



UNIVERSITY *of* ST. THOMAS

UNDERGRADUATE RESEARCH AND COLLABORATIVE  
SCHOLARSHIP (URCS) PROGRAM:  
COLLABORATIVE INQUIRY

Inquiry at UST:  
A Poster Session with the Results of  
Faculty/Student Collaboration  
at the University of St. Thomas

# Abstracts

Vol. 13  
May 14, 2009

## Introduction

The abstracts published here summarize some of the sustained research and creative inquiry carried out in recent months across many disciplines by undergraduate students at the University of St. Thomas. In all cases, the student researchers have worked in close collaboration with faculty mentors who have contributed their time and talent to help our students dig more deeply into topics of the students' choosing and design.

Funded by the University of St. Thomas through its Undergraduate Research and Collaborative Scholarship (URCS) Program, this poster session allows our dedicated scholars an opportunity to share their work with larger audiences and receive the critical scrutiny of their peers, professors, and the general public.

We hope that you enjoy this event and invite you to engage our scholars in ways that will both challenge them and encourage them to continue their journey of the mind.



David Steele , Ph.D.  
Director, URCS Program



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May 2009

As president of the University of St. Thomas, I am both pleased and proud to introduce the thirteenth annual poster session devoted to faculty/student collaborative projects, sponsored by the Undergraduate Research and Collaborative Scholarship (URCS) Program.

I believe that one of the most effective ways for students to learn is through collaborative inquiry: students and faculty working together on research that can have real-world consequences. In fact, this was one of the major themes of my 2008 Academic Convocation address to our faculty. Active learning of this kind is completely in keeping with our mission as a Catholic university grounded in the liberal arts tradition. We strive to provide a high degree of personal attention in a challenging campus environment that is engaged with the complexities of our urban community and the world beyond.

Collaborative inquiry gives our students the opportunity to experience first-hand how their professors approach research questions in a given discipline. It also gives our faculty a better opportunity to understand how our students think, and helps them develop new ways of looking at research problems. Collaborative inquiry enables our students and faculty to experience their disciplines in action, deepening students' academic experience while simultaneously increasing career competency.

I heartily endorse this effort, and I hope this presentation of work accomplished to date will illustrate the importance of collaborative inquiry at St. Thomas.

Sincerely,

Reverend Dennis Dease  
President

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*Paul Armstrong*

## **FOREIGN POWERS AND MOVEMENTS FOR REFORM AND INDEPENDENCE IN POLAND, 1772-1830**

Faculty Collaborator: Dr. Winston Chrislock

Throughout the 18th and 19th centuries, many parties vied for influence and control of the Polish-Lithuanian Commonwealth, including the Poles themselves; this state was dominated by foreign, in particular Russian, imperatives long before the actual Partitions of Poland in 1772, 1793 and 1795. Yet the Poles made attempts, both before and after this tragic Armageddon of the Commonwealth, to rebuild their country and reform it into the power which it had once been. Generally, these movements, both those which advocated peaceful reforms, and those which sought revolution as a means to enact their programs, all sought support, if not patronage, of foreign nations. Chronologically, these movements tended to increasingly reject traditional Polish measures in lieu of Western, liberal ideas. Additionally, the most successful of these movements proved to be the ones had the patronage of Russia, due to the hegemony of that state over the fate of Poland, both directly prior to the Partitions, as well as after them. These two key trends of revolutionary and reform movements of this crucial era in Polish history brought with them significant consequences, for the nation and the continent. A representative form of government, unique to Poland, was destroyed. Peaceful, legitimate attempts to replace the decrepit system with a more efficient, egalitarian and modern one were stifled by foreign intervention; had this not happened, the example of Poland would serve as a bloodless counterbalance to the violent American and French revolutions of the era. What is more, Russia was able to become a significant player in European politics, and the dominant one in the region, extending its territory deep into the Europe, especially after the Congress of Vienna. Yet most importantly, successive Polish attempts at reform and revolution proved that, perhaps with the exclusion of the Ottoman Turks, all of Europe was either unable or unwilling to successfully contest Russian power and influence, allowing that country to become the world power, which it still is today.

*Kendall Beck and Amanda McClellan*

## **YOU MAKE ME FEEL LIKE A NATURAL WOMAN: THE EFFECT OF SELF-OBJECTIFICATION AND CONNECTEDNESS TO NATURE ON WOMEN'S ENVIRONMENTAL ATTITUDES AND BEHAVIORS**

Faculty Collaborator: Dr. Britain Scott

According to social psychologists Fredrickson & Roberts (1997) and McKinley & Hyde (1996), our culture routinely sexually objectifies women, training them to take an observer's (critical) perspective on their physical selves. This "self-objectification" preoccupies women with evaluating how they fall short of the feminine beauty ideal portrayed in media. This ideal requires substantial modification of women's natural bodies and discourages women from activities that make them sweaty, messy, dirty, and muscular—which, of course, describes most outdoor recreation. In other words, the feminine beauty ideal separates women from their natural bodies and from nature-embedded experiences. We believe this separation disconnects women from nature in general. Recently, researchers have found that being connected to nature is positively related to environmental concern and proenvironmental behavior (Clayton, 2003; Schultz & Tabanico, 2007). Therefore, we hypothesize that women in a state of heightened self-objectification will have lower environmental concern and engage in less proenvironmental behavior. In the current study, we tested this hypothesis by experimentally manipulating women's self objectification and their connectedness to nature, and then measuring the impact on their self reported environmental behavior.

