranjani Ravi 004
Environmental Engineering, MS

Vikram Kapoor
Environmental Engineering, PhD

Peter Rej 015
Anthropology, MA

Julia Rine 038
Architecture & Interior Design, MSArch

Sanjeewa Rodrigo 006
Chemistry, PhD

Robert Ross 037
Chemistry, PhD

Md Ehsan Sadat 083
Physics, PhD
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Brooke Trimble  MFA Gallery
Fine Arts, MFA

Qingshi Tu
Environmental Engineering, PhD

Samuel Vaughn
Immunobiology, PhD

Jennifer Vernia
Chemistry, MS

Michelle Walker  MFA Gallery
Fine Arts, MFA

Eileen Wanamaker
Pharmaceutical Sciences, MS

Feng Wang
Materials Science, PhD

Huan Wang
Chemistry, PhD

Shanshan Wang
Educational Studies, PhD

Shujie Wang
Geography, PhD

Tingting Wang
Chemistry, PhD

Xiao Wang
Electrical Engineering, PhD

Yingying Wang
Biomedical Engineering, PhD

Geethika Weragoda
Chemistry, PhD

Niranjala Wickremasinghe
Physics, PhD

Gleason Wilson
Chemistry, PhD

Qiusheng Wu
Geography, PhD

Wenwen Yang
Chemistry, PhD

Bo Yang
Geography, MA

Gang Yang
Chemistry, PhD

Zhuo Yao
Civil Engineering, PhD
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<td>Xinjun Yu</td>
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Graduate Student Research Posters
Abstracts

Arts & Humanities
Life Sciences & Medicine
Physical Sciences & Engineering
Social & Behavioral Sciences

All students who present research posters at the Graduate Poster Forum are judged by two UC faculty members from the student’s field or a related field. The judges’ score sheets with comments and suggestions for improvement will be distributed to the participants following the event.
Effects of Urbanization on Annual Water Balance in Mill Creek Watershed

Urbanization impacts all aspects of the local hydrological cycle, and an accurate method for analyzing its effects is a critical element of sustainability research. In this study, continuous annual water balances are constructed for the Mill Creek Watershed, a highly developed watershed located in the Cincinnati, Ohio metropolitan area. Annual urban water fluxes are gathered for a period of 41 consecutive years (1970–2010) for the region and compared against pre-development hydrologic conditions. To better connect pre- and post-development, additional annual water balances are performed by modeling hydrologic conditions for several intervening periods in the catchment’s history using the computer program Aquacycle. A new variability analysis technique is then used to assess the area’s hydrologic sustainability. Additional information and analyses for the watershed are also considered, including land use changes over time, the continuing evolution of water and energy over time, and the potential urbanization mitigation effects of green infrastructure projects (i.e., rain barrels, green roofs, porous pavements, etc.).

Approaches to Side-Channel Attack Resistance: Migrating from Low-Level to High-Level Methods

The everyday hardware attacker is getting better at covertly stealing information while the everyday designer is still focused on performance optimizations – leaving users with incredibly fast and powerful, but vulnerable, devices. Side-Channel based attacks target underlying physical phenomena within hardware devices to extract meaningful, compromising information that allows full data recovery.

We propose, develop and showcase a two-part method for everyday designers to protect their devices at high levels of abstraction. Specifically, we focus on the controller logics (e.g., Finite State Machines) responsible for point of access arbitration, infrastructure control, various encoding strategies and pure cryptography applications. Preliminary results showed that insecure controllers exhibited correlations of up to 67% with respect to side-channel models while secured versions could reduce the correlations to below 16%. 
Vikram Kapoor  
Environmental Engineering, PhD  
Advisor: David Wendell, PhD

Ranjani Ravi  
Environmental Engineering, MS  
Advisor: David Wendell, PhD

Engineering Molecular Efflux Pumps for Solar-Powered Bioremediation of Surface Waters

The present standard for removing emerging contaminants from surface waters is activated carbon. Although carbon is commonly used in water treatment for removing a broad range of organic substrates, the cost of this prolific absorbance is specificity: contaminants such as antibiotics escape capture, due to their relatively low abundance compared to other organic matter. Also, the heat regeneration of activated carbon, which is critical for efficient and increased useful lifetime of the media, is energy intensive. Clearly, there is a need for an effective and selective antibiotic removal material, capable of functioning in organics-rich wastewaters with minimum energy input. Here we demonstrate the selective removal of ampicillin, vancomycin and ethidium bromide (a carcinogenic reagent) by engineering a light-powered proteovesicle molecular assembly using the multidrug efflux pump protein AcrB. When comparing the removal efficiency of our system to an equivalent amount of activated carbon using river water and sunlight, our vesicle system removed approximately twice the amount of antibiotics.

Altogether, AcrB-dR technology enables environmentally-friendly and cost-effective extraction of antibiotics from surface waters and allows potential antibiotic recovery and reuse through vesicle solubilization.

Ranjani Ravi  
Environmental Engineering, MS  
Advisor: David Wendell, PhD

Vikram Kapoor  
Environmental Engineering, PhD  
Advisor: David Wendell, PhD

A Novel RNA Virus Detection System Based on Duplex Specific Nuclease

In developing countries, norovirus, an agent for waterborne gastroenteritis, causes the death of 200,000 children annually. Molecular diagnostic methods based on quantitative reverse transcription polymerase chain reaction (RT-qPCR) offer a broader examination of the role of norovirus in epidemic and sporadic gastroenteritis. Because they use reverse transcription, these methods are costly and limited by low virus concentrations and inefficient viral RNA extraction methods. Here we report an assay for the detection of norovirus with high sensitivity and specificity. We use the specificity of the Duplex-specific nuclease (DSN), an enzyme that exhibits a strong preference for cleaving double-stranded DNA or single-stranded DNA in a DNA-RNA
hybrid duplex. Using the viral genomic RNA as a template, DSN preferentially cleaves fluorescent DNA probes in the DNA-RNA duplex, resulting in an amplified fluorescence signal. We spiked surface water collected from the Little Miami River with norovirus RNA and compared these results against RT-qPCR. Our preliminary results show a detection limit of 10 norovirus copies per assay, which is comparable to RT-qPCR. Because our method does not require a thermocycler and takes less than thirty minutes to complete, it holds great promise for developing countries where sporadic outbreaks of norovirus and other RNA virus infections have had catastrophic effects.

005

Cindy Lentz
Curriculum & Instruction, EdD
Advisor: Janet Mannheimer Zydney, PhD

Implementing Constructivist Learning Principles: From Teacher-Centered to Learner-Centered Instruction

This study examined the application of constructivist learning principles to the process of school change at an elementary school in Northern California. A qualitative case study was conducted over an eight-month period during the fifth year of a five-year commitment to school change. Triangulation of data, consisting of on-site observations and semi-structured interviews, produced a deep description of the change process from the viewpoint of the teachers at the school. Often those who made the most dramatic changes had created partnerships with peers who challenged them to think differently. Over half of the respondents said they had changed from a dominant belief in teacher control and knowledge to a belief in student choice in the learning process. Previous beliefs were described using statements such as “I felt I had to have all the answers” and “I would dish it out and you would absorb it.” Changed beliefs were more difficult to express and teachers used statements such as “This type of teaching makes the teacher’s role harder, not simpler.”

006

Sanjeewa Rodrigo
Chemistry, PhD
Advisor: Hairong Guan, PhD

Quick Installation of a 1,4-Difunctionality via Regioselective Nickel-Catalyzed Reductive Coupling of Ynoates and Aldehydes

For some time, we have needed to establish efficient methods to synthesize 1,4-difunctionalized molecules. In this work, intermolecular reductive coupling of ynoates and aldehydes in the presence of a silane reducing agent has been accomplished for the first time using catalytic amounts of Ni(COD)2, an N-heterocyclic carbene ligand, and PPh3. High regioselectivity has been demonstrated for the multi-component coupling reactions, and 19 invaluable silyl-protected γ-hydroxy-α,β-enoates have been synthesized. Synthetic applications of these molecules have been demonstrated by utilizing this methodology to synthesize other 1,4-difunctional compounds and oxygen-containing five-membered rings. The intermediacy of metallacycles in the catalytic cycle has been established by deuterium-labeling experiments.
Reliability and Validity of Two Agility Tests for Screening Non-Disabled Adults

Agility tests are routinely included in studies of fall risk among older adults or clinical subgroups with ambulation difficulties. Given the impact of agility on safety and productivity, reliable measures are needed to assess adults who do not suffer from constraints such as ceiling effects or safety/privacy concerns. To determine reliability and validity for a new Two Step Agility Test (TSAT) and Maximum Forward Step Length (MFSL) among novice raters and to assess concurrent validity with established fall risk measures, twenty-eight non-disabled adults of varying fitness and age were enrolled. Three trials of MFSL and TSAT were performed in a randomized order with other comparative agility tests. MFSL and TSAT test retest reliability was assessed by comparison with repeated testing ~1 week later. Inter-rater reliability using the best of two trials was excellent (ICC 0.99) for MFSL right, MFSL left, and TSAT. Both the TSAT and MFST are practical for inclusion in longitudinal studies of aging because minimal equipment, space and staff time/expertise are required for reliable administration with adults with highly variable levels of physical fitness.

Transcriptional Regulation of Fluconazole Susceptibility in *Candida parapsilosis*

*Candida parapsilosis* is a major cause of fungal infections in the United States. The development of high-level azole resistance in *C. parapsilosis* has recently been reported in bloodstream isolates. The ability to develop resistance to this antifungal class during therapy or prophylaxis makes this a significant problem in the management of candidiasis. Using RNA-Seq and real-time RT-PCR, we identified regulatory networks involved in azole resistance in *C. parapsilosis*. We compared the changes in gene expression between clinical matched fluconazole-susceptible and -resistant *C. parapsilosis* isolates representing the development of azole antifungal resistance during a course of fluconazole therapy used to treat endocarditis (isolate set 35177 (MIC <1µg/ml) versus 35176 (MIC >64µg/ml)) and during routine use of fluconazole prophylaxis in a NICU (isolate set 20360.053 (MIC <2µg/ml) versus 20360.066 (MIC >64µg/ml)). Although these isolates have similar azole susceptibility patterns, the mechanisms of resistance appear to be different. This research provides understanding of the molecular pathways involved in azole resistance in *C. parapsilosis* and is expected to lead to development of pharmacologic strategies that will circumvent the problem of azole resistance in all *Candida* species.
Cluster Analysis of Elemental Composition of Personal, Indoor, and Outdoor PM2.5 Mass Concentrations

The Relationships of Indoor, Outdoor, and Personal Air (RIOPA) study has collected measurements of the elemental composition of PM2.5 in indoor, outdoor and personal air samples. Samples of the mass concentrations of 36 elements ranging from Ag (silver) to Zr (zirconium) from about 70 subjects in each city were obtained from Los Angeles (CA), Houston (TX) and Elizabeth (NJ). Each subject in each city provides a data vector of 108 measurements. The goal was to relate personal air samples to indoor and outdoor air samples and other covariates. Before proceeding with this objective, we embarked on dimensionality reduction, which is the main objective of this presentation. We performed a number of cluster analysis methods on each of the sample types of data (indoor, outdoor and personal). We found that elements mainly of crustal origin and elements of anthropogenic sources band together separately in the clusters of outdoor samples. In addition, elements associated with vehicular emissions cluster together.

The Development and Validation of the Algebra Curriculum-Based Measure

This study develops and validates the algebra curriculum-based measure (ACBM) to assess preschool children’s sorting and classifying ability based on one and two attributes simultaneously. The hypothesis is that two subconstructs (sorting and classifying ability based on one attribute and two attributes simultaneously and algebraic understanding and reasoning with respect to sorting and classifying skills) contribute significantly to the general construct of sorting and classifying skills, making the ACBM a significant indicator of preschool children’s sorting and classifying ability. A convenience sample of 115 children ages 3 to 5 was selected from three accredited day care centers in Cincinnati during the 2012-2013 school year. I use exploratory factor analysis to evaluate the hypothesized model and answer two research questions. What is the contribution of each subconstruct to the general construct on the ACBM? What is the technical adequacy of the ACBM in measuring preschool children’s sorting and classifying abilities? Data analysis is in progress and expected to be completed by the end of January 2013.
Developing Operating Mode Distribution Inputs for MOVES Using Computer Vision-Based Vehicle Data Collector

Reliable vehicle activity inputs to the U.S. EPA MOVES model are necessary to maximize the modeling capacity and allow federal and state officials to improve the quality of transportation management. For this purpose, operating mode distribution and other traffic activity data must be collected rapidly for the MOVES model input. This study develops a computer vision-based software tool called Rapid Traffic Emission and Energy Consumption Analysis (REMCAN) to enable rapid operating mode distribution profiling for the MOVES model. The video-based system provides traffic activity inputs—including vehicle speeds and acceleration/deceleration rates—that are difficult to extract from traditional traffic data extraction sources. The speed measurement, the most critical factor for operating mode profiling, is calibrated by a coefficient that converts screen space to real-world space. Three case studies with different traffic operation scenarios are used to demonstrate the capability of REMCAN system. The integration of REMCAN traffic activity data collection and MOVES operating mode distribution generation provide timely, low-cost and accurate environmental impact assessment compared to traditional data sources for emission estimation analysis.

Design and Development of Polystyrene/Fe3O4@Silica Janus Nanocomposites for Drug Delivery and Targeting in Cancer Therapy

Further advancement in cancer therapy requires multi-functionalities from carriers, which is still challenging due to the potential interference among different species. We designed and developed Polystyrene/Fe3O4@Silica ternary Janus nanocomposites, which consist of polystyrene cores and Fe3O4@Silica hybrid half shell. The Janus nanocomposites offer two distinct surfaces, one of which was conjugated with folic acid for targeting, while the other was utilized for drug storage via pH-sensitive hydrazone linkers. The conjugates displayed pH-dependent drug release behavior in vitro and showed targeting effect in cell cytotoxicity.
Modulation of CYP3A4 by BEZ235, a Dual Inhibitor of PI3K and mTOR

BEZ235 is a novel inhibitor of PI3K and mTOR, which are often constitutively activated in tumor cells. Based on the observations that this agent acts synergistically with the mTOR inhibitor everolimus (RAD001) in tumor xenografts animal models, a phase I-b2 trial has been initiated to assess this combination in patients with solid tumors. Since RAD001 is predominantly metabolized by CYP3A4, we investigated whether BEZ235 modulates CYP3A4 expression and activity and would, therefore, have the potential to impact RAD001 pharmacokinetics. To examine the effects of BEZ235 on both the expression and activity of CYP3A4, we employed primary human hepatocytes, pooled human liver microsomes and cell-based assays. BEZ235 appears to have dual contrasting effects on CYP3A4. While it activates PXR and induces CYP3A4 expression, it potently inhibits CYP3A4 activity. Further studies are in progress to assess the impact, mechanistically and clinically, of BEZ235 on everolimus PK in patients.

Loan Tactics among Ohio Valley Organic Farmers: An Ethnographic Study of Assuring Success

Organic farming makes up the largest growth segment in farming (Organic Trade Association) and is considered vital to fighting hunger and climate change (Maddey and Johns 2007). Agribusiness is under scrutiny and organic produce is desired as an alternative to corporate food, which consumers associate with food-borne illnesses and business malpractice (Eades and Brown 2006). As with other small farms, the success of organic farms depends on the urban factor: the idea that proximity to an urban center increases the likelihood of success (Eades and Brown 2006; USDA-ERS 1999). Defining what constitutes success, however, is problematic given the term's subjectivity. The United States Department of Agriculture’s Economic Research Service identifies success in terms of gross sales increases; land expansion; the ability to survive adverse market conditions and poor harvests; and an operation that provides adequate income without requiring work off the farm. In response, I have developed the success triad, which considers the factors of longevity, profit and expansion. To maximize these factors, I hypothesize that organic farmers will utilize lines of credit, such as loans, to expand land and increase sales and that organic farmers will use tactics and strategies that differ from conventional farms to obtain these loans.
Peter Rej  
Anthropology, MA  
Advisor: Heather Norton, PhD

Measuring Mitochondrial DNA Diversity and Demographic Patterns of the Tribal and Caste Populations from the Northeast Indian State of Assam

The human mtDNA molecule is a non-recombining nucleotide that has a high mutation rate; is inherited maternally; and has a high copy number, all of which make it a high-resolution genetic marker that can be utilized to test hypotheses on the genetic, linguistic, and cultural evolution of Homo sapiens. Investigating these relationships between populations can also elucidate sociocultural patterns, including societal matrilineality; patrilineality; and the stratification that results from a social caste system. I am analyzing mtDNA polymorphisms in three tribal populations (Ahom, Kachari and Rabha) and in the caste populations of the ethnically diverse Northeast Indian state of Assam. Because Assam connects Asia and the Indian subcontinent, the region has been in a state of demographic flux ever since the first humans arrived during the Early Paleolithic. Despite their rich history and the abundance of diversity in the region, there have been no mtDNA investigations that have exclusively focused on the autochthonous populations of Assam. There have only been a handful of genetic surveys that have even looked at Northeast Indians in general, and these have only compared their diversity to the rest of India (Cordaux et al. 2003; Cordaux et al. 2004; Chandrasekar et al. 2009). I answer demographic questions by measuring haplogroup frequency; intra- and intergroup diversity; admixture (gene flow); and genetic and linguistic co-evolution among the Assamese caste and tribal populations.