*Stephanie Collette, Tom Faltsek and Kelvin Kosbab*

## **A PEER-TO-PEER MESSAGE SYSTEM**

Faculty Collaborator: Dr. Patrick L. Jarvis

An instant messenger application, such as the commercially available IChat system, transmits message among computers. Most of these applications use a client-server method of computing in which a central server has resources that are accessed by client machines – a star topology network. When used with an instant messenger system, the central server acts as a gateway. All messages are sent to the gateway, which then sends them out to the clients.

A peer-to-peer method is an alternative to client-server. The peers act cooperatively, which eliminates the need for a central server. Our instant messenger system uses the peer-to-peer approach. Peers make initial contact with one another and communication is then done directly between pairs of peers. This results in a fully connected network with point-to-point communications for each pair of peers. While more difficult to design and implement, a peer-to-peer system has the advantages of robustness and portability. Failure of a peer does not affect the other peers. Our object-oriented system is written in Java and supports both text messages and file transfers. The system is multi-threaded in order to allow overlap of activities. By its nature, an instant messenger system has a limited number of peers – dozens rather than thousands – and this is well within the capacity of our system.

*Meghan Davy*

## **BEYOND THE SECRET ANNEX: AN ARGUMENT FOR INCORPORATING VOICES BESIDES ANNE FRANK'S INTO THE DISCUSSION OF HIDDEN CHILDREN IN THE HOLOCAUST**

Faculty Collaborator: Dr. Joan Piorkowski

In the realm of Holocaust child memoir, *The Diary of Anne Frank* has remained the undisputed canonical work for over five decades. Indeed, the viewpoints and feelings expressed by its young author express an undeniable wisdom beyond her fifteen years. Yet there is a danger in referencing only Frank's diary when reading and discussing the child's experience in the Holocaust, namely because the diary represents only a single viewpoint, and additionally because Frank's overall outlook on her present and future situation is so optimistic that it threatens to lead readers to a false sense of positive closure on the experience of the child in the Holocaust, if read without the supplemented context of other child memoirs. For the purposes of this project I chose to focus on Frank's diary as it reveals the experience of a Jewish child in hiding during the Holocaust, comparing and contrasting the text with *Trains*, the recently published memoir of former hidden child Miriam Winter. Winter's circumstances and viewpoint differed greatly from Frank's, but bear similarities to the experiences of many other hidden children. I examined the likenesses and differences between the two girls experiences in hiding— Frank in an attic with her family and Winter under a false identity among Christian strangers— and the impact of the hiding experience on their relationships and sense of personal identity. I also examined the differences in tone and personal outlook within the two texts: Frank's optimism and sense of eventual survival while writing the events as they unfolded, and Winter's sense of terror, loneliness and loss while writing about her experience decades after the fact. Through juxtaposing Winter's memoir with Frank's diary, I argued that the diary, though a poignant recollection, should not stand as the single definition of the hidden child's experience during the Holocaust.

*Nathan Devroy*

## **SHADES OF BLACKNESS: AN IDEOLOGICAL ANALYSIS OF THE GOOD IN CHRISTOPHER NOLAN'S BATMAN**

Faculty Collaborator: Dr. Dina Gavrilos

“Sometimes...the truth isn't enough” a stoic Batman tells police commissioner Jim Gordon in *The Dark Knight* before assuming responsibility for deceased district attorney Harvey Dent's crimes, saving Gotham city from certain anarchy. This research attempts to explore Batman's sacrifice, his history as an anti-hero, and the socio-symbolic order he protects. Through a critical analysis of the two latest Batman films - *Batman Begins* (2005) and *The Dark Knight* (2008) – this work analyzes the dynamic of good and evil in Batman's final sacrificial act and the ideological fantasies that sustain his position. How do the film's plot and themes reflect global and political constellations framed by ideologies of today's Late Capitalism? Content consists of critical research of the two films, using theories formulated by scholars including Slavoj Zizek to connect themes of anti-heroism, belief, and power with Batman as both a vigilante hero and hunted villain. The results explore the hero's history, a mapping of the “background” essential to an effective ideology, and the ways in which power creates excesses it must destroy in order to survive.

*Matthew John Eldred*

## **THE CHANGE WE CAN BELIEVE IN?**

Faculty Collaborator: Dr. Angela High-Pippert

Only three days after Super Tuesday, Jim Willis, a political commentator and author said, “Change won this election already. ...Change won and now they're competing to see who is going to be the agent of change.” Unique in its historic diversity of candidates, extraordinary length, and vigor in its ability to mobilize voters, the 2008 Democratic presidential nomination contests paired three major Democratic candidates with at least one unified message: Change. While all three major candidates lobbied a message of change, Americans now associate a young senator from Illinois, Barack Obama, with Change and the infamous phrase: *The Change We Can Believe In*. One may expect that this association could be drawn from the influence of the many television advertisements during the early nominating contests. Through content analysis of a sample of Clinton, Edwards, and Obama campaign television advertisements in Iowa, New Hampshire, and South Carolina, we can analyze the relative frequency of the words like change and believe, and similarly, references to issues and proposed solutions. Testing this, we would expect to find a high amount of change phrases and issue proposals in the Obama campaign advertisements, which would correlate with the association made by American voters. We would also expect to find fewer similar phrases in the competing candidates' advertizing, which would indicate the same correlation. This study's findings indicate that television commercials were an important factor in facilitating the associations with change made by voters. In the end, this research will serve as an important case study of the power of television advertising to establish the relationship between political identity, campaign agenda setting, and the candidate.

*Travis P. Emmert*

## **TOWARD CONTROL OF SOLID-STATE PHASE TRANSITIONS BY CO-CRYSTALLIZATION OF STRICTLY ISOSTERIC MOLECULES**

Faculty Collaborator: Dr. William H. Ojala

Upon heating in the solid state, many organic compounds undergo one or more transitions to different solid phases before melting. One method for influencing the course of such transitions is the co-crystallization of the compound

of interest with another compound that does not undergo the transition. Those compounds that would co-crystallize most readily are those that are similar in molecular size and shape (isosteric); for example, replacement of a methyl group with a trifluoromethyl group on a given molecule can enable the two molecules to co-crystallize to at least some extent. We are interested in molecules in which the resemblance is as close as possible with respect both to the atomic coordinates and to the van der Waals radii of the atoms involved. An example of such a *strictly isosteric* pair would be diphenylmaleic anhydride and diphenylfuroxan; twofold disorder in the diphenylfuroxan crystal structure lends this molecule the same space-filling characteristics as the anhydride. The anhydride occurs in at least two crystalline forms (polymorphs), one is capable of conversion to another by heating in the solid state. We intend to co-crystallize the anhydride and furoxan to determine whether the temperature or the entire course of the phase transition in the anhydride can be controlled by its co-crystallization with appropriate proportions of the furoxan. As part of this work, we report here the crystal structure (obtained by low-temperature single-crystal X-ray diffraction) of one of the polymorphs of the anhydride. Future work will include an analysis of the bis(4-chlorophenyl) analogues, in which it is the furoxan that undergoes the phase transition.

*Brianne Gaetze*

## **CHARACTERIZING MICROFACIES OF ANCIENT SYSTEMS TO DETERMINE PAST ECOSYSTEMS**

Faculty Collaborator: Dr. Thomas Hickson

Sedimentary rocks are the best recorders of deep Earth history. Although they are not perfect, they preserve clues that enable us to determine past ecosystems, climate, and landscape. The Lake Mead Region in Nevada is part of a much larger province, the Basin and Range, which extends from Wyoming to Mexico. The area has been pulled apart by a tectonic process called extension, where the crust is stretched. This stretching can happen on many spatial and temporal scales. Extension has occurred in many areas, including Minnesota about 1 billion years ago. Understanding this process helps to explain large-scale properties of the Earth's topography, as well as the geometry of oil reservoirs, aquifers, and mineral deposits. In the Basin and Range, the initial extension started around 23 million years ago at the start of the Miocene and climate was similar to the present but slightly warmer. My project focuses on the Rainbow Garden Member (RBG) of the Miocene Horse Spring Formation. These sedimentary rocks were deposited during the onset of extension between 20-17.5 million years ago. By understanding the depositional environment of the RBG and how it evolves, we may be able to determine how extension works. As a first step in this examination, I observed and characterized rock samples and thin sections of these samples from the RBG in an effort to determine the depositional environment of these sedimentary rocks. Sandstones indicate a fluvial (riverine) environment. Limestone suggests a shallow lake environment. Root traces in both of these units imply that there was soil formation after the sediments were deposited. Together these features show that the area experienced a progression that started with a river system that later evolved to a shallow lake. The lake then expanded and contracted which led to soil formation.

*Will Grimmius*

## **IDENTIFYING FACTORS RELATED TO GRADUATION RATES AT CATHOLIC COLLEGES AND UNIVERSITIES**

Faculty Collaborator: Dr. Michael Cogan

Six-year graduation rates have been reported to the National Center for Education Statistics since 1993 and are one of the variables used to define success of higher education institutions. For students entering any national four year institution in the 2001 cohort, approximately 56 percent graduated from the same institution within six years.

Six-year graduation rates have been studied for years, however little is known about graduation rates at Catholic colleges and universities. With that in mind the intent of this project was to identify factors related to and that perhaps influence six-year graduation rates as Catholic institutions.

A total of 46 explanatory variables were used in the study and were broken down into four groups that included demographic variables, cost of attendance, admissions patterns, and institutional measures. The data set was developed using the National Center for Education Statistics' Data Analysis System and included 176 Catholic institutions.

After analyzing the model, results showed three factors that affected graduation rates included; tuition, fall-to-fall retention rate, and percent of students receiving federal grant aid.

*Eric Gronli*

## **SATISFACTION AND IMPORTANCE PLACED ON FRESHMAN FACULTY ADVISORS AT UST (2006-2008)**

Faculty Collaborator: Dr. Michael Cogan

Faculty advising is an important aspect to higher educational learning and student engagement. There is more responsibility than ever placed upon administrators and advisors to ensure that students succeed. Studies have been done within the National Academic Advising Association (NACADA) that has worked with concerns related to faculty advising and its impact on students. The University of St. Thomas has also been researching this issue for the past three years. A survey has been administered every fall for freshmen students to improve the advising system. Subsequently, the survey data was linked student data. A series of bivariate analysis were conducted to evaluate the outcomes of the program. The results show that students were satisfied with the faculty advising program at UST.