Hengye Jing  
Environmental Engineering, PhD  
Advisor: George A. Sorial, PhD

Bacterial Biofilm Interaction with Engineered Nanoparticles

Biofilms form in different environments under either field or laboratory conditions on naturally occurring and man-made surfaces. The interaction of nanoparticles (NP) with bacterial biofilms can help evaluate the risk of NPs in natural environments, including aquatic ones. This study focuses on the interaction and diffusion of CeO2 nanoparticles with biofilms from two types of microorganisms: Pseudomonas fluorescens and Mycobacterium smegmatis. Scanning electron microscopy (SEM) provided information on the distribution of CeO2 penetration within the biofilm and the effects that NPs exerted on the underlying substratum of the biofilm. Batch studies were conducted to understand adsorption and desorption kinetics and equilibrium of ceria onto biofilms. A Live/Dead BacLight Bacterial Viability Kit and confocal laser scanning microscope were used to estimate the live and dead bacteria within the biofilm when exposed to ceria NPs. Kinetics of adsorption and diffusion of NPs within the biofilm at different growth stages and viability were conducted.
Listening to stories at a very early age helps children develop their language skills. Story comprehension skills have been suggested to play an important role in language development. In this study, we aim to compare a passive listening (PL) story task to an active-response (AR) version that includes online performance monitoring using independent component analysis (ICA) on functional magnetic resonance imaging (fMRI) data from 21 adolescents (ages 14-18 years) in order to visualize a brain network associated with processing an aurally-presented story. The PL version uses a 30-second on-off block design, and the AR version uses an event-related design that includes specific sparse data acquisition. Both tasks activate similar brain networks, including the auditory, temporoparietal and frontoparietal language networks – and cover the primary auditory cortex, Wernicke’s area and Broca’s area. The AR task elicits more extensive networks, including the left dorsolateral prefrontal, anterior cingulate and sensorimotor networks. These networks are likely associated with memory, attention, self-monitoring and motor-planning elements engaged especially in the AR task. In addition, we found significant positive correlation between the online response time and the strength of connectivity between frontal language network and sensorimotor network for the AR task, which may suggest that a longer reaction time indicates a stronger connection between the frontal language network and the sensorimotor network.
Continuous Rare Cell Extraction Using Self-Releasing Vortex in an Inertial Microfluidic Device

This work presents an inertial microfluidic device for size-dependent continuous extraction of rare cells. Cell separation, such as extraction of circulating tumor cell (CTC) and leukocytes from blood, is a critical sample preparation step in cell biology and clinical diagnostics. While continuous cell separation in spiral inertial microfluidic devices has been reported by our group, limitations with regard to selectivity and sensitivity preclude the use of these devices for rare cell extraction. Our group and DiCarlo, et al. recently reported a rare cell extraction approach based on vortex trapping. However, the system faces a number of shortcomings, stemming from the need to switch flows to release trapped cells (which increases operation complexity). The extraction capacity and efficiency are limited by the vortex dimensions. Herein, we present a simple inertial microfluidic system using a self-releasing vortex that can achieve continuous rare cell extraction with high selectivity and no limitation on capture capacity.
Maria Gomez
Molecular & Developmental Biology, PhD
Advisor: Katherine Yutzey, PhD

The Role of BMP Signaling in the Progression of Calcific Aortic Valve Disease (CAVD)

Calcific aortic valve disease (CAVD) affects >2% of the US population, but its incidence increases to 10% in the aged population. Currently the standard treatment is valve replacement. Because this treatment is associated with long-term complications and significant re-implantation rates, it is not always an option for elderly patients. CAVD is a progressive disease but, so far, there are no pharmacologic-based therapies that can prevent or inhibit CAVD. Despite its clinical significance, the pathogenic mechanisms that drive the development of CAVD and that could serve as potential therapeutic targets are not well understood. Human studies of diseased valves provide initial evidence that the bone morphogenetic proteins (BMPs) play a critical role in the progression of CAVD. In addition, the BMP pathway has essential functions during osteogenic gene induction, a key feature of CAVD. Our preliminary studies demonstrate that increased phosphorylation of Smads 1/5/8, downstream effectors of the BMP pathway, precedes osteogenic gene induction and localizes with calcification in a novel mouse model of CAVD. Our central hypothesis is that activation of BMP signaling and pSmad1/5/8 activation promote CAVD progression. Our long-term goal is to determine the underlying role of the BMP pathway and its downstream targets in the pathogenesis of CAVD and to use a pharmacologic inhibitor of BMP signaling as a potential treatment for CAVD in the Klotho-null mice, a novel mouse model of CAVD.

Karthickeyan Chella Krishnan
Molecular Genetics, Biochemistry, & Microbiology PhD
Advisor: Malak Kotb, PhD

Effects of Zinc on Streptococcal Cysteine Protease (SpeB) and its Biological Implications

Group A Streptococcus (GAS) is the causative agent for a plethora of human diseases, ranging from non-severe pharyngitis to fatal necrotizing fasciitis. SpeB is the major cysteine protease produced by GAS and is initially synthesized and secreted as a 42-kDa zymogen, which self-processes to the 28-kDa mature active form. When active, this protease cleaves a wide variety of proteins belonging to both the host and bacteria. SpeB expression during GAS infection has been widely studied, yet its virulence correlation remains elusive. In order to further understand the importance of SpeB expression, we developed a mouse cage model wherein we found SpeB expression to be irreversibly muted once the bacteria become invasive, resulting in a hypervirulent state of the bacteria leading to many severe disease outcomes. Further studies...
conducted in our lab in identifying the key host regulatory factors involved in variable SpeB expression have established the possible role of human transferin and lactoferrin mediated by the iron saturation status of these proteins. As a follow-up to this study, we sought to determine if iron or any other metals could possibly be involved in SpeB regulation. We found that the divalent metal zinc (Zn$^{2+}$) was able to regulate SpeB activity on a post-translational level and that this regulation was reversible. Based on our findings, we propose that Zn$^{2+}$ availability in the niche of the bacteria can intervene with SpeB activity and thereby protect the integrity of several other virulence factors essential for bacterial survival and disease severity.

Adam Hehr
Mechanical Engineering, MS
Advisor: Mark J. Schulz, PhD

Embedded Carbon Nanotube Thread Strain and Damage Sensor for Composite Materials

This research investigates the use of carbon nanotube (CNT) thread for use in distributed structural health monitoring (SHM) systems, specifically as an embedded damage and strain sensor for laminated polymeric fiber composite materials. Specific areas of investigation deal with strain sensor performance, damage mode identification, sensor invasiveness and potential SHM design architectures for aircraft. The end goal of this research is to improve upon composite material reliability, which will increase material use in high performance applications.

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Anagha Jamthe
Suryadip Chakraborty
Saibal Ghosh
Computer Science & Engineering, PhD
Advisor: Dharma P. Agrawal, DSc

Activity Monitoring in Patients with Parkinson’s Disease Using Wireless Sensor Networks

Parkinson’s disease (PD) is a neuro-degenerative movement disorder, which leads to progressive motor impairment, that may respond poorly to currently available therapies. Patients exhibit a variety of motor symptoms including tremor, gait and balance impairment. The latter may express itself in the form of shuffling, decreased stride length (shortened distance between feet when walking), festination (rapid increase in cadence at greater expense of stride length), and freezing of gait (FOG, inability to lift the feet off the ground when walking). Currently, physicians use the Unified Parkinson’s Disease Rating Scale (UPDRS) to quantify the severity of the disease in a patient at the clinic. However, due to the episodic nature of FOG and other forms of gait impairment, motor deficit is poorly quantified in the clinic and may not accurately represent the daily burden of impairment and subsequent risk of falls. Studies have shown that most FOG events occur when patients are turning or walking in narrow or crowded places. Therefore, we suggest the use of Wireless Sensor Networks to determine gait impairment. Gyroscopes and proximity sensors can be used to conduct these tests in patients’ homes, providing more
accurate data regarding the frequency and severity of gait impairment. When necessary, FOG can also be measured offline by calculating the coefficient of the variation of step amplitude using kinematic sensors, force sensitive insole sensors and accelerometers.

Nikki Bibler
Educational Studies, PhD
Advisor: Christopher Swoboda, PhD

Impact of Ignoring Non-Random Conditions of a Facet within a Generalizability Study

The purpose of this study is to examine the impact of ignoring non-random conditions of the item facet within a multiple mini interview (MMI), the multi-sampling approach to the medical school preadmissions interview, using a generalizability (G) study. The more random and representative the sample used in G theory is, the closer the aggregate scores approximate the “universe score,” which is analogous to the “true score.” However, if the conditions of a facet are not random or representative, this assumption breaks down, and as with other analyses, G studies are only as robust as the data used in analysis (Brennan, 2001). The literature identifies up to 87 different attributes considered important for an aspiring physician (Albanese et. al, 2003), yet the MMI typically assesses only 4-6 attributes. Therefore, there is much variation across MMI studies in terms of the specific attributes assessed. Current studies treat the attributes assessed as random facets (Eva et. al., 2004), but because of the variation in attributes assessed, the item facet should be considered fixed. Using simulated data to generate the known parameters of MMI rater biases and MMI rater errors, this study will demonstrate the impact of ignoring non-random conditions of the item facet through the evaluation of a design that represents the MMI. The results of this study can impact the application of G theory to future MMI studies.

Martial Longla
Mathematical Sciences, PhD
Advisor: Magda Peligrad, PhD

On Functional Central Limit Theorem for Reversible Markov Chains with Nonlinear Growth of the Variance of Partial Sums

We provide a study of the functional central limit theorem (CLT) for stationary Markov chains with self-adjoint operators and general state spaces. We investigate the case when the variance of the partial sum is not asymptotically linear in $n$ and establish that conditional convergence in distribution of partial sums implies a functional CLT. The main tools are maximal inequalities that are further exploited to derive conditions for tightness and convergence to the Brownian motion.
Florence Nyemba  
Educational Studies, PhD  
Advisor: Lisa M. Vaughn, PhD

A Participatory Action Research to Examine the Immigration Experiences of Black Zimbabwean Immigrant Women in Greater Cincinnati Region

This study investigates the migration of black Zimbabwean immigrant women residing in the U.S. in order to understand how these women create and give meaning to their experiences. The study will address the current statistics/trends that reference Zimbabwean immigration to the U.S. and the sociocultural, political and economic context of Zimbabwe that has contributed to women's choice to migrate. It will also explore the reasons black Zimbabwean immigrant women take the initiative to migrate alone, often leaving their families behind, and the challenges they encounter in the U.S. The researcher proposes a qualitative participatory action research approach (PAR) with data collected using a Photovoice research design. The sample will comprise seven to ten black Zimbabwean women immigrants. Participants will use cameras to take photographs related to the research question. Data analysis will be guided by Dr. Wang’s “SHOWed” (1999) approach. This PAR study will provide more information about black Zimbabwean women's immigration experiences and help to give a voice to this marginalized immigrant population.

Osmary Contreras  
Environmental Engineering, MS  
Advisor: George A. Sorial, PhD

A Comparative Study of Tailored Activated Carbon from Waste Tires against Commercial Activated Carbon (F400) for the Removal of Methylene Blue

In this study, the use of waste tires as a raw material for developing activated carbon is evaluated. Tires of 400µm nominal size were impregnated with potassium hydroxide in different ratios (0:1, 1:1, 2:1, 3:1, 4:1 and 5:1) and a full factorial experimental design was conducted to evaluate two factors on activation. One is the activation temperature (600, 700 and 800°C) and the second is contact time (1, 2 and 3 hrs). The BET surface area and pore size distribution for each carbon was determined. Then, the condition that provided the highest surface area and desirable pore sizes was used for evaluating the maximum capacity of adsorption for the removal of methylene blue (Textile dye). Finally, the developed adsorbent was compared to commercial activated carbon (F400).
Fabiola Bittencourt
Molecular Genetics, Biochemistry, & Microbiology, PhD
Advisor: William Miller, PhD

The MCMV Encoded M33 GPCR Is Required for Viral Growth Within Tissues Important for Horizontal Transmission

Murine cytomegalovirus (MCMV), which has been widely used as a model for viral pathogenesis, encodes two GPCRs: M33 and M78. M33 signals in a ligand-independent fashion through Gaq/PLC beta and is required for viral persistence in tissues important for horizontal transmission, including the salivary gland. Our objective was to determine if M33 is required for dissemination to the gland or growth within the gland itself. Using an immunodeficient mouse model, we demonstrated that wildtype and M33-knockout viruses are found in similarly high levels in the liver and spleen, while only the wildtype virus can be detected at high levels in the salivary gland. Increasing the infectious dose enabled us to track viral dissemination at earlier time points and with higher sensitivity. We demonstrated that both viruses reach the gland, but the M33-knockout virus fails to amplify once there. Moreover, microscopy experiments indicated that the M33-knockout virus failed to spread efficiently within acinar epithelium. Thus, M33 appears necessary for viral spread and amplification within the actual substructure of the gland. Future experiments aim to use molecular approaches to investigate the M33 signaling pathways required for viral growth within the gland.

Haley Titus-Mitchell
Neuroscience/Medical Science Scholars Interdisciplinary, PhD
Advisor: Nancy Ratner, PhD

Unraveled, Molecular Mechanisms Underlying Disrupted Myelination in Gain of Function Rasopathies

Neurofibromatosis type 1 (NF1) is caused by a mutation of the NF1 tumor suppressor gene and Ras persists in the active GTP-bound state. Costello syndrome is a rare GOF rasopathy caused by activating mutations of H-Ras. Central nervous system (CNS) manifestations of NF1 may be representative of demyelination, including macrocephaly, increase in white matter tract size, and T2 hyper-intensities on MRI. Additionally, learning and developmental disorders are present in a majority of NF1 patients. Our hypothesis is that aberrant CNS glial cell proliferation/differentiation and defects in white matter are due to altered activation of the Ras/ MAPK pathway in the oligodendrocyte cell lineage. We tested whether canonical Notch signaling is an effector of Ras in oligodendrocytes. We conditionally tamoxifen induced loss of Nf1 or constitutively activated H-Ras in adult mice and found decompaction of myelin as well as an increase in large unmyelinated fibers in the white matter tracts, including the corpus callosum, anterior commissure, and optic nerve. We found an increase in the oligodendrocyte cell lineage and an increase in the number of oligodendrocyte progenitor cells with canonical Notch pathway activity in white matter tracts. Pharmacological inhibition of Notch intracellular domain (NICD) cleavage in vivo partially rescued decompaction of myelin in white matter tracts of the Nf1 and HRas mutant mouse models.
Dippy Aggarwal  
Computer Science & Engineering, PhD  
Advisor: Karen C. Davis, PhD

From the Enterprise World to the Cloud Platforms: Building Metadata Bridges

Data warehouses represent a central repository of data created by consolidating information from two or more disparate sources in order to facilitate reporting and analysis of the integrated information. However, the different modeling schemes adopted by different sources introduce model-based heterogeneity, raising challenges in the processes of data warehouse schema creation and enterprise-wide schema interoperability. These problems are further exacerbated with the proliferation in the operational data models accompanied by an increasing number of organizations embracing the cloud computing paradigm for delivering data analytics solutions. Our work aims to provide a generic framework for mapping schemas expressed in heterogeneous models in a seamless manner. This framework includes three families of data models: (1) operational models that represent data sources, (2) multidimensional models that capture integrated data warehouse schema requirements, and (3) cloud data models that serve as the target implementation platform. Our approach provides a formalism to restructure data warehouse designs to adapt them to the cloud data stores. The mapping framework between multidimensional constructs to cloud stores also lays groundwork for query modeling that will enable an end user to specify queries in familiar high-level query languages and automatic transformation of those queries into cloud-platform query languages. In addition to the schema interoperability illustrated here, it is anticipated that the approach supports round-trip engineering and all three phases of schema design, including conceptual, logical and physical design.

Marcia Gail Headley  
Educational Studies, PhD  
Advisor: Christopher Swoboda, PhD

An Emerging Theory of Symbolic Mathematics Language Literacy Development

Communication is a fundamental goal of mathematics education as it is necessary for justifying and sharing mathematical reasoning as well as analyzing and evaluating the mathematical work of others. It is well established that pedagogical, cultural and neurological differences influence students’ ability to translate written language into spoken words and vice versa. Initially, the phonological deficit hypothesis was greeted with hesitation because decoding words falls short of the goal of reading comprehension. However, today phonological assessments and instruction are critical components of reading and writing education. Furthermore, a growing body of evidence across languages suggests that differences in the orthographic and linguistic nature of language impacts the typical trajectory of reading and writing acquisition. Finally, individual learning difficulties may be explained by biological differences at the brain level. Together these results suggest that a theory of symbolic mathematics language literacy (SMLL) acquisition may be foundational to understanding mathematical communication. SMLL is distinct from numeracy and
mathematical proficiency, which require conceptual understanding. SMLL is also distinct from traditional reading literacy as written mathematics requires additional characters and uses common punctuation in novel ways. Specifically, SMLL entails the ability to read, speak and write the unique symbols and language of mathematics. The purpose of the research in progress is to analyze the validity of a Symbolic Mathematics Language Literacy Measurement Tool prototype. Such a tool is necessary to begin mapping typical SMLL acquisition and has implications for classroom instruction.

033

Fathima Thowfeik
Chemistry, PhD
Advisor: Edward Merino, PhD

Biochemistry of the Cellular Response to an ROS-Activated Agent

Developing chemotherapeutics with enhanced selectivity is a major goal in cancer drug design. With this in mind, we designed novel anti-cancer agents using a pro-drug strategy. The designed agents are selective against leukemia cells compared to blood cells. These pro-drugs are activated by oxidative stress, a complex cellular pathway. A key unanswered question in the development of these agents is what leads to their activation within a cell. Gene expression in untreated leukemia cancer cells was investigated. Genes within three categories were quantified: oncogenes, antioxidant defense, and DNA repair using two agents. In five cell lines, we correlated IC50 with normalized gene expression. Out of 111 mRNA transcripts assessed, twenty had a correlation coefficient (r) of >0.75 for compound 1, while twenty-six were identified with a structurally similar agent. Significantly these genes showed potency in both cases: GPX7, GSTZ1, CSDE1, CCS, MMS19 and MDM4. A rationale why these agents are indicative of high potency is shown.

034

Maria Fox
Anthropology, MA
Advisor: Katherine Whitcome, PhD

Neandertal Lumbopelvic Anatomy and the Biomechanical Effects of a Reduced Lumbar Lordosis

A fundamental change associated with bipedalism was the evolution of a lumbar lordosis. Recent research suggests that unlike early hominins and modern humans, Neandertals were hypolordotic. Absence of a lordosis in Neandertals is surprising given both the evolutionary and biomechanical relevance of the lumbar curve in bipedal locomotion. To better understand the function of the reduced lumbar lordosis in Neandertals, I will investigate the function and anatomy of the lumbopelvic complex through two paired methods: a) kinematic assessment of movements of the lumbopelvic complex in human subjects walking with an experimentally reduced lordosis, and b) skeletal analysis of modern human variation in the lumbar and pelvic regions and comparison to known Neandertal specimens. I predict that among modern humans, those with a reduced lumbar lordosis will share other anatomical features of the lumbopelvic complex with Neandertals. This lumbopelvic complex would include a lesser degree of wedging in the lower lumbar verte-
brae and possibly a more posteriorly tilted pelvis in modern subjects. It is also likely that Neandertal and hypolordotic modern human gaits exhibit similar deviations, such as a reduced walking speed and shorter stride. When both the gait kinematics of experimentally induced hypolordosis in modern bipeds and the relatively short legs of Neandertals are taken into account, it suggests that Neandertals were less efficient bipeds than modern humans and, thus, likely expended greater energy in their foraging and hunting efforts.

Parveen Kumar
Physics, PhD
Advisor: Leigh M. Smith, PhD

Photocurrent Spectroscopy of Semiconductor Nanostructures

We study the photocurrent from photoexcited charge carriers in semiconductor nanostructures. As grown nanowires (NW) or nanosheets (NS) are sonicated in methanol and dispersed on Si-SiO insulated substrate. Photolithography followed by Ti/Al (20nm/300nm) metal evaporation and lift-off is used to fabricate contacts in metal-semiconductor-metal across single NW/NS. Spatial imaging of the photocurrent shows that the photosensitive regions are localized at the reverse biased contact for Schottky type contacts and uniformly distributed throughout the NS/NW for Ohmic contacts. We use photocurrent spectroscopy to determine the crystal structure and the orientations of atoms in these nanostructures. The goal of this project is to demonstrate the promise of these single nanoscale devices for future electro-optical devices.