*Mary Hammer*

## **IDENTIFICATION OF UNKNOWN PFC METABOLITES USING MASS SPECTROMETRY**

Faculty Collaborator: Dr. Anthony Borgerding

Polyfluorinated Compounds (PFCs) are used for stain repellent materials (e.g. scotch guard) and are frequently dumped into landfills. The PFCs are water soluble and accumulate in the groundwater and in many lakes. A large amount research has been done on PFCs as they are emitted into the environment, but little research has been done on the degradation of PFCs as they react with other compounds in the environment. PFC extracts from water, plants, forage fish, and predator fish have been taken from Lake Johanna and concentrated to about 1 mL. These extracts were studied using an ESI-QTOF instrument and unknown peaks were found at 419.162, 239.145, 232.052, 327.229, 281.265, and 215.039. The elemental composition was determined and potential structures were found using the compounds' exact masses.

*Matthew Humbert*

## **GAS PHASE MICRODIALYSIS EXTRACTION AND CHEMILUMINESCENCE DETECTION: A SMALL, FAST, AND SENSITIVE MEANS OF MEASURING AQUEOUS NITRIC OXIDE**

Faculty Collaborator: Dr. Anthony Borgerding

Gas phase microdialysis extraction has been interfaced with a sensitive nitric oxide chemiluminescence detector and is capable of extracting and detecting chemically generated nitric oxide in artificial cerebral spinal fluid as low as 1  $\mu\text{M}$ . The probes used are small (200  $\mu\text{m}$  x 3 mm) and significantly improve upon current methods used to measure nitric oxide in biological environments which are either too large to be used in vivo, or lack the sensitivity to measure physiological levels of nitric oxide. Results from experiments using gas phase microdialysis probes to measure nitric oxide generated by macrophages and rats will also be presented.

*Renee Huset*

## **USING GEOGRAPHIC INFORMATION SYSTEMS (GIS) TO IDENTIFY DEGRADED FOREST LAND FOR UST CARBON OFFSET PROJECTS**

Faculty Collaborator: Dr. Paul Lorah

This project stems from President Dease's signing of the Presidents Climate Commitment that obligates the University of Saint Thomas (UST) to "initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible." This project seeks to locate degraded forest land in Minnesota that can be purchased and restored by UST to offset the University's Carbon footprint, or sum of annual Carbon emissions, which has been calculated as 71,271 metric tons based upon figures from the 2006-2007 fiscal year. Geographic Information Systems (GIS) technology will be used to identify the most desirable land for purchase and restoration based on factors including travel time to UST, cost effectiveness of the parcels, and the Carbon-absorption potential of each landscape. As stated in the UST motto, students are to learn to "...work skillfully to advance the common good." By purchasing and restoring degraded forests near UST to reach their Carbon-sequestration potential, students will be given the chance work closely with the environment in a laboratory setting for the common good of present and future generations.

*Ryan L. Irey*

## **MUSICAL ELEMENTS OF COGNITION IN "WOHIN?"**

Faculty Collaborator: Dr. Shersten Johnson

Franz Schubert's song cycle of poems by Wilhelm Müller, titled "Die Schöne Müllerin", is widely adored within Lieder repertoire, a genre of song that is characterized by its extensive musical enhancement of poetic imagery. The scope of this research presents a method for measuring how a musical setting either reinforces or changes our perception of a poem. Through an analysis of two settings of "Wohin?" I will compare the works of Schubert and English composer Edward Loder to see how their music either burgeons the affect of Müller's text, or how the synergy of text and music produces a different conceptualization than that of the text by itself. A complete harmonic and contextual analysis of each setting, research on cognitive linguistics and music, and the application of recent research by Lawrence Zbikowski involving the use of conceptual integration networks to show how music and text interact has put forth valuable insight on the cognitive application of text painting inherent to Lieder.

Emma M. Jindra

## **MOLECULAR AND CRYSTAL STRUCTURES OF GLYCOSYLAMINES PRODUCED BY REACTION OF MONOSACCHARIDES WITH SECONDARY AMINES**

Faculty Collaborator: Dr. William H. Ojala

The reaction of a monosaccharide with a primary aromatic amine could yield an open-chain Schiff base or a cyclic glycosylamine as the crystalline product. We have been investigating by means of single-crystal X-ray diffraction the solid-state structures of the derivatives formed upon reaction of a monosaccharide with a *secondary* amine. In this case the glycosylamine is the anticipated product. We have attempted the preparation of this kind of derivative from a variety of monosaccharides and secondary amines; we have now obtained in crystalline form the derivative produced by reaction of D-galactose with piperidine. Here we describe the molecular structure and the solid-state packing arrangement assumed by molecules of this glycosylamine product. The orientation of the cyclic aglycone is equatorial with respect to the galactopyranosyl ring. Both rings assume the chair conformation in the solid state. The molecular packing involves a complex system of hydrogen bonds. Similarities are observed between this H-bond pattern and the one found in a previous structure, the *N*-(4-methoxyphenyl)-galactosylamine, but this pattern differs substantially from that of another previously determined galactosylamine structure, that of the *N*-(4-nitrophenyl) derivative.

Alexandria Johnson

## **CHANGES IN COGNITIVE APPRAISAL AMONG FEMALE MUSICIANS SURVIVING BREAST CANCER**

Faculty Collaborator: Dr. Jean Giebenhain

This is a preliminary study looking at how one specific group of breast cancer survivors experienced changes in their cognitive appraisals during and after breast cancer treatment. This qualitative study uses coded transcripts from 20 female musicians who survived breast cancer to measure themes related to changes in cognitive appraisals. Preliminary results show that most women engaged in some form of cognitive reappraisal. A few of the most common cognitive shifts included: “*Don’t sweat the small stuff,*” “*Seize the day,*” and “*One day at a time.*” A traumatic life event like breast cancer can initiate various outcomes, one of which may be cognitive reappraisal, as a means of coping.