Robert Ross
Chemistry, PhD
Advisor: Patrick A. Limbach, PhD

Thermus thermophilus tRNAs Asn, Asp, His, and Tyr Contain Guanosine rather than Queuosine at Position 34

*Thermus thermophilus* is a gram-negative *thermophilic* bacteria that has served as the model organism for recent studies into ribosome structure and function. Unlike a majority of bacteria, *Thermus* does not possess the hyper-modified nucleoside queuosine (Q) within its tRNAs. In other bacteria, tRNAs coding for asparagine, aspartic acid, histidine and tyrosine contain Q, modified in place of guanosine, at position 34 – the wobble position. While the exact function of Q is still not understood, it appears that this modification may enhance translational fidelity through reading frame maintenance or improved decoding. Before undertaking a detailed study into the significance of queuosine’s absence in *Thermus*, we first sought to determine whether some other modified nucleoside is found at the wobble position of these four tRNAs. To answer this question, individual tRNAs from *Thermus* were purified using hybridization probes attached to biotinylated streptavidin beads. These purified tRNAs were digested with RNase A or T1 and the resulting oligonucleotides were analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS). Mass spectrometry sequencing of the anticodon region of these four tRNAs reveals each to contain the genome-encoded guanosine, with no evidence that other modifications are found in place of queuosine for *Thermus* tRNAs. In addition to presenting the data characterizing the anticodon
sequences for these four tRNAs, additional sequence information from each will be presented, including placement of modified nucleosides found at other sequence locations.

Niby Kannai Itteera  
Counselor Education, EdD  
Advisor: Cirecie West Olatunji, PhD

Alcoholism and Spirituality

Drug and alcohol abuse affects millions and causes serious health complications and emotional issues, such as dementia, cardiomyopathy and liver disease. Alcoholism is the third leading life-style related cause of death in the U.S. Often spirituality is a significant element of treatment. In the research literature during past ten years, there are mixed results for the use of spirituality in the recovery treatment. Spirituality helped many achieve a speedy recovery, but for others, it led to stress and to continued drug abuse. The different results forced researchers to reconsider the content of spirituality. One of the distinctions in spirituality can be positive and negative spirituality. Positive religious coping can be seen as a positive secure, loving, benevolent relationship with God and finding an optimistic meaning for struggles in life, but negative spirituality leads one to the fear of punishment from God for sin or abandonment from God.

037

Julia Rine  
Architecture, MSARCH  
Advisor: Jeffrey Tilman, PhD

The Effects of Diversity and Cultural Change on Historical Preservation and Monuments within the United States

The United States is constantly growing and diversifying through immigration and the mixing of cultures. Diversity and cultural change impact the way American citizens value and treat historical preservation and monuments. While some events and memorials may have been valued by past generations, subsequent generations may overlook, discredit or dislike those same monuments. The translations that occur at the site of a monument may also impact the views and importance of that monument to the American people or the ethnic group it may represent. Historical monuments may also be controversial to different groups or generations of Americans. These issues can, in turn, impact the care, restoration, preservation or removal of a monument.
Manufacturing and Applications of Carbon Nanotube Sheets

Individual carbon nanotubes (CNTs) have exceptional mechanical and electrical properties. The transfer of these extraordinary qualities into CNT products, without compromising performance, remains a challenge. This paper presents an insight in the manufacturing of CNT sheets, the use of plasma for functionalization of nanotubes and their applications. Sheets of multiwalled carbon nanotubes (MWNTs) drawn from spinable CNT arrays have been developed. The sheets composed of nanotubes aligned in the pulling direction as shown via the scanning electron microscope characterization. The alignment of the nanotubes imparts anisotropic properties to the sheet and leads to a significantly higher electromagnetic interference (EMI) shielding effectiveness. Surface modification of aligned MWNT sheets was carried out via an atmospheric pressure plasma jet during the post-treatment process. Helium/oxygen plasma was utilized to produce carboxyl (-COO-) functionality on the surface of the nanotubes. X-Ray Photoelectron Spectroscopy confirmed the presence of functional groups on the nanotube surface. The sheet is further characterized by Raman spectroscopy, Fourier transform infrared (FTIR) spectroscopy and contact angle testing. Composite laminates made from functionalized CNT sheets in a polyvinyl alcohol (PVA) matrix demonstrate more than 100% increase in tensile strength over those made with pristine sheets used as reinforcement material.

Nonapoptotic Function of Caspase-3 Pathway Drives the Reorganization and Maturation of Corticospinal Circuits

Experimental manipulations in animal models and clinical observations of human patients have demonstrated the important roles of corticospinal circuits (CSCs) in controlling voluntary movements, but the connectivity of CSCs remains unclear. In mice, the majority of the descending corticospinal axons synapse with spinal interneurons (INs). These INs relay cortical inputs to motor neurons (MNs) and complete the disynaptic connections between the cortical neurons and MNs. We have established a dual-color transsynaptic retrograde pseudorabies virus (PRV) tracing assay to visualize CSCs for functionally related muscle pairs in each injected mouse. We observed a clear segregation between INs and MNs at the spinal cord level for synergistic or antagonistic muscle pairs. In early postnatal mice, at the level of the motor cortex, the largely segregated INs-MNs networks of synergistic muscle pairs converge to common cortical neurons, creating convergent CSCs to control synergistic muscles. By contrast, the antagonistic motor neuron pools are connected by distinct populations of cortical neurons via different sets of INs at the early postnatal stage. As CSCs mature, the segregated CSCs for antagonistic muscle pair are rewired into convergent circuits. Here we show that the nonapoptotic activation of caspase-3 is localized to descending axons during the critical period and is required for this structural plasticity. The maturation
Preservice Teacher Use of Adaptive Strategies with Diverse Learners

Diverse learners have a variety of interests, needs and proficiencies that produce complex challenges in inclusive secondary science classrooms. Evidence indicates that adaptive teachers meet the needs of diverse learners and produce positive student outcomes; therefore preservice teacher preparation calls for skill in adaptive teaching strategies. The purpose of this descriptive qualitative study is to determine (a) how preservice teachers use adaptive strategies with a population of diverse learners in urban classrooms and (b) preservice teachers’ understanding of the use of adaptive strategies. Using a framework based on Universal Design for Learning, three preservice secondary science teachers were included in this study of adaptive strategy use and rationale. Through the investigation of data sources (including interviews, observations, assessments and lesson plans) results indicate that preservice teachers have a better understanding of how to use adaptive strategies concerning student engagement, while their knowledge of adapting teacher representation of information and student expression is limited. Implications for the design of future teacher preparation programs are included.
Copper-Based Sensor for Point-of-Care Measurement of Zinc in Serum

We report the first copper-based microsensor for electrochemical measurement of zinc in serum. Zinc is a trace metal that requires carefully monitoring, yet current methods are too complex for a point-of-care system. Electrochemistry offers a simple technique for metal detection, but the conventional electrode materials are difficult or expensive to microfabricate. Our sensor uses copper as a low-cost electrode material that is simple to fabricate. The sensor shows competitive performance in electrochemical detection. Anodic stripping voltammetry of zinc exhibited 91 nM limit of detection and successfully determined its concentration in serum. These features make our sensor suitable for disposable, point-of-care applications.

Perceiving Action Capabilities with Objects that Are No Longer Present

An experiment was conducted to test whether individuals are capable of perceiving their action capabilities with objects that are no longer present. Participants judged their ability to stand on a slope while wearing a backpack on the front or back of their body (control). Participants then attempted to judge their ability to stand on a slope a) without a backpack but as if they were wearing it (memory condition) and b) with a backpack on the opposite side of their body as they judged (interference condition). Participants indicated that they could stand on similar slopes in the control and memory conditions, but their estimates became larger in the interference condition. These results suggest that participants made larger slope estimates to compensate for the weight added to the opposite side of their body. The results also replicate past research on remembering action capabilities with objects that are no longer present.
Thomas Malgieri  
Geology, MS  
Advisor: Carlton E. Brett, PhD  

Preliminary Revision of the Sequence Stratigraphy and Nomenclature of the Upper Maysvillian-Lower Richmondian Strata Exposed in Kentucky  

Late Ordovician (Katian) strata of Kentucky in the Cincinnati Arch region display a regional change in lithologic and faunal gradients corresponding to a southeast-shallowing epicontinental ramp. While a detailed sequence stratigraphic framework has been established for the lower Cincinnatian, that of the upper Maysvillian-lower Richmondian succession of northern and central Kentucky has not been studied in detail. Moreover, locally and inconsistently applied lithostratigraphic terms reflecting facies changes along the ramp have complicated precise subdivisions of sequences into component cycles and inhibited recognition of regionally consistent patterns. This study uses high-resolution facies analysis and tracing of distinctive stratigraphic markers (including biostromal horizons, rhythmic intervals, erosion and flooding surfaces, and distinctive fossil epiboles across lithofacies and nomenclatorial boundaries) to reveal stratigraphic consistencies largely overlooked by previous researchers. By using these methods, it is possible to refine the depositional sequences whilst creating a nomenclature that can be applied more consistently throughout the region. Preliminary results indicate that much of the past terminology can be retained and refined, allowing the use of one unified set of names on the member scale level that will be integrated into formations. This will allow easier correlations along the Cincinnati Arch and lead to a refined sequence stratigraphic framework for a better understanding of depositional environments and changes in faunal gradients.

Yuguang Liu  
Electrical Engineering, PhD  
Advisor: Ian Papautsky, PhD  

Deterministic Splitting of Electrowetting Channels  

In digital microfluidics, droplet generation approaches show ~10% variation in droplet volumes. We demonstrate a new approach for splitting sample volumes precisely by gradually ramping down voltage at the splitting electrode. This allows us to eliminate hydrodynamic instabilities responsible for variations in droplet volume. A simple visual method was developed for measuring sample volumes created on chip.
Unconscious Phenomenal Experience: An Oxymoron—Or Is It?

Ned Block (2007) argues that phenomenology “overflows” cognitive accessibility. He takes this to go against Stanislas Dehaene and Lionel Naccache (2001), according to whom global accessibility is what defines consciousness, phenomenal consciousness included. I argue that this is not necessarily so. Block misinterprets Dehaene and Naccache’s view on phenomenology. Their view is consistent with the statement that phenomenology is broader than cognitive accessibility as long as phenomenology is taken to include conscious as well as unconscious phenomenal experiences. I show how the standard philosophical use (adopted by Block) of “phenomenal consciousness,” “consciousness” and “experience” as synonyms renders the expression “unconscious phenomenal experience” an oxymoron. I present an example of an incoherent model of consciousness that relies on this use. I then offer a revision of the terminology and show that the model, which resembles Dehaene and Naccache’s model, proves to be better than Block’s in accounting for psychosis in schizophrenia.

Gastric Sonic Hedgehog Acts as a Chemoattractant for Macrophages during Tissue Regeneration

Sonic Hedgehog (Shh) has been shown to regulate wound healing in various tissues. Immune cells such as macrophages (Mø) have also been shown to regulate repair. Despite its known function in tissue regeneration, the role of Shh as a regulator of the immune system during gastric tissue repair remains unknown. Our hypothesis is that Shh secreted from the gastric epithelium mediates the recruitment of Møs that drives tissue repair. A mouse model expressing a parietal cell-specific deletion of Shh (PC-ShhKO) and a mouse model expressing a myeloid cell-specific deletion of Hedgehog receptor Smoothened (LysMCre/SmoKO) were used. Acetic acid-ulcers were induced and samples collected. In controls, ulcers healed within 7 days post injury. Tissue regeneration was accompanied by the recruitment of Møs to the stomach within 48 hours post injury. Control mice had elevated expression of cytokines and the pro-angiogenic factor VEGF that correlated with an increased Shh tissue concentration within 3 days post injury. PC-ShhKO mice showed complete loss of ulcer repair, the absence of Mø recruitment and reduced Shh tissue concentrations. LysMCre/SmoKO mice exhibited delayed repair of ulcerated tissue. While in vitro macrophages migrated towards the Shh gradient, cells isolated from LysMCre/SmoKO mice failed to respond. Therefore, we conclude that gastric Shh facilitates tissue repair by acting as a
Sea Stacks at the Ordovician-Silurian Boundary in Southern Indiana

The Ordovician-Silurian contact (Cherokee Unconformity) in the Cincinnati Arch region is generally a planar disconformity or, less commonly, an irregular karstic surface underlying the Early Silurian (Aeronian) Brassfield Formation. The New Point Stone quarry near Napoleon, Ripley County in southeastern Indiana exposes several unusual discordant sedimentary bodies extending into, and onlapped by, the typical “Golden Brassfield” found throughout the region. These bodies, over two meters in height, are composed of light gray, pinkish-gray, and brick red micritic sediments that contrast sharply with the golden-brown crinoidal grainstones of the Brassfield Formation. Boundaries between these bodies and the surrounding Brassfield sediments are sharp and irregular. Glaucite-lined Trypanites borings into the margin of these structures, infilled with Brassfield sediment, indicate that these structures cannot be karst-fill. Rather, these bodies represent former topographic highs (i.e., sea stacks) that were subsequently submerged during eustatic sea-level rise associated with Early Silurian transgression.

Mahmood Karimi Abdolmaleki
Chemistry, PhD
Advisor: William B. Connick, PhD

Synthesis and Characterization of Vapochromic Complexes

Vapochromism is a type of chemical sensing response in which a material reversibly absorbs a vapor and undergoes a color change. Stacked square planar d8-electron metal complexes with relatively short metal…metal interactions have proven especially effective in this capacity. Solvent sorption can induce a dramatic color response associated with specific analyte-chromophore interactions as well as changes in stacking interactions and the dielectric constant of the medium surrounding the d8-electron chromophore. Here we describe a yellow metal salt that turns orange upon exposure to dichloromethane vapor. The structures of yellow crystals and the orange solvate crystals have been determined. In the yellow form, the metal centers of adjacent complexes are well separated (>4 Å), whereas the complexes form an approximate linear chain structure in orange crystals (<3.5 Å). Therefore, the change in Pt…Pt distances upon vapor absorption results in the color change from yellow to orange. Excitation of the yellow crystals results in a broad emission band near 650 nm. Upon exposure to vapor, the band shifts to 700 nm. The red shift in the emission band is consistent with decrease in Pt…Pt distance.
Evaluating Horizontal Slip Rates for the Southern San Andreas Fault via Strain Modeling of Bedrock Terraces

The southern San Andreas Fault (SAF) is potentially one of the most dangerous faults in the world. However, evaluating the potential hazard for a significant earthquake requires an understanding of the fault’s slip history and the fault’s slip rate through time. We examined the southern SAF in the Mecca Hills within the Coachella Valley as this region is proximal to major population centers but has not produced an earthquake historically. Compared to other sections of the SAF, the slip rate along this section of the fault is poorly constrained (between 5 and 22 mm/yr) and few noncontroversial locations exist to measure it. Researchers have had some success using remotely sensed INSAR and surface creep monitoring. These studies, however, measure a modern rate of slip, and it is unclear how these relate to the long-term average or if there is a present build up of earthquake-producing strain. Due to the lack of clear offset features, other methods are necessary to infer the slip rate. This study intends to infer a rate of slip for the SAF by quantifying the uplift created in a convergent bend and by using geometric relationships and strain field modeling to convert this uplift into a horizontal rate of slip. Remote geologic mapping reveals crustal thickening and mechanisms of deformation within the convergent bend. Field-based geomorphic mapping indicates terraces abandoned by river incision as a response to uplift. We sampled these terraces to calculate incision rates using optically stimulated luminescence dating. In addition, we explored assumptions involved with these calculations, such as the relationship between fluvial incision/tectonic uplift rates and the influence of climate.
keywords showed that the prompt questions play an essential role in developing the essays, with the argument essays repeating keywords more often than the issue essays. Findings from this study imply that L2 students would benefit from more explicit teaching and a better understanding of the different genre expectations for the two types of essays.

Shanshan Wang
Educational Studies, PhD
Advisor: Christopher Swoboda, PhD

A Genre-Based Investigation of Twenty Issue and Twenty Argument Essays for the GRE Writing Test

While writing genres have been analyzed and tested by researchers in a wide variety of L2 situations (e.g., Reppen, 1995; Hyland, 2003, 2004, 2007; Swales, 1990; Swales & Feak, 2004), no previous studies address the genre expected for the Graduate Record Exam (GRE) analytical written test. This study analyzed the generic structure and linguistic features of GRE analytical written test essays. Twenty issue essays and twenty argument essays, all of which received the highest score possible, were selected from the preparation book “GRE CAT: Answers to the Real Essay Questions” and examined using Derewianka’s (1990) register analysis of argumentative writing, a modified version of Swales’ (1990) CARS model, and Halliday’s (1994) lexical cohesion category of repetition as it relates to keywords in the relevant essay prompts. The results indicated that while both the issue and the argument essays reflect the basic register of “argument” (Derewianka, 1990), there are differences in the way personal pronouns (tenor) are used to show the views and opinions of the writer and in the way communicative structures are presented (i.e., communicative “moves” and “steps,” Swales, 1990). In addition, the repetition of keywords showed that the prompt questions play an essential role in developing the essays, with the argument essays repeating keywords more often than the issue essays. Findings from this study imply that L2 students would benefit from more explicit teaching and a better understanding of the different genre expectations for the two types of essays.

Longrui Chen
Chemistry, PhD
Advisor: James Mack, PhD

Study and Synthesis of Corannulene-Based Organic Compounds Using High Speed Ball Milling (HSBM)

This research project will focus on making large aromatic molecules based on corannulene. Corannulene, C20H10, is a unique and fascinating molecule which represents 1/3 of one of carbon’s allotropes, C60. We are using High Speed Ball Milling (HSBM) to synthesize larger aromatic systems in solvent-free conditions. The poor solubility of large aromatic molecules makes their synthesis possible for HSBM. Our hypothesis is by using sonagashira coupling we can expand the aromatic system based off corannulene under solvent-free conditions. The sonogashira reaction is a cross-coupling reaction using a palladium catalyst and copper co-catalyst to form a carbon–carbon bond between a terminal alkyne and an aryl or vinyl halide. To determine if our hypothesis is valid, we use 1,2,5,6-tetramethylcorannulene as starting material and a copper reaction vial with sonogashira coupling to determine if it is better than in solution. In the past, our group successfully conducted sonogashira
coupling reactions in HSBM. We will keep developing other corannulene derivatives through sonogashira coupling in HSBM and will report the synthesis and characterization of these molecules.

Katie Brown
Human Resources, MAHR
Advisor: Stacie Furst-Holloway, PhD

Getting Veterans Back to Work: Lessons from the VA

Since 2001, nearly 3 million men and women who served in the U.S. military ended their service and returned to civilian life (Greengard, 2012). This unprecedented influx of veterans has created a challenge for organizations in both the private and public sector to get veterans back to work. In this business case study, veteran and non-veteran work experiences within the Department of Veterans Affairs (VA) are compared to explore differences in veteran employee recruitment and retention. Data from Entry (N~48,163) and Exit (N~21,424) VA human resources surveys completed by VA employees (FY2009-FY2012) reveal several differences between veteran and non-veteran employees’ reasons for joining and leaving VA. For instance, veteran employees often join VA because of the veteran-focused mission while non-veterans come to VA because of anticipated career opportunities. The primary reason both veterans and non-veterans leave VA is retirement. Most veterans who leave VA for non-retirement reasons transfer to a position in another federal agency, but non-veterans most often take positions in the private sector or become entrepreneurs. Collectively, these findings may provide a number of insights into how veterans’ job entry and exit choices may differ from non-veterans. Implications of those differences may lead to changes in developing recruitment, development, and retention programs targeted specifically at veterans. This work is based upon work supported by the Department of Veterans Affairs. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author and do not necessarily represent the view of VA or the U.S. government.

Xian Cao
Chemistry, PhD
Advisor: Peng Zhang, PhD

Synergistic Effects of Dual Acceptors in Triplet-Triplet Annihilation Upconversion

We report the first observation of a significant synergistic effect in upconversion based on triplet-triplet annihilation (TTA) from a single-sensitizer/dual-acceptor system. The upconversion quantum yield of 32% is roughly double the highest value ever reported. The highest TTA quantum yield for the dual-acceptor system is much higher than that of all single-acceptor systems in the literature. A hetero-TTA process between triplet acceptors of different types is believed to account for the synergistic effect. The results provide new insight into the TTA upconversion process and have profound implications for future TTA studies as well as other photophysical studies.
Metalloproteome of *Histoplasma capsulatum*: The Role of Metals in Microbial Growth

Investigations into the area of proteomics have grown tremendously in the past few decades and have expanded to include metal-containing proteins, known as metalloproteins. Exploring the set of metalloproteins expressed by an organism, known as the metalloproteome, of pathogenic organisms provides valuable information regarding the relationship between pathogen and host as well as an overall greater understanding of the pathogenic organism. Utilizing metal-based purification and identification to study the metalloproteome of a pathogenic organism is currently being applied to the dimorphic fungus *Histoplasma capsulatum* in Dr. Caruso’s metallomics laboratory. Examination of metal acquisition and identification of metalloproteins within *Histoplasma capsulatum* would allow for better understanding of the microbial growth and toxicity mechanisms that may partially function through metal up or down regulation. Inductively coupled plasma mass spectrometry, high pressure liquid chromatography and electrospray ionization/ion trap mass spectrometry allow for a robust metal-based approach to the identification of metalloproteins within *Histoplasma capsulatum*.

Photoinduced Trans-Cis Isomerization of P-Methylacetophenone Isomers 1a and 1b

One of the most important properties of the a,ß unsaturated acetophenone derivatives is trans-cis photoisomerization. These compounds have a potential as photoswitchers and phototriggers. We have shown that p-methylacetophenone derivatives (1a) and (1b) undergo trans-cis isomerism in the presence of ultraviolet (UV) light. When irradiated, both 1a and 1b isomers form their singlet excited states which intersystem cross to give their triplet ketones. The triplet ketones rearrange to give a 1,2 biradical (1c). The lifetime of 1,2 biradical (1c) is of the order of several microseconds and the biradical decays to its corresponding cis (1b) and trans (1a) isomers. The mechanism for the trans-cis isomerization of p-methylacetophenone derivatives was studied using transient spectroscopy and theoretical calculations.
H. Dushanee Sriyarathne  
Chemistry, PhD  
Advisor: Anna D. Gudmundsdottir, PhD

A New Tool to Predict the Stability of Carbon- and Nitrogen-Centered Radicals with Oxygen

Oxidation of organic materials in air, or autoxidation, leads to significant economic losses. Antioxidants are often added during the manufacturing process to protect these materials. Radical-based antioxidants have rekindled research interest in persistent radicals. We are studying, both experimentally and theoretically, how carbon- and nitrogen-based radicals react with molecular oxygen. Irradiation of beta substituted azido propiophenone derivatives (1) results in both a) azido cleavage and formation of carbon-centered radicals and b) triplet alkyl nitrene. We used a matrix isolation technique to isolate and characterize the intermediates. In addition, we used transient spectroscopy to measure the rate of oxygen reacting with the carbon- and nitrogen-based radicals. We are preforming calculations to establish the theory that the ionization potential (IP) values for carbon- and nitrogen-centered radicals correlates with their ability to react with oxygen.

Kosala Thenna Hewa  
Chemistry, PhD  
Advisor: Anna D. Gudmundsdottir, PhD

High Yield Photorelease of Alcohols from Novel Photoremovable Protecting Group

Our newly designed photoremovable protecting group 1 releases alcohols in high quantum yields. The photorelease was observed in argon and oxygen saturated solutions. Product studies, transient spectroscopy and molecular modeling have been used as tools to elucidate the mechanism. Upon irradiation, 1 undergoes intramolecular hydrogen abstraction to form biradical 2. Expulsion of the nitrogen molecule from biradical 2 results in formation of imine radical 3, which forms the final photoprodudct 4 and releases the alcohol moiety. In competition with biradical 2 forming 3, its intersystem crosses to form photoenols E-5 and Z-5. The high yields for the photorelease are due to the fact that the imine radical 3 cannot regenerate the starting material as photoenols 5.
Melinda Engevik  
Systems Biology and Physiology, PhD  
Advisor: Roger T. Worrell, PhD  
Loss of NHE3 Affects Intestine Homeostasis and Influences Bacteroides Thetaiotaomicron Growth

Microbial dysbiosis, or the alteration of normal gut flora, plays a key role in complex diseases, such as IBD, obesity and C. difficile-associated disease. These diseases are associated with changes in the dominant bacterial phyla Bacteroidetes and Firmicutes. However, little is known regarding the effect of epithelial ion transport on the microbiota. Na+/H+ exchanger isoform 3 (NHE3) plays an integral role in intestinal Na+ absorption and was used to examine region-specific microbial dysbiosis. Quantitative RT-PCR revealed that NHE3-/- mice exhibit bacterial overgrowth and microbial dysbiosis in both the lumen and mucosa-associated bacteria with regional decreased Firmicutes and increased Bacteroidetes. Flame photometry and chloridometry revealed increased Na+ in all NHE3-/- intestinal segments, increased cecum and colon K+ and increased cecum Cl-. NHE3-/- intestine pH was also more alkaline. Quantitative RT-PCR also revealed that the genus Bacteroides and the species B. theta, members of Bacteroidetes, were increased only in the NHE3-/- ileum. The NHE3-/- ileum [Na+] 42.8 mM was found to be optimal for B. theta growth in vitro and did not correlate with in vivo pH. This correlated with increased fut2 mRNA and fucosylation in the NHE3-/- ileum. This study examined microbial dysbiosis due to altered ion transport and shows that NHE3-/- mice exhibit region specific microbial dysbiosis with changes in single species, B. theta, which correlates to sodium levels and host epithelial changes. These data together show a possible mechanism for B. theta proliferation and contribution to microbial dysbiosis in the NHE3-/- mouse intestine.

Nadeesha Nambukara Wellala  
Chemistry, PhD  
Advisor: Hairong Guan, PhD  
Secondary Phosphine Oxides as an Effective Ligand for Transition-Metal-Catalyzed Reactions

Carbon-sulfur cross-coupling reactions have received much attention in the synthesis of pharmaceutically active compounds that contain the aryl sulfide moiety. Air- and moisture-stable pentavalent secondary phosphine oxides are good alternative pre-ligands for the carbon-sulfur cross-coupling reactions. There is a tautomeric equilibrium between stable pentavalent secondary phosphine oxide and its less stable trivalent phosphinous acid. The phosphinous acid formed exhibits good coordinating capability toward transition metals. Synthesis of novel secondary phosphine oxides involves reaction between organolithium compounds and PPhCl(NEt2) followed by hydrolysis in acidic media.
A Preliminary Comparison of the Late Ordovician Butter Shales of the Cincinnati Arch

The Late Ordovician (Cincinnatian) of Ohio, Kentucky and Indiana contain several claystone units colloquially referred to as “butter shales” or “trilobite shales.” These units are widely known for their relative abundance of well-preserved trilobites Isotelus and Flexicalymene. Previous studies have focused on trilobite taphonomy and bed characteristics of individual butter shales; however, there has been little comparison between each claystone unit or any attempt to address lateral variation within the butter shales. This study attempts to make such a comparison by examining the geographic extent of each claystone unit and lateral variations in bed thickness, paleoecology, taphonomy and clay sedimentology within and between various butter shales. The Treptoceras duseri shale, arguably the most extensively studied of the butter shales, has produced fauna adapted for environments experiencing constant and rapid sedimentation in contrast to the brachiopod-dominated fauna of the surrounding units, which cannot survive under such conditions. Although some butter shales contain Tetradium and Stromatocerium, unusual fauna for clay dominated environments, paleoecologic evidence suggests conditions of steady sedimentation. These butter shales will be placed in a sequence stratigraphic framework, which will show a common position within a third- and fourth-order stacking, which will explain this seeming disparity.

Reactivity of Photoactive Iron Complexes

Iron is an essential element for living organisms. In marine siderophores, which sequester iron for bacteria, a photochemical reaction occurs that reduces and releases iron. Several complexes using an α-hydroxy acid moiety and salicylidene moiety (Sal-AHA) have been made. The quantum yield of the Sal-AHA chelates was determined for UVA, UVB, and 420nm wavelengths using potassium ferrioxalate as the actinometer and both circular dichroism and UV/Vis absorption spectroscopy to monitor the reaction. The photoproducts of the Sal-AHA chelates have also been determined for aerobic and anaerobic environments. A hypothesis on the mechanism of the photoreaction has been evaluated, and it leads to new hypotheses about the origins of different kinds of photoproducts in different marine siderophores.
Li Duan
Mathematics (Statistics), PhD
Advisor: Emily Lei Kang, PhD

Mapping Global Surface Temperatures: Spatial Predictions with Massive Data Sets

The National Climatic Data Center (NCDC) has been keeping records of surface temperatures over the globe. Those data are important in monitoring climate activities, calculating temperature trends, and identifying irregularity in global climate. Therefore, maps of global temperatures are in great demand. However, those massive data sets from monitoring stations around the world can “break” the algorithms associated with classical statistical methods, such as kriging. Moreover, the diversity of global temperature patterns makes it undesirable to use any naïve parametric statistical models that assume independence or stationarity over the globe. In this research, we present a geostatistical method that alleviates these difficulties. We apply a flexible family of non-stationary spatial covariance functions that are defined through a fixed number of basis functions, which leads to dimension reduction, and the associated computations are linearly scalable to the number of observations. This makes it feasible to process massive global data, and statistically optimal (kriging) maps with associated uncertainty measures can be obtained exactly and efficiently. We apply this methodology, called Fixed Rank Kriging (FRK), to a large data set of mean surface temperatures from NCDC. For this data set of 5,783 observations over the entire globe, it takes less than one minute to fit the model parameters and to generate a statistically optimal map, including filtered out noises and making predictions at locations without observations.

Tingting Wang
Chemistry, PhD
Advisor: William R. Heineman, PhD

Simplified Nitrate Reductase Based Nitrate Biosensor

A novel simplified nitrate reductase (SNaR) based nitrate biosensor was developed using an indium tin oxide (ITO) thin layer electrochemical cell. Previous studies attempted to immobilize the nitrate reductase on the electrode surface by using polymers, but in this work, nitrate reduction was performed in a thin layer cell using methyl viologen (MV) as the electron transfer mediator without any polymer pretreatment or coating. The nitrate sample solution required for analysis is less than 500 µL. Controlled potential coulometry (CPC) and UV/vis spectroscopy were combined for nitrate reduction and nitrite monitoring. Under optimal conditions, the linear range of the nitrate response was determined as 1-160 µM, with the sensitivity of 8000 AU M⁻¹. The detection of nitrate concentration of several natural water samples using this device agrees with the reports by Environmental Protection Agency (EPA).
Advocacy Planning in a Turkish Context: A Case Study of Sulukule, Istanbul

Today in the developing world, urban renewal projects are usually used in built-up areas as development tools. Larger cities try to adapt to globalization by renovation movements, but these are implemented without dwellers’ input. Advocacy planning (AP) may be a model for responding to the difficult situations faced by people in these urban renewal areas. According to this method, planners play a significant role for underrepresented groups. Today, we can see AP practices being followed in some developing countries, but Turkey never experimented with it until the alternative project of Sulukule Platform was created in opposition to the Sulukule Renovation Project implemented by Fatih Municipality in Istanbul in 2009. This study begins with a discussion of urban renewal and AP and then describes changes taking place in Istanbul in general and Sulukule in particular that have led to the urban renewal controversy.

A “Universal” Approach to N-Alkyl Urea Peptoid Synthesis

N-alkyl urea peptoids are biomimetic oligomers that possess large potential synthetic diversity. However, for many applications, control over the oligomer permutation at a single residue level is unnecessary. Therefore, it would be advantageous to prepare oligomer sequences in which each residue (i.e. N-alkyl group) is the same, thus speeding up the synthesis. Furthermore, if the N-alkyl group is a reactive functional group, it would lead to the potential synthesis of many oligomers from one universal precursor molecule. Oligomers with ethoxymethyl (MOM) group as the N-alkyl side chain are used as this precursor. Deprotecting the MOM groups with HCl in methanol, afforded oligomers with alcohol functional groups. The hydroxyl group can easily be converted to other functional groups, leading to oligomers containing azide, amine or carboxylic acid groups. This approach will greatly accelerate projects involving structure-property relationships and the preparation of novel soft materials.
Qingshi Tu  
Environmental Engineering, PhD  
Advisor: Mingming Lu, PhD

Application of Waste Coffee Grounds in Biodiesel Production  
Steps: A Preliminary Study

This study investigated the feasibility of reusing waste coffee grounds (WCG) in certain steps of biodiesel production process. The results indicated the oil content in WCG ranged from 8.37 to 19.63 weight percent solutions and the after-extraction WCG was found to be able to efficiently remove most of the impurities in the crude biodiesel. The preliminary results also indicated that WCG still demonstrated a high heating value after extraction.

Bevin Kenney  
Anthropology, MA  
Advisor: Brooke Crowley, PhD

Using Stable Isotopes to Ascertain Paleo-Foraging Strategies through the Study of Woodland Bison Behavior

Big Bone Lick State Park (BBL) in the Ohio River Valley is often considered the birthplace of American paleontology. The site is the final resting place for a number of extinct or locally extirpated large mammals. Skeletal remains from eastern woodland bison, *Bison bison*, are abundantly deposited in the creek bed. Past investigations have indicated that the presence of bison at this site is the result of a single kill event by humans dating approximately 530 years ago. This time is roughly equivalent to the Fort Ancient culture. The hunting decisions of the people who organized this kill event are important for understanding the impact of human activity on woodland bison ecology and the role of bison in Fort Ancient subsistence strategies. The purpose of this project is to determine the nutrition, extent of migration, and age of woodland bison using isotopic analysis of carbon, oxygen, nitrogen and strontium, as well as comparative dating methods. This information can be used to better understand the foraging behavior of Fort Ancient people. Using this suite of methods we have examined the extent of the BBL bison habitat and gathered information on their health and diet. We find that BBL bison had a mixed browse and grass diet and a relatively restricted range along Ohio River Valley waterways. It is therefore likely that bison was a relatively stable and abundant local food resource for Fort Ancient people.
Wenwen Yang  
Chemistry, PhD  
Advisor: Neil Ayres, PhD

Self-Assembly of N-Alkyl Urea Peptoid Oligomers

N-alkyl urea peptoids are non-natural oligomers that act as peptidomimetics. N-alkyl urea peptoids possess hydrogen bond donor and acceptor groups and the potential to incorporate a wide variety of side groups through the N-alkyl group. The aim of this project is to investigate the observed self-assembly of certain N-alkyl urea peptoid oligomers and elucidate the self-assembly mechanisms. Symmetrical “six-mer” oligomers with N-methyl side groups and various central N-alkyl groups, including 3-methoxypropane, benzyl, 2-methoxyl benzyl, 4-methoxyl benzyl, 2,4-methoxyl benzyl, and 2-(2-methoxyethoxy)ethane, have been synthesized in order to conduct initial structure-property relationship testing. The products were confirmed by Fourier transform infrared spectroscopy, 1H-Nuclear magnetic resonance spectroscopy, 13C-Nuclear magnetic resonance spectroscope and mass spectrometry. The self-assembly of the N-alkyl urea peptoid oligomers was examined using nuclear overhauser effect spectroscopy and rotating frame nuclear overhauser effect spectroscopy to probe through-space coupling of the oligomers at various concentrations and temperatures.

Shujie Wang  
Geography, PhD  
Advisor: Hongxing Liu, PhD


The Antarctic Peninsula has experienced dramatic temperature rise and ice shelf collapses in the context of global climate change. Monitoring the ice flow dynamics of outlet glaciers and ice shelves on Antarctic Peninsula is useful for understanding their responses to regional and global climate changes. In this study, we derived and examined the ice surface velocity on the Antarctic Peninsula during the period from 1986 to 2012. Multi-sensor satellite images, including Landsat TM, ETM+, ASTER and Radarsat-1 SAR images, were used to for image time series for detecting ice flow velocity variation in different time intervals. The multi-scale hierarchical image matching method was implemented to compute the ice surface velocity given any bi-temporal image pairs from sequential image time series. The spurious matches/velocities were filtered out by a series of statistically based operations. We generated ice surface velocity maps for nine time intervals. The spatiotemporal variability of ice flow velocity between these nine time internals has been examined and analyzed. The fastest ice flows are distributed at the front of the ice shelf and near the grounding line of outlet glaciers draining into the ice shelf. Our analysis results suggest that the ice flow on the Larsen B Ice Shelf and the ice streams draining into this ice shelf accelerated drastically in recent years, especially
after the ice shelf disintegration event, while the ice motion of the Larsen C Ice Shelf maintained a relatively stable velocity.

073

Qiusheng Wu
Geography, PhD
Advisor: Hongxing Liu, PhD

Evaluation of SMOS Level 3 Soil Moisture Products Using International Soil Moisture Networks

Estimation of soil moisture can be acquired by using in situ soil moisture instruments (sensors), atmospheric and hydrologic models, or remote sensing technology. Among the remote sensing systems, the passive microwave remote sensors are able to penetrate clouds and operate in day or night. They provide more reliable and accurate measurements on soil moisture due to their sensitivity to the effect of moisture content on the dielectric constant and hence the emissivity of the soil.