Mikhail Klimstra

## **THE DIETARY BALANCE OF CARBON AND NITROGEN CORRELATES TO CHANGES IN THE COMPOSITION OF CUTICULAR HYDROCARBONS IN THE INVASIVE ANT SPECIES, LINEPITHEMA HUMILE**

Faculty Collaborator: Dr. Thomas C. Marsh

Argentine ants, *Linepithema humile*, were used as a model to investigate possible changes in hydrocarbon profiles as a function of dietary modification. These ants are an invasive species that display extraordinary social organization and communication. Previous research that examined how nutrient balance affected colony behavior and fitness in *L. humile* showed that an increasing ratio of nitrogen to carbon was detrimental to fitness. A significant metabolic consequence of this diet was drastically altered quantities of storage lipid between colonies fed high and low carbohydrate to protein ratios. In addition to being essential fuel molecules, hydrocarbons are used in chemical communication. Hydrocarbon molecules used in chemical messaging are synthesized in a path shared with fuel lipids; therefore, abundance of communication cuticular hydrocarbons may also be affected by the dietary balance of carbon and nitrogen. Dr. Adam Kay’s research group previously reared sample colonies of Argentine ants that were fed

different diets varying in carbohydrate and protein content. These colonies were monitored, collected, and preserved. Cuticular hydrocarbons were isolated through solvent extraction and then quantitatively analyzed by Gas Chromatography with detection by Flame Ionization. Examination of colonies at the extreme ends of the dietary range (high carbohydrate: low protein & low carbohydrate: high protein) revealed a significant difference in the abundance of specific hydrocarbons in the ant's hydrocarbon profile. Additionally, certain hydrocarbons showed a greater difference than others. The observed difference in specific hydrocarbon abundances, as opposed to a global overall shift in the hydrocarbon quantity, suggests that ants may have preference towards maintaining particular hydrocarbons on their cuticles.

*Abigail Krause*

## **CONSERVATION RESERVE PROGRAM IN THE MINNESOTA RIVER WATERSHED**

Faculty Collaborator: Dr. David Kelly

The Conservation Reserve Program (CRP) works with environmentally sensitive farmland voluntarily submitted into the program by farmers. Participants apply and compete to secure their land in a ten to fifteen year contract with the CRP, during which they are financially compensated for the land they have volunteered. In order to determine what lands are eligible, the CRP uses a list of criterion known as the Environmental Benefits Index (EBI). Using standard geospatial operations embedded in the discipline of the Geography Program, I am seeking to determine what physical criterion makes the best CRP land in the Minnesota River Watershed. In order to do this, I will look at current CRP land in the watershed and compare it to land enrolled during previous years. Furthermore, I will explore the EBI and its factors. Finally, to bring this project into a larger context, I want to determine the effects the price of corn has on CRP lands. Comparing CRP land enrollment to annual corn prices will give me an indication of whether farmers are discontinuing their contracts in order to replant corn, or if the financial compensation of the CRP is still more beneficial to them.

*Jeremy D. Leavell*

## **INVESTIGATION OF THE SOLID-STATE STRUCTURES OF ACID FLUORIDES AND THEIR ISOSTERIC ANALOGUES**

Faculty Collaborator: Dr. William H. Ojala

Although the crystal structures of a variety of derivatives of carboxylic acids have been described in detail in the crystallographic literature, relatively few crystal structures of acid fluorides have been published. This is presumably due to their high reactivity (being easily hydrolyzed to the carboxylic acid) and to their relatively low melting points, which make them difficult to isolate in solid form. We are interested in acid fluorides because the acyl fluoride group is *isosteric* (closely similar in size and shape) to the nitro group; we wish to determine whether acid fluorides could be co-crystallized with their nitro analogues to form interesting and useful new materials. Co-crystallization would occur most readily if the acid fluoride and nitro compound happened to be *isostructural*, assuming the same molecular packing arrangement in their respective pure crystals, so we have been attempting to prepare acid fluorides for analysis by single-crystal X-ray diffraction to find out whether such isostructural pairs exist. Another functional group isosteric with the acyl fluoride group is the carboxylate group; here the necessity of a counterion to the carboxylate might present an obstacle to isostructuralism, but choosing a carboxylate with the charged atom incorporated into the molecule itself might overcome that obstacle. We have attempted to prepare acid fluorides from the parent acids by metathesis with sodium fluoride; we have also attempted recrystallization of acid fluorides from commercial sources. Although our attempts to prepare X-ray quality crystals of these compounds have been unsuccessful thus far, further samples we have prepared await X-ray analysis.

*Jake Ludwig*

## **USING ZO-1, A TIGHT-JUNCTIONAL PROTEIN, AS A MARKER OF AVIAN LIVER DIFFERENTIATION**

Faculty Collaborator: Dr. Glenn Sherer

The liver carries out a multitude of vital functions in order to maintain a body's metabolic homeostasis, including proper digestion, metabolite detoxification, and metabolism of proteins, lipids, and carbohydrates. The emulsification of fats, as well as digestion of carbohydrates, is carried out by bile, the liver's primary production and secretion product. Bile is secreted from the basal surface of hepatocytes and flows through submicroscopic channels called bile canaliculi. These minuscule spaces, located between the lateral faces of contiguous hepatocytes, are held together by tight junctions, structures that are composed of a number of different proteins. The barrier function performed by these junctions can be attributed to the transmembrane protein occludin, which is anchored to the junction's cytoplasmic plaque by the protein ZO-1 (*zona occludens 1*). Thus, the confirmed presence of ZO-1 can be taken as an indication that functional tight junctions are present and, by this criterion, that the organ has differentiated both structurally and functionally. In this study, embryonic livers of 4- to 17-day Japanese quail (*Coturnix coturnix japonica*) were examined for the presence of this protein by immunohistochemistry using a rabbit anti-chick-ZO-1 antibody and a goat-anti-rabbit IgG linked to horseradish peroxidase (HRP). Positive results were visualized as a brown precipitate representing the HRP-catalyzed oxidation product of diaminobenzidine.