The European Space Agency (ESA) Soil Moisture and Ocean Salinity (SMOS) satellite with an L-band (1.4 GHz) microwave radiometer, launched in 2009, has provided the first-ever dedicated global near-surface soil moisture data, with an average revisit frequency of three days. As SMOS is the first L-band passive microwave system in operation, it is critical to evaluate the SMOS products to ensure data quality before widespread utilization of the data for scientific research. For this study, we utilize the seven in situ soil moisture sensor networks, with a total of more than 600 stations, to evaluate the SMOS soil moisture products from January 2010 to December 2012 over the contiguous U.S. The spatial pattern of the measurement error has been examined, and factors that potentially influence the performance of SMOS soil moisture retrievals are also analyzed.

074

Bo Yang
Geography, MA
Advisor: Hongxing Liu, PhD

Spatiotemporal Cokriging Images Fusion of Multi-Sensor Land Surface Temperature over Thaw Lakes on North Alaska

Thermal infrared (TIR) remote sensing provides an effective tool for mapping land surface temperature (LST), which is a useful parameter for estimating the near-surface soil moisture status and evapotranspiration (ET) and detecting the onset and severity of drought. Hydrologic applications in agriculture and water resource management require ET/soil moisture information over a range of temporal and spatial scales, from hourly to monthly time steps and at field to regional scale. Unfortunately, no single satellite system provides the thermal measurements at both high spatial and high temporal resolution. Polar orbiting satellite systems like MODIS provide daily thermal data at a moderate spatial resolution (1 km). Landsat and ASTER satellite systems can acquire thermal data at
relatively high spatial resolution (60 m or 120 m for Landsat, 90 m for ASTER) but with temporally infrequent coverage (16 day revisit for both Landsat and ASTER).

This paper presents a technique based on ST cokriging and Inverse Distance Weighting (IDW) for fusing thermal observations from multiple satellite platforms with different revisit frequency and different spatial resolutions to derive hourly/daily surface temperature and emissivity at a high spatial resolution (30 m). Thermal remote sensing images from ASTER and Landsat TM, as the fine spatial resolution image, blend with MODIS for the coarse resolution data. This technique will be imposed on the region of thaw lakes in north Alaska. The C++ code will be programmed to achieve the spatiotemporal cokriging and IDW. Results of IDW and spatiotemporal cokriging algorithm are made a comparison. This result will be validated by using the in situ survey data.

Gaurav Mukherjee  
Mechanical Engineering, MS  
Advisor: Manish Kumar, PhD

Shikha Chaganti  
Computer Science, MS  
Advisor: Anca L. Ralescu, PhD

On Their Own Two Feet: Design of an Assistive Exoskeleton for the Geriatric Population

Present day statistics suggest that the world is growing older. Three million of the 45 million senior citizens presently in the U.S. live in a setting, whether at an institution or at home, with nursing supervision in at least one form or the other. A significant portion of this care is dedicated to assisting with activities of daily living (ADL). An anticipated exponential rise in the number of senior citizens in the next 15 years dictates the need to develop technologies such as exoskeletons that allow our seniors to live independently. The aim of this project is to develop an energy efficient, light weight exoskeleton that efficiently assists the user in performing sit to stand transference independently while intelligently understanding the user's intent based on bioelectric, kinematic and kinetic input, thus complementing the user's own ability to move rather than following the present technological trend of forcing a pre-programmed motion on the wearer. It is hypothesized that the resulting system will allow sarcopenic geriatric patients, paraplegics and post-stroke patients undergoing rehabilitation to benefit from the use of this system, given the
variable nature of assistance based on the patient’s inherent ability to perform the targeted ADL.

Mark Chrisman
Chemistry, PhD
Advisor: Michael J. Baldwin, PhD

Formation of Metal Complexes Using α-Hydroxy Acid Containing Chelates

Inspired by marine siderophores, a new class of medium complexity α-hydroxy acid containing chelates has been designed to create photoactive Fe(III) complexes. These α-hydroxy acid containing ligands also contain an imine and phenolate moiety which are capable of binding to the metal. The interesting Fe(III) cluster structure formed with these chelates has inspired us to examine the structural chemistry and potential photochemistry with other metals. Citrate—another α-hydroxy acid containing ligand—has been shown to be photoactive with iron, cobalt, titanium, europium and uranium. Among the new complexes we are characterizing, the uranyl complex of our chelate has been shown to be photoactive. Spectroscopic and mass spectrometry experiments indicate that this complex is a 1:1 U:chelate dimer.

Stacey Cranert
Cancer and Cell Biology, PhD
Advisor: Carolyn M. Price, PhD

Functional Divergence of Tetrahymena POT1: A Role for POT1B in Chromosome Breakage and New Telomere Addition

The ends of linear, eukaryotic chromosomes are protected by dynamic complexes of protein and nucleic acid called telomeres. These structures not only solve the end replication problem, but they also prevent the exposed chromosome terminus from eliciting an aberrant DNA damage response. The nucleic acid portion of each telomere consists of tandemly repeated sequence that terminates in a short, 3’ G-rich overhang. Protection of Telomeres 1 (POT1) is a telomere protein that binds to this overhang and is essential for preventing recognition of the telomere as a double stranded break (DSB). POT1 is functionally conserved across many species, and in the protozoa Tetrahymena thermophila there are two homologs, POT1a and POT1b. While POT1a is known to be the functional homolog of the vertebrate POT1, the function of POT1b is less obvious. We show that unlike POT1a, POT1b has no function during somatic growth but, instead, is expressed only during the sexual stage of the life cycle. During this stage, the five large chromosomes from the germ-line micronucleus are cleaved into 200 to 300 pieces to which new telomere are added in the newly developing macronucleus. We show that POT1b localizes to the developing macronucleus at the time of new telomere addition. However, chromatin immunoprecipitation (ChIP) analysis shows that POT1b does not localize to telomeres but to sites of chromosome breakage (CBS) where
chromosomes are cleaved prior to the addition of new telomeres. We hypothesize that POT1b could be recruiting cleavage components to these sites or bringing in telomerase for the addition of new telomeres. These data indicate an exciting and important new role for POT1 proteins in telomere and DNA damage repair biology.

Sangwoo Chung
Physics, PhD
Advisor: Carlos Bolech, PhD

Variational Matrix Product Ansatz for Interacting 1D Gases

Shortly after the advent of the density matrix renormalization group (DMRG) method, Ostlund and Rommer [PRL 75, 3537-3540 (1995)] have demonstrated that ground states of one-dimensional lattice systems obtained with the DMRG procedure can be written in terms of products of matrices and, remarkably, that those ground states can be obtained from variational methods without making any reference to DMRG. Recently, there was some additional success in going beyond lattice models and obtaining the ground state properties of interacting bosons in the continuum. We extend those findings and discuss systems of both interacting Bosons and Fermions in one-dimension.

Bineyam Mezgebe
Environmental Engineering, PhD
Advisor: George A. Sorial, PhD

Removal of Disinfection By-Products by Utilizing Biotrickling Filters under Anaerobic Conditions

The efficacy of using biotrickling filters (BTF) to remove disinfection by-products (DBPs) has been investigated. Trihalomethanes (THMs) and haloacetic acids (HAA5) are the main groups of DBPs. Chloroform was chosen as a model THM for the lab scale biological experiment. The effect of co-metabolite on the bioprocess has also been assessed. Methanol or ethanol was used as co-metabolite with variety of inlet loading rates. The performance of the BTF was evaluated for co-metabolite loading rates, empty bed residence time (EBRT) and inlet chloroform concentration for both anoxic and anaerobic condition. The BTF system was operated under oxygen deficiency environment, and the inlet loading rates for the chloroform varied from 0.6 g/m3hr to 7.44 g/m3hr. The BTF results indicated that chloroform was removed at an efficiency of more than 59% with an EBRT of 5 minutes. Additionally, Tomadol 25-7, a surfactant, has been used to study the effects of a surfactant on further improving the bioavailability of chloroform.
Growth modification is under investigation as a treatment for early adolescent idiopathic scoliosis. Biomechanical property changes due to device implantation are essential to characterize immediate post-operative treatment effects. In vitro biomechanical tests were conducted on 18 thoracic functional spinal units. Specimens were tested before and after implantation of a clip-screw construct in lateral bending, flexion-extension, and axial rotation, with 6 specimens per direction. Pure moments were applied, and range of motion, stiffness and neutral zone were measured. Implantation of the clip-screw construct decreased range of motion in lateral bending by 19%, flexion-extension by 11%, and axial rotation by 8%. Mean stiffness in lateral bending toward and away from the treated side increased 20% and 33%, respectively. In flexion and extension, stiffness increased 10% and 16%, respectively. Treatment decreased the neutral zone in lateral bending toward and away from the instrumented side by 30% and 47%. In flexion and extension, the neutral zone decreased 20% and 26%. In axial rotation toward and away from the treated side, the neutral zone decreased by 22% and 7%. Implantation of a spinal hemiepiphyseal clip-screw construct decreased range of motion by less than one-fifth, increased stiffness by one-third or less, and decreased the neutral zone by less than one-half. Implantation of the spinal hemiepiphyseal construct preserved most of the flexibility of the spine in the immediate post-operative period.

In this work, we demonstrate the continuous sorting of blood cells and extraction of plasma in a simple passive microfluidic device. Our approach takes advantage of the principles of inertial microfluidics and Dean drag forces in spiral microchannels. We also determine the optimum sample dilution necessary for inertial separations. Since blood is a non-Newtonian fluid, separating blood components in inertial microfluidic devices that rely on hydrodynamic forces acting in a Newtonian flow presents a challenge. Our device utilizes the balance of hydrodynamic forces (inertial lift and shear forces due to parabolic velocity profile) acting on cells within laminar flow, and rotational Dean drag due to spiral microchannel geometry to focus the cells in streams near the inner channel wall. While the lift forces are dependent on the Newtonian nature of the fluid, the Dean vortices can form in viscous fluids too. This differential effect of blood rheology impacts sorting efficiency and throughput in spiral microchannels. We obtained successful isolation of plasma and separation of blood cells, with high throughput (1-2mL/min) and high separation efficiency (>95%). These devices are small and efficient, and can be easily integrated with on-chip sample preparation systems paving way for point-of-care blood analysis.
Microscopic Origins of Microtubule Depolymerization

Microtubules (MTs) are cytoskeletal filaments crucial in eukaryotic cells. They have many functions in the cell, including participating in cell division and acting as tracks for molecular motor transport. These processes depend on the depolymerization mechanism of MTs, which are collections of protofilaments arranged in a cylindrical architecture. The depolymerization begins with the outward curling of protofilaments leading to formation of “ram’s horn” and circular structures made of a single protofilament. Experimental studies suggest that these structures result from the interaction between kinesin and MTs. To decipher the microscopic origins of the depolymerization process, we employed large scale simulations of a minimalist model representing MT protofilaments. We mimicked the interaction between kinesin and MTs through an applied force acting on protofilaments. Our results indicate that the depolymerization behavior depends on the orientation and magnitude of the applied force as well as on the point of application of force. We recovered the initial events that would lead to the formation of ram’s horn structures and our simulations, therefore, can provide molecular information on the depolymerization dynamics.

Relaxation Losses of Multifunctional Superparamagnetic Iron-Oxide Nanoparticles Under an Alternating Magnetic Field: Application in Magnetic Hyperthermia Therapeutics

Superparamagnetic iron-oxide nanoparticles with unique physical and chemical properties, primarily their ability to absorb and convert electromagnetic energy into heat, are a potentially promising tool for hyperthermia cancer therapy. In this study, the heating profiles of five different concentrations of two distinct iron-oxide magnetic nanoparticle systems were measured when the nanoparticles were exposed to an alternating magnetic field with a frequency and an amplitude of 13.56MHz and 4500A/m respectively. These two distinctively different nanoparticle systems are polystyrene/iron-oxide composite NPs and polyacrylic acid (PAA) coated iron-oxide NPs. The former involves 10 nm diameter iron-oxide nanoparticles embedded in the polystyrene sphere with an average diameter of 100 nm, while the latter is the iron-oxide nanoparticles of the similar dimension (~13 nm), but coated with a thin film of PAA. DC magnetization measurements showed that all samples were superparamagnetic in nature with almost zero retentivity and coercivity. For all samples, the saturation magnetization was observed to increase linearly accompanied by an increased concentration of iron-oxide, which led to the observed concentration-dependent heating rates. It was also observed that the structural difference between the two systems led to significant hyperther-
magnetic heating differences as a result of individual MNPs’s configuration, interparticle spacing, and physical confinement. The strength of the dipole-dipole interaction was identified to be responsible for drastically lower hyperthermia heating in the polystyrene/iron-oxide composites.

Jennifer Vernia
Chemistry, MS
Advisor: Michael J. Baldwin, PhD

New α-Hydroxy Acid-Containing Tripodal Amine Chelates and their Iron Complexes

The α-hydroxy acid moiety found in photoactive siderophores can be incorporated into organic molecules that mimic the strong binding affinity and photoreaction of an iron-siderophore complex. A library of compounds that contain the α-hydroxy acid (AHA) in the tripodal amine structural motif is being synthesized. Varying the functional groups attached to the non-AHA arms to the tripodal amine allows for studies of metal complex structure and solubility. Functional groups employed so far include carboxylate (acetate and propionate), pyridyl, oximate and hydroxamate. The synthesis, characterization and preliminary photochemical and electrochemical studies of Fe(III) complexes of some of these chelates will be presented.

Nestor Alonso Mancipe Munoz
Environmental Engineering, MS
Advisor: Steven G. Buchberger, PhD

Decentralized Detention-Based Green/Grey Infrastructure for Storm Water Management in Urban Areas

This poster presents preliminary results of a decentralized storage-release system for storm water management in urban areas. This proposed system is called detention-based green/grey infrastructure (DBGI) and can be adapted to urban areas where receiving water bodies are scarce. DBGI temporarily stores storm runoff and then gradually releases it back to the existing combined sewer system. The release is dynamically controlled from multiple decentralized DBGI facilities in a manner to minimize the chance of causing a downstream combined sewer overflow. Potential DBGI locations are identified in a study area located in Cincinnati, Ohio by two customized routines in ArcGIS 10. The DBGI system is implemented in a continuous rainfall-runoff model that accurately reproduces urban runoff from a physically-based semi-distributed SWMM5 model. Application of the decentralized DBGI system in SWMM5 indicates that the proposed scheme may be a technically and economically feasible option for storm water management in a highly urbanized watershed.
Masoud Kaveh Baghbadorani  
Physics, MS  
Advisor: Hans Wagner, PhD

Exciton Dynamics in Hexagonal InP Nanowires

We studied the exciton dynamics in InP nanowire ensembles by intensity- and temperature-dependent photoluminescence (PL) measurements, time-correlated-single-photon-counting (TCSPC) and heterodyne detected four-wave-mixing experiments (HFWM). The InP nanowires were grown on fused silica substrate by 50 nm gold catalyst metal-organic-vapor-phase-epitaxy at a temperature of 450˚C, resulting in nearly wurtzite-type nanowires. The PL measurements at 15 K show a strong emission band at 837 nm and two weak side bands at nearly 820 and 860 nm. The bands are tentatively attributed to trapped, free and zinc-blende related exciton transitions, respectively. When the temperature is increased, the free-exciton band gains importance relative to the dominating trapped exciton band while the low energy band vanishes. TCSPC measurements show an increasing PL decay rate of all emission bands with increasing temperature most pronounced for the low energy band. The result agrees with the exciton population dynamics obtained from three-beam HFWM measurements. Photon echo experiments at 80 K reveal an ultrafast exciton dephasing time of less than 100 fs, which is attributed to scattering with a high carrier background in these nanowires.

Jennifer Killham  
Educational Studies, PhD  
Advisor: Vanessa Allen-Brown, PhD

R. Alan Wight  
Educational Studies, PhD  
Advisor: Mary L. Brydon-Miller, PhD

Looking Beyond the Plate: Raising Food Consciousness Through Food Mapping

“Food mapping” is an experiential exercise inspired by the Situationist International’s theory of dérive: a psychogeographic drifting through space. Our project uses critical ethnographic and geographic frameworks to examine the underlying structures of modern food production and consumption. Our approach to inquiry is the creation of a “food lens,” which asks people to look beyond their plates. This lens requires us to ask questions about how the food was produced. Were chemicals, hormones, or antibiotics used? How much were the workers paid? How far has the food traveled? Does it contain genetically modified ingredients and what does that mean? And in total, what are the physical, economic, and ecological impacts of our food choices? This project involves pictures, detailed descriptive notes and collected data, such as type of food sources; prices; nutritional and ingredient information; location atmospherics; and brands for sale. Maps of routes and visual representations of the data will be presented.
Vanessa Bentley
Philosophy, PhD
Advisor: Robert A. Skipper, PhD

Socially and Morally Responsible Cognitive Neuroimaging: Mental Rotation Case Study

The results of cognitive brain imaging studies on sex/gender differences are widely sensationalized and used to offer a biological explanation for differences between men and women, which can be used to justify stereotypes, prescribe certain social structures and limit resources for individuals interested in non-gender-normative pursuits. Mental rotation ability is one of the most static and robust sex/gender differences in cognition. However, most neuroimaging studies fail to elicit the supposed male performance advantage, and there is little overlap and no consensus on different sex/gender-linked areas or networks underlying mental rotation processing. Despite failing to demonstrate a performance advantage for men in mental rotation, the activation differences are attributed to different “cognitive strategies” used by men and women without assessing whether subjects are indeed engaging in different cognitive strategies. My review identifies a number of problems. 1) A sexist theory regarding male performance advantage in mental rotation persists despite failing to demonstrate sex/gender differences. 2) Observed activation differences are attributed to an untested, yet testable, “cognitive strategy” explanation. 3) “Natural” sex differences are supposed despite only testing individuals from industrialized Western cultures. 4) No consideration is given to the different gendered social environment experienced by males and females despite studies that show how experience affects mental rotation ability. 5) Imprecise language regarding sex, gender and biology contributes to confusion regarding the cause of the supposed difference. 6) The data is not analyzed blind to sex/gender.

Niranjala Wickremasinghe
Physics, PhD
Advisor: Hans Wagner, PhD

Managing Thermal Effects in Z-Scan Measurements on PTCDA Films

We study the two-photon absorption in micrometer-thick polycrystalline PTCDA (perylene-3,4,9,10-tetracarboxylic-3,4,9,10-dianhydride) films using the open aperture z-scan technique. The films were grown by organic molecular beam deposition on Pyrex substrate and have been excited with 150 fs high repetition rate laser pulses at a wavelength of 820 nm. The pulses are focused onto the sample with a 10x or a 20x long distance microscope objective lens. The excitation intensities have been kept the same in both cases. To study the influence of sample heating, the laser repetition rate has been varied from 4 MHz to 50 kHz by an acousto-optic pulse selector. At laser repetition rates larger than 200 kHz and 1 MHz for the 10x and 20x microscope lenses, respectively, we observe a reduction of the z-scan transmission dip. This reduction is attributed to a counteracting thermal effect due to film heating in the focus area. The reduced thermal effect using a 20x microscope lens is attributed to faster thermal diffusion from the smaller focus area into the unexcited film. At
lower repetition rates, the z-scan dip is independent of the repetition rate and the two-photon absorption coefficient in PTCDA films was determined to be approximately 4 cm/GW.