*Madelyn Mayry*

## **EFFECT OF HOST PHOSPHORUS CONTENT ON PARASITE INFECTION RATE**

Faculty Collaborator: Dr. Adam D. Kay

The paradox of sex has been a persistent question in evolutionary biology. Asexual organisms, because they are all female, should be able to out compete sexual organisms due to higher exponential population growth. In our study organism, *Potamopyrgus antipodarum*, asexual and sexual snails coexist. The theories of ecological stoichiometry suggest that elemental composition plays a large role in the overall fitness of an organism. Our focus on phosphorus highlights important compositional differences between triploid asexuals and diploid sexuals. Previously, we proved asexual snails have a higher % bodily phosphorus than sexual snails. *P. antipodarum* also live with castrating parasites. Through investigating the effects of host condition on parasite infection, we could discover a disadvantage of asexuality based on phosphorus content. I propose a study that looks at the effects of dietary phosphorus in *P. antipodarum* on the infection rate by an allopatric parasite. A study in this area would show whether parasites will preferentially infect a host based on differences in host condition, namely phosphorus content.

*Andrew Rischall*

## **INCREASING SENSITIVITY OF GAS PHASE MICRODIALYSIS PROBES USING OF A CARBON NANOTUBE COATED TRAP**

Faculty Collaborator: Dr. Anthony Borgerding

Gas phase micro-dialysis extraction (GPME) probes are used to extract volatile organic compounds (VOCs) from aqueous solutions. Current GPME probe research has been successful in monitoring reactions and analyzing analytes in diverse environments. A major constraint while using GPME probes is their lack of sensitivity (~1-20mM). A new method was devised to increase the sensitivity of GPME probes. Samples were pre-concentrated by cryofocusing analytes on a carbon nanotube (CNT) coated trap. After a 10s cryofocusing period, the trap is moved into an analyte desorption region, which is kept at a constant 300°C. Analyte is then detected by a flame ionization detector (FID).

1mM ethanol samples have shown increased resolution, separation, and increased signal strength in chromatographic data. Our studies have shown 100 times greater signal strength, which is crucial in analyte detection. Peak width for ethanol was observed around 10-15s. Reproducibility of peaks continues to be a problem. This may be due to difficulty keeping a constant cryofocusing temperature.

*Alisa Schilmoeller*

## **THE ROLE OF VISUAL IMAGERY IN THINKING ABOUT THE FUTURE**

Faculty Collaborator: Dr. Greg Robinson-Riegler

Recent psychological research has found that some of the same cognitive mechanisms that are engaged in thinking about one's personal past (i.e., their autobiographical recall) are also used when one thinks about future events. One such set of mechanisms is working memory, which is responsible for temporarily storing and manipulating information. One component of working memory is the visuo-spatial sketchpad. The visuo-spatial sketchpad is the part of working memory responsible for forming visual representations in the mind. D'Argembeau & van der Linden (2006) found that the ability to visualize future events is related to one's individual capacity for visual imagery. The current research attempts to determine whether this relationship is based in the spatial or visual aspect of visual imagery. The working memory model describes visual and spatial memory as two independent mechanisms. While doing visual or spatial distraction tasks, participants imagined doing either challenging or non-challenging activities in the future and reported the vividness of their mental representation. If the ability to generate future events is more related to visual or spatial memory, then distracting the components of the visuo-spatial sketchpad should affect the subjective experience of future events.

*Louis Sigtermans*

## **SELECTION OF RESISTANT BACTERIA WITHIN AN ENVIRONMENTAL COMMUNITY IN RESPONSE TO LOW-LEVEL EXPOSURE TO AN ANTIBACTERIAL AGENT**

Faculty Collaborator: Dr. Kristine H. Wammer

The emergence of bacterial strains resistant to antibacterial compounds is a growing concern worldwide. Because of the possibility of resistance genes transferring between bacterial species, the rise of resistance in environmental bacteria is of interest. This study explored the effect of exposure to low levels of triclosan (a widely used antibacterial agent that is included in many consumer and personal health-care products) on the selection of resistant bacteria in environmental communities. The project had two main objectives. The first objective was to determine current resistance levels to triclosan among bacterial communities collected from several natural water sources that vary in their land use and human impact. Bacterial samples from the Mississippi River, California coast, and Lake Superior were spread on Petri plates containing agar media spiked with varying triclosan concentrations. Resistance levels did not vary significantly when bacteria obtained from highly impacted areas were compared with those from more pristine areas. The second objective was to observe the impact of low concentrations of triclosan on bacterial communities over time. Bacteria collected from a natural water source were grown in bioreactors known as chemostats, exposed to low concentrations of triclosan, and tested periodically. Resistance was monitored by growing samples of bacteria from the chemostats in media containing lethal levels of triclosan. The bacteria were also analyzed over time for community composition of a highly variable DNA region via Automated Ribosomal Intergenic Spacer Analysis (ARISA). Our results indicate that significant community shifts are likely to be observed only with exposure to triclosan concentrations well above those observed to date in natural waters, but that subtle effects may be observed at lower concentrations. Future studies include isolating resistant strains for further DNA analysis.