Investigating the Relation between Maximizing Tendency and Performance

To date, much research has been conducted exploring various predictors of performance. Although other personality traits have been investigated as predictors, no research has examined the relation between maximizing tendency and performance. Maximizing tendency is a decision-making construct reflecting people’s general tendency to choose the best option instead of a merely good enough option (satisficing). In other words, maximizers tend to review all possible options before making a decision, but satisficers tend to be satisfied by an acceptable option. Understanding how maximizing tendency relates to performance would improve predictions related to performance as well as aid in employee selection. Students (N=191) at a small private Midwestern university were asked to complete the Maximizing Tendency Scale as well as conscientiousness items from the International Personality Item Pool (IPIP). Student ID’s were used to acquire SAT scores and college GPAs, both well-established measures of cognitive ability and performance. It is hypothesized that some level of maximizing tendency will be beneficial but that individuals whose levels are too high will experience reduced performance, such that maximizing tendency will have a nonlinear relationship with performance. Given that cognitive ability and conscientiousness are well-established predictors of performance, the incremental variance of maximizing tendency above and beyond cognitive ability and conscientiousness was investigated.

History of Transportation and Land Use Change in Cincinnati

This poster graphically represents the analysis of the evolution of the modes of transportation and the resulting changes in land use in Cincinnati, from the late eighteenth century to the present. This study examines the evolution of the forms of transportation available in Cincinnati, including issues related to infrastructure; policies and programs; key decisions; and the land use patterns.
Theoretical Modeling of Frequency-Dependent Cell Responses to Electromagnetic Fields

External electric fields (EFs) acting on cells in the ionic environment can trigger a variety of mechanical and chemical cell responses that regulate cell functions, such as adhesion, migration and cell signaling; thus manipulation of EFs can be used in therapeutic applications. To optimize this process, realistic studies of EF interaction with cells are essential. We have developed a combined theoretical-experimental approach to study cell response to external EFs in the native configuration. The cell is modeled as a membrane-enclosed hemisphere, which is cultured on a substrate and surrounded by electrolyte. Maxwell’s equations are solved numerically (ANSYS-HFSS) to obtain 3D EF distribution inside of and near the cell subjected to an external EF. Theoretical results indicate that the cell response is frequency dependent, where at a low frequency the EF is excluded from the cell interior while EF penetration into the cell increases at higher frequencies. In both regimes, the spatial distribution and strength of the induced EF in membranes varies with frequency. Experimental results are consistent with theoretical predictions and show frequency-dependent cell responses, including membrane-initiated and intracellular pathway activation and growth factor release.
collaboration between Arginine residues and the critical residues at the paddling D2 loop.

Secil Caskurlu
Curriculum & Instruction, MEd
Advisor: Kyeong Ju Seo, PhD

Online Training Program for Community ESL Tutors

Immigrants need to learn English to survive in the U.S., but many immigrants are unable to afford the fees associated with university or private language school programs. For these learners, community ESL programs, which provide free or low-cost options and a flexible schedule, are optimal. Many individuals in the community are interested in volunteering their time to work with immigrant adults, but they rarely have the theoretical, cultural, and pedagogical knowledge they need to successfully do so. This technology-based online training program aims to provide local and regional volunteer tutors with the skills they need to work effectively with immigrant adult learners of English.

Abdulaziz Alsaqobi
Architecture & Interior Design, MSArch
Advisor: Aarati Kanekar, PhD

Architecture as a Social Partner: A Hermeneutic Study of Kuwaiti dwellings

Despite of the many positive developments associated with the oil boom of the 1930s, the built environment of Kuwait City, especially the dwellings, led to a loss of architectural identity. This loss occurred because of the openness to other cultures, which happened because of the sudden wealth, and because of the desire to import the new and the unfamiliar into the community. By reviewing the artistic, cultural, economic, political and religious literature and products of the unstable Kuwaiti community during the first half of the last century, I study the people's behavior and how their relationship with their dwellings has changed. By analyzing these research results hermeneutically, I will explore some design features that could engage with the new situation of this society to create architecture that is born from our shared context and our lived world. Based on these results, I will produce a treatise that will present specific design solutions and principles that could help young Kuwaiti architects to understand architecture from a different angle by better understanding the context. These flexible architectural principles could be changed depending on the location, and by generalizing these solutions, this treatise could be published widely and used by different societies.
Silver Nanoparticle Toxicity in an Invasive Freshwater Plant Pistia stratiotes: Total Metal Analysis

Silver has been engineered into structures from 1 to 100 nm in size are now known as nanoparticles (NPs). NPs have a high ratio of activation value to weight due to the amount of surface area and small size. These NPs exhibit stronger antibacterial properties than bulk silver sources, causing them to continue to gain popularity. With increased usage, these NPs lose adhesion to the product and escape into the environment. This research shows preliminary total metal analysis of silver within an invasive freshwater plant Pistia stratiotes when doped with various concentrations of AgNPs. This research provides an understanding of the plant’s intake of AgNPs and the effects on the plant. All results are accomplished using ICPMS for silver concentrations and UV-Vis analysis to evaluate the silver species present in the plant.

How a Larger Side Chain Affects the Photorelease Mechanism of a Photoremoveable Protecting Group

Our group has designed several photoremoveable protecting groups (PRPGs) which release alcohols upon irradiation. PRPGs are used in many different applications, such as drug delivery, synthetic approaches and the release of fragrances in household goods; clearly, there is a need for PRPGs with different physical properties. The mechanism for photorelease has been elucidated using product studies, transient spectroscopy and theoretical calculations. Irradiation of Methyl γ-(2-methylbenzoyl) propionate 1 yields photoenols. Z-enol decays by regenerating 1, whereas E-enol undergoes lactonization to release the alcohol moiety.

We are studying how intramolecular lactonization affects the photorelease and therefore, we prepared ester Methyl γ-(2-methylbenzoyl) butyrate 2 that has one more CH2 group in the side chain than 1. We will compare the photorelease reaction mechanism for 1 and 2.
Fady Bishara  
Physics, PhD  
Advisor: Jure Zupan, PhD

Photon Polarization in Higgs Decay

We show that the photon polarizations in the Higgs (h) to di-photons decay can be used to extract information about the CP properties of the Higgs interactions. The Higgs to di-photons coupling is one-loop suppressed in the Standard Model (SM) and is a good place to test for New Physics (NP) for two reasons. First, NP that modifies the couplings of the Higgs to vector bosons will have a larger effect on the h to di-photons than the hZZ coupling, which is tree-level in the SM. Second, in the differential decay rate, CP violating observables are linearly proportional to interference terms that vanish in the total rate. Measuring the photon polarizations allows us to probe these interference terms. In the h to di-photons process, both photons convert via a Bethe-Heitler process in 50% of the events. For a vector boson in general, the decay plane is itself correlated with its polarization. In this work, we construct observables sensitive to the CP violating terms in the decay process and present differential distributions from simulated events.

Gang Yang  
Chemistry, PhD  
Advisor: Neil Ayres, PhD

Synthesis of a Polymer/N-Alkyl Urea Peptoid Conjugate

Peptides consist of polyamide main chains bearing substituents. The term "peptidomimetics" can encompass compounds designed to resemble peptide main chains, side chains or both. Peptidomimetics that can present side chains on main-chain scaffolds containing amide bonds are ubiquitous. Many analogues are designed to mimic bioactive peptides by using this approach. Peptide modifications to produce molecules that resemble secondary structures are also widespread. N-substituted glycines (peptoids) represent a class of pseudo-peptides that feature amide structures on the backbone with substitution on nitrogen atoms. Based on our group’s previous research in synthesizing N-alkyl urea peptoids, a new N-alkyl urea peptoid oligomer with BOC-protected amine side groups was prepared. Amines are afforded after deprotecting the BOC protecting groups, leading to potentially cationic oligomers that can be used in drug delivery, dene delivery and surfactant applications. Reversible addition fragmentation chain transfer (RAFT) polymerization has been used to copolymerize3-azidopropyl methacrylate (AzPMA) and N,N-dimethylacrylamide (DMAc) to form a statistical copolymer (poly(DMAc-s-AzPMA)) with well controlled molecular weight and narrow polydispersity. The oligomer and the copolymer are conjugated via the copper(I)-catalyzed azide-alkyne cycloaddition (CuAAC) “click” reaction to obtain a polymer/N-alkyl urea peptoid conjugate.
Exploring the Formation of Biradicals in Strained Systems and Investigating Their Properties with the Aid of Laser Flash Photolysis

Straight chain aryl ketones (containing double bond) undergo trans-cis isomerism upon exposure to light, presumably via the formation of 1,2-biradicals. These 1,2-biradicals are stabilized by the two carbon center radical being orthogonal to each other to minimize the interaction between the two radicals. Currently, we are investigating whether 1,2-biradicals can be formed selectively in ring systems. We are also studying the effect of ring and angle strain on the formation and stability of the biradicals. We will present product studies, laser flash photolysis and theoretical calculation to identify the intermediates formed upon exposing the strained molecules 1 and 2 to light.

Engineering Versatile SERS-Active Nanoparticles by Embedding Reporters between Au-Core/Ag-Shell Through Layer-By-Layer Deposited Polyelectrolytes

Surface-enhanced Raman scattering (SERS) has been widely studied and applied for over three decades. Raman scattering of molecules, while being an extremely inefficient process with very small cross-sections, can be greatly enhanced by orders of magnitude if the molecules reside in the vicinity of some metal nanostructures, those of silver and gold in particular. Herein we report a new strategy to engineer versatile SERS-active nanoparticles by embedding Raman reporter molecules inside Au-core/Ag-shell nanoparticles through layer-by-layer deposition of polyelectrolytes. The results demonstrate a class of core-shell nanoparticles that can find use as SERS-tags for Raman-based assay and imaging with strong SERS signals, versatility and simplicity in synthesis, and good stability. The strategy may also be useful to the preparation of plasmonic nanostructures for other purposes.
Tianeka Scott  
Chemistry, MS  
Advisor: Anna D. Gudmundsdottir, PhD

Effects of Intramolecular H-Bonding on Lactonization

Photoremovable protecting groups are used to release molecules of interest, such as drugs and signaling molecules in biochemistry (as protecting groups in synthesis), and to release fragrance in household goods. Photolysis of 1 resulted in formation of 2 and release of methanol. In comparison, 3 is photostable. We used laser flash photolysis, phosphorescence, product studies, and density functional theory calculation to elucidate the mechanism for the release from 1 and to explain why 3 is photostable. Intramolecular H-bonding controls the reactivity of 1 and 3.

Mahendra Thapa  
Physics, PhD  
Advisor: Mark A. Rance, PhD

Prediction of Chemical Shifts of the Protein Calbindin D-9k Derived from Molecular Dynamics Simulations Using Sparta+

Calbindin D9k (CAB) is a small protein. It is found predominantly in tissues involved in the uptake and transport of calcium, such as cells of the intestinal brush border membrane. Molecular dynamics simulation (MD) of the protein helps to study motion and its development over time. Chemical shifts are calculated from the data generated by MD using various chemical shift prediction tools such as Sparta+. Chemical shift study helps to (a) predict S2 order parameters and (b) predict backbone and side-chain dihedral angle population distribution. We used AMBER 12.0 software to simulate the protein and then Sparta+ to predict chemical shifts values for backbone atoms. These values are close to the experimental values from nuclear magnetic resonance techniques.
Nathaniel Bates  
Biomedical Engineering, PhD  
Advisor: Timothy Hewett, PhD

Prediction of Kinematic and Kinetic Performance in a Drop Vertical Jump with Individual Anatomic and Strength Factors

Knee kinematics and kinetics have been studied for years in order to assess an athlete’s relative risk of injuring soft tissue structures such as the anterior cruciate ligament. Within these motion studies, certain factors, such as knee abduction moment and quadriceps to hamstrings muscle activation, have been identified to correlate as better predictors of injury risk. However, limited work has been done to evaluate whether an athlete’s body structure alone may correlate to injury risk. The purpose of this research is to investigate how height and weight correspond to known kinematic injury risk factors across a population of 239 high school female basketball players.

Matthew Bauman  
Germanic Languages & Literature, PhD  
Advisor: Valerie Weinstein, PhD

Camera Left? Camera Right? Acting and Ideology in Nazi Germany

The Film Chamber of the Reich, Nazi Germany’s film oversight organ, was not as pure an organization as its outward obsession with ideological conformity would imply. Rather, even after the political purge of the national cinema, there remained many holdovers from the brief democratic period that preceded it. In the interest of having an operational film industry ready to go, some of these “impurities” were overlooked, but this managed to put some actors in situations that were less than ideal. One such actor, Friedrich Gnaß, made a name for himself in Weimar Germany as a supporting player, not only in universally acclaimed classics such as “M,” but also in left-wing, proletarian films, such as “Mother Krause’s Journey to Happiness.” He continued as a supporting actor during the Third Reich, but in outright Nazi propaganda, such as Karl Ritter’s “Pour le Mérite.” After the war, he settled in East Berlin, where he became instrumental in helping Bertolt Brecht establish the renowned Berliner Ensemble. The question becomes, did Gnaß have a drastic change of heart for only twelve years? Given his actions after the war, this seems unlikely. Instead, I propose that Gnaß, due to his acting style, was able to bridge the chasm between left- and right-wing propaganda due to a unique combination of characteristics. This poster will explore this proposition by examining Gnaß’s acting throughout his career, using “Mother Krause” and “Pour
le Mérite” as examples, in light of both leftist, proletarian acting theories and National Socialist æsthetics.

Yasunaka Cho
Community Planning, MCP
Advisor: David J. Edelman, PhD

Evaluation of the Baan Mankong Slum Upgrading Project in Thailand

The Baan Mankong programme (BMP) is a participatory slum upgrading program in Thailand. A United Nations’ study reveals that the number of slum dwellers worldwide is projected to rise over the next 20 years to about 2 billion if no serious action is taken. Since 2003, the BMP has been introducing new ways to reduce the number of slums.

This poster presents evaluations on both the macro and micro level, including an analysis of how closely the project came to reaching its initial goals, as well as an analysis of the improvement of the Klong Toey slum (the biggest slum in Thailand). The poster then concludes that the BMP has succeeded in terms of physical improvements, however issues with its financial model slows down the effectiveness of the program. In the end, this research makes recommendations on how the government and other organizations can improve the program in order to produce better outcomes.

Sagil James
Mechanical Engineering, PhD
Advisor: Sundaram Murali Meenakshi, PhD

Study of Vibration-Assisted Nano-Impact Machining by Loose Abrasives (VANILIA) Process

Nanomachining of hard and brittle materials, such as glass and ceramics, is a challenge owing to their high hardness, wear resistance, low thermal expansion and electrical conductivity. Mechanical-based techniques are effective, but direct contact of the tool with the workpiece causes large scale tool wear. In this research, the target-specific machining capability of a single-point tool-based processes is combined with the hard and brittle material machining abilities of abrasives to develop the vibration-assisted nano-impact machining by loose abrasives (VANILIA) process—a novel hybrid nanomachining process that uses a single-point atomic force microscope (AFM) probe with loose abrasives and vibration assistance to perform target specific impact-based machining of nanoscale features on hard and brittle materials. The process was developed on an AFM platform in which a slurry of nanodiamond abrasive particles is introduced between the tool and the workpiece. The machining is conducted in tapping mode where the tool probe continuously hammers the abrasive nanoparticles suspended in the liquid medium, which in turn impacts the workpiece surface at a relatively high velocity. The feasibility of nanoscale machining using the VANILIA process was successfully verified experimentally and theoretically on various hard and brittle workpiece materials. Nano-cavities with circular cross-sections having depths in the range of
5-100 nm and diameters in the range of 50-300 nm were machined on silicon and borosilicate glass substrates. An analytical model based on Hertzian fracture theory is developed to evaluate the feasibility of the process for different workpiece materials.

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Lindsay Chaney
Biological Sciences, MS
Advisor: Regina S. Baucom, PhD

Tolerance and Plasticity in the Agricultural Weed Ipomoea purpurea when Grown in Competition with Maize

Agricultural weeds are in constant competition for light, soil and nutrient resources with their interspecific crop competitors. Understanding the microevolutionary potential of an agricultural weed when grown in competition can aid in determining the best strategies for weed management practices. Progeny from a full/half-sib breeding design was used in a field experiment to assess tolerance to interspecific competition with maize. Presence of plasticity to competition was assessed in four traits: day of grabbing on, day of first flower, length of flowering, and relative growth rate. Phenotypic plasticity is commonly considered to be a trait associated with weediness and plant invasions because it may enhance the ability of plants to grow in a broader range of environments. Tolerance is a plant’s ability to maintain high fitness levels across different environments, a trait that also contributes to the success of a weed. Assessing an agricultural weed in this way can give us further insight into its evolutionary potential, including how selection may act, and whether or not it is likely to result in a more problematic weed.

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Arundhoti Chakraborty
Chemistry, PhD
Hairong Guan, PhD

Heterobimetallic Complexes of Fe and Cu Featuring a Bridging Hydride: Potential Application in Homogeneous Water-Gas Shift Reaction

Heterobimetallic complexes of iron and copper that features a bridging hydride have been synthesized by reactions between cyclopentadienone-derived iron(0) tricarbonyl complexes and N-heterocyclic copper(I) hydroxide species. Carbon dioxide was released as a byproduct from these reactions. These bimetallic complexes are characterized by 1H NMR, 13C{1H} NMR, IR, and X-ray crystallography. When carbon monoxide (1 atm) was introduced to a THF-d8 solution containing a Fe/Cu heterobimetallic complex, regeneration of the starting iron(0) tricarbonyl complex was observed. Currently, these Fe/Cu heterobimetallic complexes are being tested for homogeneous water-gas shift reaction.
The Impact of Inbreeding Depression on the Evolution of Herbicide Resistance

Weedy plants exposed to herbicide application have evolved herbicide resistance, the ability to survive and grow following the application of the harmful chemical. The use of herbicide selectively eliminates the susceptible portion of the population, effectively reducing the population size to those that are resistant. This could alter the population dynamics by constricting the population to fewer mating individuals. Progeny of the surviving individuals may, in turn, experience high levels of inbreeding through self-pollination or sib-mating. Inbred populations are likely to suffer from inbreeding depression, negative effects that result from the loss of genetic diversity. It is unknown whether the potential cost of inbreeding depression might outweigh the benefit of being herbicide resistant in a weed population. This project reports the first examination of such a principle by using Ipomoea purpurea, the common morning glory, to test the impact of inbreeding depression on an herbicide-resistant population. Parental lines previously selected for high and low herbicide resistance were bred to produce two generations of selfed seeds (high inbreeding depression) and two generations of outcrossed seeds (low inbreeding depression). The experimental plants were cultivated in the field, exposed to herbicide treatment, and observed throughout their annual life cycle.

Measurement of the Dilepton Charge Asymmetry in Neutral B Decays

We are measuring the asymmetry $|A_{bs}|$ in positive and negative same-sign lepton pairs from dual semileptonic decay of neutral B-mesons. The Standard Model (SM) predicts that both the value of $|A_{bs}|$ should be small and that any non-zero value is due to charge-parity symmetry (CP) violation in mixing within the $B_s$ and $B_d$ meson systems. Under the SM, the value of $|A_{bs}|$ places constraints on the mixing parameters $\Delta M_q, G_q, \Delta G_q$ where $q = \{s, d\}$. An anomalous but statistically inconclusive measurement of $|A_{bs}|$ by the D0 collaboration in 2011 strongly suggests the existence of new physics in neutral B mixing beyond the scope of the SM. We present an independent approach to measuring the dilepton charge asymmetry using the 122 fb$^{-1}$ data sample recorded by the Belle experiment operating at the $\Upsilon(5S)$ resonance.
Ayse Arslanargin
Physics, PhD
Advisor: Thomas L. Beck, PhD

The Thermodynamics of Ion Solvation in Ethylene Carbonate, One of the Most Efficient Solvents Used in Rechargeable Lithium-Ion Batteries

In today's world, the global need for more energy causes an increase in the demand for renewable energy. Energy storage is a crucial factor for harnessing clean and reliable energy from these sources. Developments in the energy storage technologies give us a chance to choose the ideal storage technology. Lithium-ion batteries are expected to have an important role in renewable energy plants and in hybrid and electric vehicles as electrochemical energy storage systems. Ethylene carbonate (EC), one of the most efficient solvents in terms of battery cyclability, is important due to its use as electrolyte in lithium-ion batteries. A better understanding of ion solvation in non-aqueous electrolyte systems will result in new ways of designing higher density and higher power delivery supercapacitor devices. The LMFT free energy partitioning approach has been used to calculate the hydration free energies of anions in water. Molecular dynamics simulations of several anions in EC will be performed to compute the ion solvation free energies by employing the LMFT method. Our study will be the first to examine specific ion or Hofmeister effects in the thermodynamics of solvation in a non-aqueous environment. So far, the theoretical results of the physical properties of EC have been consistent with the experimental measurements.

Angela Stastny
Chemistry, PhD
Advisor: William B. Connick, PhD

Studies of the Oxidation of Platinum(II) to Platinum(IV) in Acid

The interconversion between platinum(II) and platinum(IV) is of fundamental importance in applications ranging from the development of new anticancer therapeutics to the design of new multi-redox catalysts. We previously observed the oxidation of platinum(II) complexes in nitric acid and hydrochloric acid, though the mechanistic details are unclear. Studies in nitric acid are challenging because the solvent absorbs strongly at wavelengths <340nm, obscuring important features in the reactant and product spectra. On the other hand, reactions in hydrochloric acid are painfully slow, sometimes taking weeks to reach completion. These obstacles have caused us to investigate the oxidation of platinum(II) complexes by other oxidants, which is the focus of this presentation. Interestingly, the addition of oxidizing salts to hydrochloric acid produced a strongly oxidizing solution. Under these conditions, the conversion of Pt(II) to Pt(IV) is sufficiently slow to allow for kinetics measurements by conventional UV-visible absorption spectroscopy. This presentation describes some of our recent results.
Tubes of Maximal Probability and Transition Pathway Sampling

We are studying how a collection of atoms, governed by Brownian dynamics, undergoes a conformational change. When the encountered energy barrier is much larger than the thermal energy of the atoms, the transition is a rare event. We probe the free energy landscape and directly sample such rare transition paths in an efficient manner using a hybrid Monte Carlo method. This method includes thermal fluctuations and thus conserves the sample's thermodynamic significance. To interpret the data generated by direct sampling of the paths, we explore a novel method that approximates the physical measure with a Gaussian measure that can be viewed as a tube that encloses the vast majority of the paths. The extracted parameters define the tube center and its width.

Study of Allosteric Transitions in Chaperonins by Using Normal Mode Analysis

Chaperonins are large double-ring assemblies that assist in folding of proteins under non-permissive cellular conditions. In bacterial chaperonins (Group I), such as GroEL, subunits within each ring move in concerted fashion, but in eukaryotic chaperonins (Group II), they move in sequential fashion. While the mechanism of concerted allostery in the bacterial chaperonins is extensively studied, the mechanism of sequential allostery in the eukaryotic chaperonins is not completely understood. We use normal mode analysis of an elastic network model of the archaeal (Group II) chaperonin thermosome to contrast the behavior of the two chaperonin types. We focus on the thermosome monomer and double-ring structure and identify normal modes that contribute significantly to the transition between the closed (ADP bound) to the open (nucleotide-free) state. Our results show that the lower frequency modes are important for the thermosome monomers yet distinct higher frequency modes are attributed to functional specialization of these subunit types. We find that the higher frequency modes contribute most to motions of the thermosome double-ring structure as well as GroEL. Our results also indicate weaker long-range inter-subunit correlation of amino acid pairs in thermosome compared to GroEL. These results support distinct allosteric mechanisms of the two chaperonin types.
PXK and Lupus: Defining Novel Immunobiology for an Autoimmune Risk Gene

Systemic Lupus Erythematosus (SLE) is a systemic autoimmune disease with a strong genetic component. Over 50 risk genes have been associated with SLE, many with no immediate biological connection to disease. We previously identified one such gene, PXK, as being a candidate gene associated with SLE in women of European descent and these findings have since been replicated. PXK has additionally been identified as a risk gene for rheumatoid arthritis as well, suggesting that PXK may have a broad role in the pathobiology of autoimmune disease. In this work we undertake the fine mapping of the PXK genetic locus in an effort to refine the association signal. We identify one independent effect in the region occurring strictly in individuals of European ancestry. In tandem with refinement of the genetic signal, we also attempt to identify the SLE relevant biological import of PXK by examining the role it plays in B cells. PXK has been shown to participate in receptor internalization, and using ImageStream technology, we find that PXK colocalizes with the B cell receptor (BCR) upon BCR internalization. Finally, we show that B cells derived from individuals carrying the PXK risk allele internalize the BCR faster than those carrying the protective allele. These results suggest that PXK may play an important role in the regulation of BCR signaling and B cell differentiation and survival. As B cell regulation is crucial to SLE pathogenesis, understanding the specific changes induced by SLE-associated variants in PXK will provide important insight into SLE pathogenesis.

Modeling Stormwater Runoff from Synthetic Turf Fields Using HYDRUS and SWMM

A study was conducted on the effectiveness of synthetic turf field drainage systems to infiltrate and temporarily detain stormwater runoff volume. The drainage performance of a synthetic turf soccer field was simulated using the combination of HYDRUS 2D/3D computer software and the EPA Storm Water Management Model (SWMM). HYDRUS 2D/3D was used to simulate precipitation percolating through a 2-dimensional soil domain into perforated drainage pipes. To simplify the analysis, the field was subdivided into hydrologically uniform parcels. Each parcel corresponded to the drainage area for a single perforated subsurface drain. We ported the output of HYDRUS 2D into SWMM to simulate the hydraulics of the subsurface pipe network to the outfall point. Simulation results were calibrated with field measurements (rainfall depth and rate, antecedent soil moisture content, outflow volume) taken during storm events at the Northern Kentucky University Soccer Stadium in Highland Heights KY, USA. Preliminary results show that both the rainfall intensity and the soil moisture content regulate storage capacity, and therefore they strongly influence the runoff hydrograph for the subdrain conveyance.
system. We expect that an accurate model of storm drainage from synthetic turf fields will improve both cost effectiveness and hydraulic efficiency of synthetic turf drainage systems, with benefits for further integration with other landscape-scale stormwater management features.

Anish Kizhakkekkara Vadukoot
Chemistry, PhD
Advisor: Edward Merino, PhD

Novel ROS Activated Michael Acceptors as Pro-Drugs: A Strategy to Target Elevated Oxidative Stress in Cancer

Reactive oxygen species (ROS) are chemically reactive molecules formed as a natural byproduct of metabolism in cells. These species play an important role in cell signaling and homeostasis. Recent literature studies have shown that bulk cancer cells, including cancer stem cells, have elevated levels of ROS when compared to normal cells. We have designed ROS activated pro-drugs that target cancer cells over normal cells. We have recently synthesized a new agent scaffold which undergoes oxidation in presence of ROS to activate. Our hypothesis is that upon oxidation, this new agent acts as a Michael acceptor and reacts with glutathione to cause its depletion, which leads to cell death. We are synthesizing a new series of these agents with modifications at various locations in the lead molecule to understand structure activity relationship. This study will help us design agents with increased specificity and cytotoxicity.

Huan Wang
Chemistry, PhD
Advisor: George Stan, PhD

Unfolding and Translocation Mechanism of Peptides with Diverse Structures by ClpY ATPase

Clp ATPases associates with its peptidase partner to degrade proteins in repetitive cycle of ATP hydrolysis. Clp ATPases use conformational changes coupled with ATP hydrolysis to cause the substrate protein to unfold and translocate through the central pore to the chambered peptidase for degradation. ClpY, one of the best structurally characterized member of Clp ATPase, is a hexameric ring-shaped AAA+ motor with a central pore formed by a highly conserved loop (GYVG motif) from each subunit. To elucidate the substrate remodeling mechanisms, we performed implicit solvent simulations that describe the interaction between peptides with diverse secondary structure (alpha helix/beta turn/random coil/helixal turn) covalently attached to a degradation tag (ssrA) and the central channel of ClpY. We found that the substrate protein’s secondary and tertiary structure have unraveled before translocation. The secondary structure of peptides unraveled, starting from both termini. Translocation of structured substrate proteins requires significantly longer timescale than unstructured substrate protein with unfolding as the rate-limiting step. Highly cooperative breakage event of intra-strand hydrogen bonds and cooperative translocation of residues suggests that unfolding and translocation follow a power-stroke mechanism. Disulfide bonds stabilize substrate protein by slowing down the unfolding event. However, structure
with disulfide bond could be translocated through central pore of ClpY with its secondary structure unraveled.

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**Andrea Kravats**  
Chemistry, PhD  
Advisor: George Stan, PhD

**Probing the Dependence of Protein Topology on Unfolding and Translocation Mechanisms of the ClpY ATPase**

Bacterial Clp ATPases are macromolecular machines specializing in degradation of damaged proteins within the cell, threading them through a narrow pore to be delivered to a sequestered protease. ClpY, a well characterized unfoldase, assembles as a homohexameric ring structure encompassing a narrow central pore leading into a protease partner, ClpQ. Flexible pore loops, which undergo large scale conformational changes resulting from ATP hydrolysis, serve as the driving force to unravel substrate proteins (SP) and translocate them to ClpQ. Using coarse grained molecular dynamics simulations, we elucidate the ClpY assisted unfolding and translocation pathway of an a/b SP. Due to the SP's high mechanical stability, unfolding is the rate limiting step in the degradation pathway. Unfolding occurs via two pathways, either by shearing the C-terminal β-strand, breaking a critical number of contacts yet remaining in a non-native folded conformation, or by completely unzipping the C-terminal β-strand. Upon the removal of the C-terminal β-strand from the folded structure, translocation occurs in discrete steps, indicating a powerstroke mechanism. This result is in agreement with recent single molecule experiments. Clp assisted unfolding and translocation mechanisms differ radically from mechanical unfolding and translocation. Mechanical unfolding by AFM type simulations reveals multiple unfolding pathways from the C-terminus, N-terminus or simultaneously from both termini. Additionally, mechanical unfolding and translocation by pulling through a rigid ClpY pore with constant velocity requires larger effective forces, while pulling with constant force results in simultaneous unfolding and translocation.

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**Divya Sardana**  
Computer Science & Engineering, PhD  
Advisor: Raj K. Bhatnagar, PhD

**Graph Clustering Using Mutual K-Nearest Neighbors**

Most real world networks, like social networks, biological protein-protein interaction networks, etc., can be represented as graphs which tend to cluster into densely connected subgroups or modules. Such modules have the property that nodes inside them connect much more cohesively to each other than to the outside world. Further, the nodes belonging to different modules may be loosely connected to each other through a sparse set of nodes. Finding such dense and sparse structures in a network can provide deep insights into the organization of nodes in the network. In this work, we develop a novel graph clustering algorithm based upon a node affinity measure called "Mutual K-Nearest neighbors" (MKNN). Unlike most other graph clustering algorithms, we also make use of node similarity in the form of edge weights to form clusters along with using the topological similarities between the nodes.
Further, our algorithm also establishes core-periphery associations between the dense clusters or “cores” and low density “periphery” nodes surrounding the core whose members may be loosely connected to the core. Finding such core-periphery structures in a graph can deepen our understanding of the functional relationships among nodes in a network. Using synthetic and real world datasets, we demonstrate the effectiveness of our algorithm over other state-of-the-art graph clustering algorithms.

Allison Talley  
Chemistry, PhD  
Advisor: George Stan, PhD

Elucidation of the Stability of Biopolymers upon Adsorption at Solid Surface Interfaces via Molecular Dynamics Simulations

Biological enzymes catalyze reactions that take many orders of magnitude longer without enzymatic assistance. This in turn makes them natural targets for technology development. However, their use is often hampered by the fact that enzymatic action is strongly coupled to the native structure of the protein, which has been evolutionarily optimized in a physiological environment. This introduces a challenge in the exploitation of enzymatic proteins in physical situations that are different from the environment in which the native protein resides, especially in cases where the protein is immobilized upon a surface. It is important to keep in mind that adsorption or immobilization of an enzyme in close proximity to a surface can expose it to either a potentially destabilizing environment or a stabilizing environment, thereby changing the activity.

Here, we investigate the adsorption and denaturing characteristics of three de novo proteins, all alpha, all beta and an alpha/beta structure in the presence of a single planar hydrophobic surface and planar carbon nanotube lattices via coarse-grained Langevin dynamics simulations. The initial orientation and interaction strength were varied to determine dependencies of these factors on surface binding and unfolding events. Our results indicate that an anticorrelated relationship between native state and binding occurs, and show that certain secondary structural motifs interact in different ways with the surface. Additionally, in the case of carbon nanotube lattices, the topography of the surface plays a role in the availability of certain unfolding pathways as compared to flat planar surfaces.

Heather Hopgood  
Chemistry, PhD  
Advisor: James Mack, PhD

Using High Speed Ball Milling to Induce Chirality

Green chemistry is becoming increasingly important as chemicals account for much of the harmful pollutants that leech into the environment. Green chemists attempt to reduce this exposure by constructing experiments with little or no hazardous waste. One method, high speed ball milling, replaces the solvent as the reaction medium. Instead, the reactants are physically broken up in order to facilitate their interactions and thus, the amount of waste solution created during organic reactions is greatly decreased. We are using this technique to synthesize the chiral product 2-[(4-Chlorophenyl)
Hydroxymethyl]-2-methylcyclohexanone. The production of enantiomerically pure compounds is especially important to the pharmaceutical industry in drug synthesis. It is our goal to induce chirality by conducting the reaction in the presence of a chiral environment rather than binding to a chiral auxiliary. Ideally, we would like to use cheap, naturally occurring auxiliaries such as sugars or amino acids which can be easily washed away. High pressure liquid chromatography is used to identify any enantiomeric excess.

Kelley McKissic
Chemistry, PhD
Advisor: James Mack, PhD

Developing Corannulene Based MRI Contrasting Agents

MRI contrasting agents are a key component in the diagnosis of patients. These agents are used to enhance the visibility of internal body structures in magnetic resonance imaging. Today, the contrast media contains lanthanides to help with the enhancement of the image. Our research consists of developing a new delivery system for contrasting agents and to reduce the level of toxicity patients face with current agents. Our focus is to synthesize and study azocorannulene derivatives as a new type of delivery system for contrasting agents. Azocorannulene is analogous to azobenzene; consisting of an azo group anchored by a corannulene group on each end. Corannulene, a bowl-shaped, polyaromatic hydrocarbon provides an open concave surface for binding while the rim is available for coordination. The geometric stereochemistry allows azocorannulene to act as a caged type molecule and is idea for encapsulating lanthanides.

Randall Marshall
Biological Sciences, MS
Advisor: Jodi R. Shann, PhD

Algal Isolations and Phosphorous Competition in Algal Blooms Containing Microcystis aeruginosa

Unialgal and axenic strains of Microcystis aeruginosa, Scenedesmus quadricada and Nitzschia sp. were obtained from Grand Lake Saint Mary’s summer algal bloom samples via streak and pour plate isolations. These isolates were then grown in phosphorus-limited microcosm batch cultures as monocultures and in competition. Preliminary results indicate effective quantification of the colonial cyanobacterium, competitive effects and possible pH growth limitation in standard published BG-11 nutrient media.
Andrew Schneider
Geology, MS
Advisor: Amy Townsend-Small, PhD


In Southern California, wastewater recycling has the potential to reduce demands on aquifers and alternative water production methods, such as desalination. However, wastewater recycling via nitrification-denitrification may increase direct emissions of greenhouse gases (GHGs), including carbon dioxide (CO$_2$), nitrous oxide (N$_2$O), and methane (CH$_4$). We measured direct emissions of CO$_2$, CH$_4$, and N$_2$O from the secondary treatment basins of a wastewater recycling plant in Southern California and measured the $^{14}$C content of the CO$_2$ as an indicator of the fossil fuel component of the emissions. The total emissions were 1.5 (±0.2) g-CO$_2$ m$^{-3}$ of fossil CO$_2$, 0.5 (±0.1) g-CO$_2$-eq of CH$_4$ m$^{-3}$, and 1.9 (±0.5) g-CO$_2$-eq of N$_2$O m$^{-3}$, for a total of 3.9 (±0.5) g-CO$_2$-eq m$^{-3}$. This demonstrated that wastewater treatment can be a source of GHGs, particularly CH$_4$ and N$_2$O, in urban areas. From the $^{14}$C measurements, we found that between 11.4% and 15.1% of CO$_2$ directly emitted was derived from fossil sources, which challenges previous assumptions that direct CO$_2$ emissions from wastewater treatment contain only modern carbon. A comparison of our measurements with estimates of CO$_2$ emissions from energy consumption, however, shows that wastewater recycling has a lower overall warming potential than desalination and about the same as long-distance importation.

Bethany Stahl
Biological Sciences, PhD
Advisor: Joshua Gross, PhD

Pigmentation Loss in Cave Animals: A High-Resolution Analysis of Destructive Genetic Mutations

Regressive phenotypic evolution is a widespread phenomenon that affects nearly every living organism. Cave animals are powerful models to investigate this problem, owing to the recurrent loss of pigmentation and reduction in eyes in organisms living in subterranean environments. Although the mechanism through which these traits regress is unknown, one long-standing assumption is that the genes responsible for maintaining pigmentation become non-functional through loss-of-function mutations. Alternatively, genes may instead acquire regulatory mutations leading to altered expression levels and subsequently, degenerative phenotypes. Until recently, these hypotheses have never been tested due to limited genomic resources in cave-dwelling organisms. Advances in sequencing technologies now enable comparisons between the extant surface and cave forms of the blind Mexican cavefish Astyanax mexicanus. By employing the use of gene ontology (GO) terms, we identified over 440 genes in our transcriptome with pigmentation-related functions. To evaluate if these genes harbor destructive, loss-of-function mutations in cave morphs, we completed a high-throughput structural analysis to characterize the presence of coding versus regulatory sequence mutations. Preliminary RNA-seq analyses indicate that pigment-related genes are differentially expressed in surface and cave forms and vary across critical developmental stages. Identification
of the genes, sequence mutations and expression differences responsible for depigmentation will provide a clearer picture of the mechanisms contributing to regressive evolution in *Astyanax*. This will inform our understanding of the broader principles governing phenotypic loss in the natural world.