*Jacob Smokovitz*

## **SPATIAL DISTRIBUTION OF CHEMICALS LEACHING FROM AN UNLINED LANDFILL IN NORMAN, OKLAHOMA, USA**

Faculty Collaborator: Dr. Jennifer McGuire

The United States has over 3,000 active solid waste municipal landfills and over 10,000 inactive landfills. Most of these inactive landfills were either unlined or poorly lined leading to the present day leaking of landfill leachate into groundwater and surface water supplies. The goal of my research was to map the distribution of selected chemical indicators at various depths over time from the Norman Landfill in Norman, OK to better understand chemical fate and transport of landfill leachate. Groundwater chemistry data collected by the United States Geological Survey was interpolated using ArcGIS software. The chemicals of interest include chloride, dissolved oxygen, methane, dissolved iron (II), sulfate, and dissolved organic carbon. These substances correlate with key natural biological and chemical attenuation and flow processes that occur in the sediments of the Canadian River basin. Studying these chemical characteristics yields significant insight into the design and evaluation of effective remediation plans for current and future chemical releases into the environment in order to best protect ecology and drinking water supplies.

*Amanda M. Stemig*

## **ANTIBACTERIAL ACTIVITY OF PHARMACEUTICALS TREATED WITH POTASSIUM PERMANGANATE**

Faculty Collaborator: Dr. Kristine H. Wammer

The overall goal of this project is to provide important information about the potential impacts of various antibiotics in natural water systems. Ciprofloxacin, trimethoprim and lincomycin are all antibiotics used to treat various bacterial infections in humans. Once excreted, these pharmaceuticals will find their way into wastewater treatment plants. If they are not removed in the wastewater treatment plant, they eventually will end up in the environment and when the effluent is released into natural waters. The purpose of this project, a collaborative effort with a research group at the University of Illinois at Urbana-Champaign, is to develop a water treatment technique that uses potassium permanganate in an attempt to remove each pharmaceutical from the water. This portion of the project studies the antibacterial activity of ciprofloxacin, trimethoprim and lincomycin both before and after degradation with potassium permanganate. To date, we have found that the degradation products of ciprofloxacin and trimethoprim have little to no activity thus this technique shows promise for removing these compounds from wastewater or drinking water without creating undesirable byproducts. Studies on lincomycin are ongoing.

*James Stokman*

## **SYNTHESIS OF AN ISOTHIAZOLE ANTIMICROBIAL**

Faculty Collaborator: Dr. J. Thomas Ippoliti

As bacterial resistance to current antibiotics continues to increase, new antibiotics must be continually researched and synthesized. My research has been developing and refining a nine step organic synthesis of a novel antimicrobial, modeled after Zyvox™. The main feature of this first generation class of antimicrobials is the oxazolidinone ring, which targets Gram-positive bacteria by blocking the ribosomal 50s subunit, effectively preventing translation of RNA to a polypeptide chain. As demonstrated by previous research, it is possible to increase the potency of the antimicrobial by changing the aromatic substituent attached to the oxazolidinone ring. My synthesis utilizes an aminoisothiazole aromatic substituent, which has itself been examined for antimicrobial properties. The synthesis starts with a three-step procedure to construct the isothiazole ring with an amino substituent. The amino group is

then transformed into the oxazolidinone ring in two steps. The remaining steps convert an alcohol into an acetamide group.

*Katelyn Terry*

## **EFFECTS OF POWERPOINT HANDOUTS ON LEARNING OUTCOMES**

Faculty Collaborator: Dr. Greg Robinson-Riegler

Methods for lecturing in university classrooms range from using chalkboards or discussion based lecture to convey information, to the increasingly popular Microsoft PowerPoint. The popularity of PowerPoint presentations raises questions about the effectiveness of taking notes off of the slides. Some professors choose to provide a handout to allow the students to take notes on, while other choose not to give the students a handout. This research examined the effects of PowerPoint handouts on student learning by using a two-section psychology class. One section was given a PowerPoint handout to take notes on, while the other section took notes using their notebooks. Students from both classes answered 16 multiple-choice and two short-answer questions based on information provided in the lecture. Half of the multiple-choice items were “factual” questions, and half were “application” questions. Students provided with PowerPoint notes performed better on the multiple-choice items, regardless of the type of question. The results from the short-answer items and the quality of notes are still pending, but the preliminary findings provide some evidence that providing PowerPoint handouts may facilitate student learning.

*Katie Theisen*

## **DO SEXUAL AND ASEXUAL SNAILS RESPOND DIFFERENTLY TO DIETARY PHOSPHORUS AVAILABILITY?**

Faculty Collaborator: Dr. Adam Kay

Given its many costs, sex should be rare or even nonexistent. The predominance of sexual reproduction thus indicates that sex provides substantive benefits. These benefits are usually thought to derive directly from the genetic consequences of sex; namely the production of genetically distinct offspring. Here, we take a different approach and focus on the higher ploidy level that characterizes many asexual taxa. In particular, we investigate whether polyploidy could confer costs derived from investment in the production of phosphorus-rich nucleic acids. We previously found that asexual (triploid) *Potamopyrgus antipodarum*, New Zealand freshwater snails, have higher bodily phosphorus (P) and nucleic acid content than their sexual counterparts. Since higher body P content is expected to result in higher dietary P demands, asexual *P. antipodarum* could experience greater P limitation than sexuals. We addressed this question by feeding *P. antipodarum* collected from a mixed sexual/asexual New Zealand lake population three different diets varying only in P content. We measured mortality, growth, embryo production, and dry mass across the different food treatments in order to evaluate whether there were differences in the extent to which dietary-P availability affected sexuals and asexuals.