Gleason Wilson  
Chemistry, PhD  
Advisor: Hairong Guan, PhD

**Mechanistic and Kinetic Investigation of Dimethylamine Borane Dehydrogenation Catalyzed by Nickel-Pincer Hydride Complexes**

Reaction of nickel bis(phosphinite) pincer hydride complexes, \([C_6H_3(OPR_2)2]NiH\) (R= t-butyl, isopropyl or cyclopentyl), with dimethylamine borane complex has been investigated. The nickel hydrides facilitate the dehydrogenation of dimethylamine borane under catalytic conditions. Kinetic investigation of the catalytic reaction has shown that the rate increases as the substituents on the phosphorus become less bulky (from t-butyl to isopropyl to cyclopentyl). Spectroscopic studies have also been employed to investigate potential intermediates and final products during the catalytic reaction, providing mechanistic insight into the dehydrogenation process and catalyst deactivation.

Caroline Akinyi  
Environmental Engineering, MS  
Advisor: Mingming Lu, PhD

**Thermal Decomposition Behavior of Carbon Nanocomposite Materials**

Carbon nanotubes are very appealing to many industries due to their high tensile strength; high moduli; large aspect ratios; low densities; good chemical; and environmental stabilities and high thermal and electrical conductivities. As such, they are being used to reinforce polymers which have become ubiquitous. The materials targeted in this research are high in carbon and energy content. When these materials catch fire or when they are processed thermally for energy or material recovery after use, it is critical to evaluate whether toxic pollutants will be released. Therefore, we investigated how the presence of carbon nanotubes alters the pyrolysis of polymers. The specific materials under study at the moment are carbon nanocomposites of polycarbonates, polyamides and polyimide. The percent mass loss at different temperatures was documented and graphed against the specific temperatures. The residue was microwave digested and the solution analyzed for any metals that may be present in the residues. The volatile and semi-volatile compounds released were analyzed and quantified using GC/MS. SEM and TEM analysis of the residue was performed to determine the structure and morphology of the residue. Information gained from this research will promote the development of preventive approaches and safer alternatives to minimize the unintended harmful impacts of nanotechnology.
Representative Mathematical Models for the Core Circadian Clock in *Neurospora crassa*

Circadian rhythms are daily cycles that occur in numerous species, including humans, and that provide temporal information to various biological processes such as the cell cycle. The core molecular mechanisms of circadian rhythms are similar from *Neurospora crassa* (filamentous fungus) to mammals. This suggests that a comprehensive analysis of *Neurospora* circadian rhythms will facilitate our understanding of the underlying properties of the human circadian rhythms. The *Neurospora* circadian clock is a molecular mechanism consisting of complex gene regulations that create a time-delayed negative feedback loop. The molecular components of this clock have been identified genetically and some of its core components could possibly generate new insights in this field. In this study, we use mathematical modeling because it allows us to perform detailed simulations and to introduce perturbations to the mathematical systems more easily than in experiments. Two representative mathematical systems of nonlinear differential equations are presented to model feasible molecular processes that might occur within the gene-protein regulation network that controls circadian clock of *Neurospora crassa*.

Using Theory of Planned Behavior Constructs to Predict Active Transportation Among College Students

Rising rates of physical inactivity in the U.S. pose significant health risks. Active transportation (AT) (e.g. bicycling) may prove to be a useful way to promote physical activity. Using a range of methods that including Theory of Planned Behavior (TPB) constructs, this study sought to describe predictors of AT behavior among college students at a large Midwestern university. Students were recruited through the university registrar’s office and emailed an electronic survey. Differences among AT users were determined using t-tests, and predictors of AT were identified using regression analysis. There were significant differences among AT users for all TPB constructs. Regression analysis using only TPB constructs explained 11% of the variation in AT use. Other variables added to the model resulted in a 37% increase in explained variation (48%). The final model included subjective norms, age, perceived behavioral control, and transportation type and destination. The results of this research are insightful in explaining AT behavior. Perceived norms and the level of control one has regarding method of transportation were important contributions to AT use. These results can be applied to promoting physical activity, promoting safety for AT users or generally understanding AT use.
The colonization of extreme environments is frequently accompanied by striking changes in morphology, physiology and behavior. For instance, cave-adapted organisms living in total darkness converge on a suite of regressive traits, including the complete loss of eyes and pigmentation. While many morphological traits have been evaluated in organisms living in total darkness, physiological traits have received less attention. In this study, we investigated the influence of altered light/dark cycles on activity rhythms. Predictable patterns of light and dark are essential for entraining the molecular clock that, in turn, influences many fundamental organismal processes. We explored the receptivity of light rhythms (and absence of light) in *Astyanax mexicanus*, a model fish system consisting of a derived, cave-dwelling form and an extant, “ancestral” surface form. Prior studies in this species assayed activity by proxy or using methods necessarily limited to juvenile specimens. To understand the complexity of the activity rhythms, and their relationship to a normal light cycle, in adult fish, we used direct high-resolution video recording assays. Here, we present an experimental paradigm that facilitates automated video analysis of activity profiles in adult *Astyanax*. Preliminary results suggest that, while both forms appear to respond to changes in light state, the activity profile of the cave form differs in both polarity and amplitude from that of the surface form. Additionally, while the surface form shows robust periods of activity/inactivity, this profile has degenerated in the cave morphotype.

Misfolded proteins have been implicated in a variety of crippling neurodegenerative diseases for which there are currently no decisive therapies. Therefore, understanding nature’s evolved method for addressing the complicated folding of nascent proteins and refolding of stress-denatured proteins could provide novel therapeutic pathways. For example, the eukaryotic chaperonin CCT provides a dynamic cavity in which a misfolded substrate protein may be confined and provided a chance to achieve its functional native state conformation while sequestered from the crowded cellular environment. An important step in elucidating the eukaryotic protein folding assistance process is understanding the folding kinetics of a protein under the effect of confinement. In order to investigate this, we employ Langevin dynamics to perform simulations of the folding of the multi-domain eukaryotic actin. In order to emulate the effect of confinement, we use a single-walled carbon nanotube in various confinement regimes ($R/R_{\text{amx}}$ of 2.25 and 2), where $R_{\text{amx}}$ is the minimum radius of the carbon nanotube that can fully encompass the native-state actin. Bulk folding simulations of actin show a domain-by-domain folding
mechanism in contrast to the two-stage folding observed for small proteins. Folding occurs via four distinct pathways, with each pair sharing a common intermediate state. The confinement of actin in the nanotube leads to a suppression of the major pathway as well as an enhanced yield of native state actin.

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Gary Motz
Geology, PhD
Advisor: Arnold Miller, PhD

Morphologic Variation as a Potential Driver of Taxonomic Richness: Venerid Bivalves of the Indo-Pacific

Studies of modern taxonomic richness look increasingly to the fossil record for information about the formation and development of biodiversity. As a hotspot of modern diversity in marine habitats, the Indo-Pacific has been recognized as a persistent center of origination for the majority of the Cenozoic. In this context, I am investigating the evolution of venerid-bivalve biodiversity throughout the Indo-Pacific in order to understand the causal mechanisms for the development of the tremendous molluscan diversity observed in terms of both species richness (i.e., biodiversity) and morphologic variation (i.e. disparity). I hypothesize that closely constrained biotic interactions, such as the agonistic relationship between venerid bivalves and their predators, shell-drilling naticid gastropods, may cause directional changes in shell shape and form as a heritable phenotypic response. Further, this evolutionary response may contribute to genetic differentiation and promote speciation within pre-existing clades. As an initial step, I report here on a preliminary assessment of morphological variation among several Cenozoic venerid genera from the Indo-Pacific in a stratigraphic and geographic context, taking into account frequency of naticid drilling as a potential function of morphological variation. In an initial examination of morphologic attributes of two common venerid genera, *Dosinia* and *Tapes*, taxa are randomly distributed throughout shape space with respect to geographic and temporal distributions. However, when predation instances (i.e. drilled specimens) are superimposed on the ordination in shape space, a potential bias in prey selectivity is observed.

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Kimberly Price
Health Education, PhD
Advisor: Keith King, PhD

Development and Testing of a Survey Instrument to Assess Mothers’ Social and Spiritual Connections and HPV Vaccine Acceptability

The Human Papillomavirus (HPV) vaccine could significantly reduce the disease burden of cervical cancer, which disproportionately affects underserved populations. Although social support and spirituality have been examined in terms of how cancer patients cope with their disease, little is known about how they influence preventive behaviors, such as HPV vaccine acceptability. An instrument was developed to measure a mother’s spiritual and social connections, and how they relate to knowledge of and behavior toward the HPV vaccine for their daughters. Based on a review of the literature and
theoretical models (Health Belief Model and Theory of Reasoned Action), a 3-page, 64-item survey was developed to provide an accurate measure of a mother’s spirituality, social support, and HPV vaccine acceptability. Stability reliability was established using test-retest procedures. Pearson correlation coefficients were computed for parametric items; Cronbach alphas were computed for internal consistency reliability of the subscales. Pearson correlation coefficients yielded > .80 for each of the items and Cronbach alphas resulted in > .90 for the subscales (knowledge, attitudes, social support, spiritual behaviors and beliefs). This instrument demonstrated good retest reliability and internal consistency and can be used to assess the relationship between a mother’s spirituality and social support and her acceptability of the HPV vaccine for her daughter. The results could potentially offer a more accurate view of how mothers make reproductive health decisions and, in turn, impact the planning of community-based cancer prevention programs.

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Caitlyn Kwiatkowski
Architecture & Interior Design, MSArch
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Interaction by Design: Mixed-Income Housing Developments

Through the HOPE VI program, public housing has begun shifting from concentrations of very low-income households to mixed income developments in an attempt to reduce the social ills associated with poverty concentration, to combat the stigma of public housing, and to help redevelop low-income areas. The mixed-income model has been adopted in cities throughout the United States but little research exists on how different socioeconomic classes interact with one another or how the design of the developments foster that interaction, which is one of the goals of the program as outlined by the U.S. Department of Housing and Development. By reviewing current research on mixed-income public housing, by conducting interviews and by completing on-site observational analysis of City West, a HOPE VI mixed-income public housing development in Cincinnati, this thesis will shed light on how different socio-economic classes cohabitate from a design standpoint. With the help of the Cincinnati Metro Housing Authority and the cooperation of the residents at City West, this thesis will hopefully provide a more accurate depiction of how mixed-income developments function, how much interaction actually occurs within the facilities, and whether or not mixed-income developments have met their goal of income integration.

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Rebecca Elkins
Health Education, PhD
Advisor: Laura Nabors, PhD

Ken Woodson
Health Education, PhD
Advisor: Keith King, PhD

Children and Siblings Use of Play to Work Through Medical Trauma

Children’s reactions to and coping with traumatic medical experiences have
been recorded through play. Through make believe play and accompanying stories, a child can recreate traumatic experiences in a way in which he or she can gain mastery and control over upsetting and stressful events. In this study, participants were 15 children with serious medical illnesses, 14 siblings of children with a medical illness, and 6 children in the community who did not have any ill family members. Children participated in play groups and their play with medical toys was videotaped and coded for themes that would provide a window on their perspectives. Grounded theory was used to guide qualitative analyses. The play of children with medical illnesses and siblings was similar. This indicated that siblings may experience vicarious trauma, if their brother or sister is hospitalized. Support from others was a resilience factor for coping, while coping with needle sticks was perceived as especially difficult. Children also tended to use distraction as a coping strategy. In contrast, children in the comparison group did not engage in much medical play and when they did, they did not demonstrate a rich play experience with detailed medical stories. Findings revealed that play was a mechanism for working through stress and coping with emotions related to medical trauma. Future research should focus on ways to use play therapy techniques to help medically ill children and their siblings cope with medical trauma.

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Leena Shewade  
Biological Sciences, MS  
Advisor: Daniel Buchholz, PhD

Using TAL-Effecter Nucleases to Knockout GR and Examine the Developmental Consequences at the Morphological and Molecular Levels

Tadpoles exhibit high plasticity in their rate of growth and development, which is considered to be an adaptive strategy to respond to environmental stressors. Corticosterone (CORT), the primary amphibian stress hormone, transduces the effects of environment by synergizing with thyroid hormone (TH), which is the key hormone in regulating development (i.e. metamorphosis). Previous studies, including our own, have shown that CORT treatment decelerates growth when given at premetamorphic stages and accelerates development at later metamorphic stages. CORT likely exerts its effects by binding to the glucocorticoid receptor (GR) and altering gene expression, which leads to morphological effects. To date, studies have focused on exogenous CORT treatments. Here, we propose to study the endogenous mechanisms of CORT by knocking out the GR using TALENs. TALENs are recently discovered, highly efficient artificial restriction endonucleases that contain the TAL-effector protein domains that confer 1:1 specificity TAL RVDs to target nucleotide base. We hypothesize that absence of GR from the embryonic stage would either lead to complete loss of CORT-mediated effects and, therefore, disrupt metamorphosis or this absence may reveal other endogenous mechanisms of CORT. In either case, we will gain insight into the role of CORT
in development. Because GR and stress-mediated signaling are conserved among most vertebrate species, our findings will help provide a better understanding of the genesis of developmental disorders.

Chelsea Benson
Communication Sciences and Disorders, PhD
Advisor: Fawen Zhang, MD, PhD

Behavioral Measures of Temporal Processing and Speech Perception in Normal Hearing and Cochlear Implant Listeners

Although all cochlear implant (CI) users achieve some level of hearing sensitivity, post-implantation speech perception outcomes vary greatly. Previous studies reported a strong correlation between CI users’ phoneme recognition scores and modulation detection thresholds using an electric pulse train directly presented via the electrode array, suggesting that temporal processing may largely contribute to speech perception (Fu, 2002). This study examined the relationship between speech perception performance and temporal processing using the Random Gap Detection Test (RGDT, Keith, 2000). A group of NH subjects (n=10) and CI users (n=9, 3 bilaterally implanted) participated. Stimuli were presented monaurally via loudspeaker at the most comfortable loudness level. The contralateral ear was plugged throughout the testing session. The stimuli consisted of speech recognition threshold test, Central Institute for the Deaf W-22 word discrimination test, Bamford-Kowal-Bench speech-in-noise test, and RGDT. Results showed that RGDT thresholds are significantly higher and word discrimination is significantly poorer in CI users. CI subjects required a better SNR than the NH subjects to be able to repeat 50% of the target words correctly. Regression analysis for CI data showed a nearly significant correlation between the RGDT and discrimination score (R2=0.56, p=0.05) and no significant correlation between the RGDT and SRT (R2=0.15, p>.05), or BKB-SIN (R2=0.37, p>0.05). Pilot results suggest that CI users do have temporal processing limitation, which is the basis of poorer speech discrimination.

Natashia Pierce
Geology, MS
Advisor: Craig Dietsch, PhD

Geochemical Analysis and Isotopic Considerations in Along-Strike Discrimination of Taconian Arc Regions along the Rowe-Hawley Zone of Western New England

The Shelburne Falls Arc (SFA) within the Rowe-Hawley Zone (RHZ) of western New England has been called the colliding terrane of the Taconian orogeny, but it has not been correlated along-strike across VT, MA, and CT. Geochemical analyses of RHZ metavolcanics have been compiled and used to test correlations of major units with supra-subduction zone geochemical affinity. The Hawley Fm in western MA can be differentiated from the Collinsville Fm in western CT using arrays of incompatible elements. Pearce element ratios indicate that the Hawley and Collinsville Fms could have formed in the forearc and backarc, respectively, of one arc complex similar to modern rifted
arcs of the western Pacific (e.g., Bonin). The Taconian orogeny could have been the result of sequential accretionary events of backarc, arc, and forearc regions of one composite arc. Comparing these geochemical data has led to analyzing Nd isotopic compositions of metavolcanic units to identify mantle sources and continental/sedimentary components and for long-range correlation. Using TIMS thermal ionization mass spectrometry, a suite of metabasalts the RHZ of New England are being analyzed for their Nd isotopes in an attempt to determine if the MNIS has the same mantle source as the Barnard Gneiss and Hawley Fm and if Collinsville rocks have the same mantle source as the Barnard Gneiss and Hawley Fm.
MASTERY OF FINE ARTS
Gallery
Mountaintop removal mining is the process of extracting coal using powerful explosives to remove hundreds of vertical feet of a mountain to access thin seams of coal underneath. Solid debris is then dumped into valleys burying headwater streams while the liquid waste forms massive toxic coal slurry impoundments, usually in the headwaters of a watershed. Not only has mountaintop removal mining destroyed over five hundred mountains, it has diminished jobs and devastated communities. Dust, blasting and flooding, in addition to land buyout by mining companies, have created ghost-towns throughout the southern Appalachian coalfields. I have witnessed firsthand the destruction of the Appalachian Mountains, the oldest chain of mountains in the world. I have seen the aftermath of leveling these mountains, the mountains many people in the Appalachian region call home. I have explored ghost-town communities abandoned due to nearby explosions, falling rock and coal dust. It is from these experiences I work to raise awareness about the continued destruction taking place in the Southern coalfields of Appalachia.
man body. In the way that portraiture functioned to preserve an individual’s physical appearance or record significant events prior to the advent of photography, the self-portraits in this series serve as documentation of a mental space and bodily experience that would otherwise be known only to me. The creation of these works has been both an endeavor of self-examination and introspection, and a pictorialization of my own particular psychological quirks and happenings, existing as catalog of my unstable states of mind and the flux between my interior mental space and exterior physicality. Through the distortion and fragmentation my own body, I aim to make these feelings material and tactile to the viewer, composing a contemporary architecture of the body: my muddled construction.

Michelle Walker

Advisor: Joseph Girandola, MFA

A Miniature Response to Landscape

Powdered graphite on paper and panel

The beautifully rendered paintings encourage the viewer to draw close to the image and look deep into the landscape. The depth of value and interpretation of space create a sense of seductive mystery.

“Black Earth” by Michelle Walker

Sweet, soft undulation of the field
the promise of growth, rebirth

asleep dormant wanting
emanating a musky ferrous breath
drifting pulling demanding
to be turned,
drawing dragging staccatos
the horizon gathers strength
bearing witness to vastness
broken mysterious in its mirth
open releasing uplifting
yet trapped in miniature.