*Vladimir Vinnik*

## **UNEXPECTED DISCOVERY OF A NOVEL DIALDEHYDE**

Faculty Collaborator: Dr. J. Thomas Ippoliti

The synthesis of metal organic frameworks for storage of large quantities of gases such as Hydrogen and Carbon dioxide can be carried out using a variety of reagents and procedures. The goal of the research was to make a

dialdehyde from which a metal organ framework can ultimately be made. The starting compound for the synthesis was Dimethyl-3,4-furan dicarboxylate. It was first reduced to a diol, furan-3,4-diyldimethanol, using lithium aluminum hydride. The following step, the oxidation of the diol to the dialdehyde form yielded some interesting results: a rather novel set of reagents was used for this oxidation in which there are two hydroxyl groups on the same molecule being oxidized. The yield was unexpectedly low for this reaction. When trying to recover more product from the reaction mixture after sitting for several days, crystals were discovered in the aqueous layer which upon analysis by X-ray crystallography and NMR were revealed to be those of a novel diene dialdehyde. The mechanism proposed for this novel molecule was that of a Michael addition following by a ring opening of the furan. Further experimentation is required to optimize this process and other reaction to convert the diene dialdehyde to a tetraldehyde structure will be explored.

*Jack Westman*

## **2008 ELECTION AND THE CREATIVE CLASS**

Faculty Collaborator: Dr. Paul Lorah

The 2008 election saw Barack Obama defeat John McCain by a large margin: 365 to 173 electoral votes. After the election, I wondered, “Why did the Republican Party lose by so much, and is there a way I can find out using a Geographic Information System (GIS)?” My initial theory was that one of the primary causes behind the Democrats’ victory was a group of people known as the “Creative Class.”

Richard Florida, a prominent geographer, first came up with the term “Creative Class.” As he puts it, “Leading this transformation are the 40 million Americans – over a third of our national workforce – who create for a living. This “creative class” is found in a variety of fields, from engineering to theater, biotech to education... In the future, they will determine how the workplace is organized, what companies will prosper or go bankrupt, and even which cities thrive or wither.”

At least for myself, the Creative Class seemed to fit the stereotype of people who would vote for Obama: young, intelligent, creative professionals. Since there are so many belonging to this class, couldn’t they have a large impact on the election? Using census data, data related to the Creative Class, election data, and GIS, this project attempts to answer the question, “Was the Creative Class one of the driving forces behind the Democrats’ victory in 2008? And if not, what was?”

*Sarah Wozniak & Katelynn McConnell*

## **EMOTION, PAIN, AND PERCEIVED CONTROL**

Faculty Collaborator: Dr. J. Roxanne Prichard

This study explores the relationship between mood, perceived control, and pain tolerance. Positive mood as well as perceived control lessen pain, while negative mood and lack of perceived control enhances it. Perceived control, measured by the locus of control scale, measures the extent one believes he or she has control over the environment. An individual with an internal locus of control perceives he or she has more control, while an individual with an external locus of control feels less in control. In order to induce mood, the International Affective Picture System will be used to prepare a slideshow of either positive, neutral, or negative images. Afterwards, participants will complete a cold pressor task in which they will submerge their hand in four degree Celsius water, and report when they feel pain. It is hypothesized that group exposed to negative images will have the lowest pain tolerance, while the group exposed to positive images will have the highest tolerance. Furthermore, individuals with an internal locus of control will have higher pain thresholds and tolerances than those with an external locus of control. This research has

implications for the treatment and management of chronic illnesses, such as rheumatoid arthritis, and painful injuries.

*Taylor Zumbusch*

## **BROOD-RAIDING AS AN ADVANTAGEOUS PROTEIN SOURCE FOR PAVEMENT ANTS**

Faculty Collaborator: Dr. Adam Kay

Invasive ant species have immense environmental and economic impacts due to their diverse ecological roles. Research aimed at predicting which species are likely to be invasively destructive has focused on a variety of traits, including nutritional requirements. Invasive Argentine ants rely heavily on carbohydrate-rich diets. Our research from last summer indicated a trade-off between carbohydrate and protein intake; colonies fed more carbohydrate-rich diets had high activity levels and worker longevity, while colonies fed protein-rich diets produced more brood (immature ants). Another key competitive aspect that might assist Argentine ants in being so invasively successful is brood raiding - the collection and consumption of brood from other colonies after being overrun. In this study, I propose to compare the nutritional value of ant brood to that of other protein sources for supporting colony growth. Ant colonies will be fed one of four diets with different protein sources. The prediction that colonies fed soft ant brood would grow faster than those fed adult insects (with hard exoskeletons) was incorrect. Colonies fed crickets had significantly more final brood than colonies fed fruit flies, brood, or no proteins. Colonies fed fruit flies or brood had significantly more final brood than those no given protein. There was no significant difference in final workers between the four diet treatments. Further research will be conducted to compare protein preferences to colony success between Pavement Ants and the invasive southwest Argentine Ants.

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