

BUSH FOUNDATION PROGRAM GRANT:  
COLLABORATIVE INQUIRY

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

**Abstracts**

Vol. 9  
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## Introduction

The abstracts published in this volume reflect the value we at the University of St. Thomas place on faculty/student collaboration.

Students who have recently done collaborative work with a faculty member present that work in these abstracts and at this poster session for purposes of dissemination and scrutiny by their peers, their professors, and the academic public.

The University of St. Thomas expresses its deep gratitude to the Bush Foundation, who funded this event through a three-year Program Grant. The grant seeks to increase the use of inquiry-based teaching methods, so that students experience the real work of the professions, working on real problems often taken from outside the university, in the ways they will be called upon to employ their disciplines after they leave the university.

A second theme of the Bush Program Grant is to increase faculty/student collaboration. We believe that one of the very best ways to teach is to have professors work with students collaboratively. Students see how work is really accomplished in their chosen professions, and professors have the chance to share their work as it is being created.

We hope this event and this volume gives visibility and credibility to the ideas represented in our Bush grant



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May 2007

As president of the University of St. Thomas, I am both pleased and proud to welcome you to the ninth poster session devoted to faculty/student collaboration projects developed as part of our grant from the Bush Foundation, *Focus on Inquiry: Faculty/Student Collaboration at the University of St. Thomas*.

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. This 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 am very proud of what our students and faculty are doing and I hope the work represented here will illustrate the importance of collaborative inquiry at St. Thomas.

Sincerely,

A handwritten signature in cursive script that reads "Dennis Dease".

Reverend Dennis Dease  
President

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*Trina M. Arola*

## **MOLECULAR AND CRYSTAL STRUCTURE OF A PHENYLHYDRAZONE DIMER**

Faculty Collaborator: Dr. William H. Ojala

We are working toward preparing new crystalline materials by co-crystallizing molecules we have designated “bridge-flipped isomers,” pairs of molecules related by the reversal of a bridge of atoms linking two major parts of each molecule. We are currently examining benzylideneanilines, in which the bridge-flipped isomerism is Ar-CH=N-Ar' vs Ar-N=CH-Ar' (where Ar = aryl) and phenylhydrazones, in which the bridge-flipped isomerism is Ar-CH=N-NH-Ar' vs. Ar-NH-N=CH-Ar' (where Ar = aryl). Because mutual solid-state solubility is greatest for compounds that are isostructural (same molecular packing arrangement), we are using single-crystal X-ray diffraction to identify isostructural bridge-flipped isomeric pairs that would be likely candidates for co-crystallization. In earlier studies we found that a pair of benzylideneanilines substituted with methyl and trifluoromethyl groups at the two ortho positions assumed identical packing arrangements, so we have recently extended this investigation to methyl/trifluoromethyl-substituted phenylhydrazones. In an attempt to prepare the ortho-trifluoromethylphenylhydrazone of para-tolualdehyde, we obtained an unexpected product, essentially a dimer of the expected phenylhydrazone. Here we describe its molecular and crystal structure.

*Barjeta Balidemaj*

## **A SOLID-STATE COMPARISON OF TWO CENTROSYMMETRIC BENZYLIDENEANILINES**

Faculty Collaborator: Dr. William H. Ojala

We refer to pairs of molecules related by the reversal of a chain or bridge of atoms connecting two major parts of the molecule as “bridge-flipped isomers.” The purpose of this study is to determine how frequently and under what conditions these compounds are isostructural, assuming the same molecular packing arrangement in their respective crystals. Because of this similarity, these compounds may be especially suitable for use in the preparation of solid solutions and new solid materials. We have been focusing on benzylideneaniline bridge-flipped isomers, molecules that differ only in the orientation of the -CH=N- bridge between the two major parts of the molecule. Because centrosymmetric molecules tend to assume packing arrangements in which the molecular center coincides with a crystallographic inversion center, we are examining centrosymmetric benzylideneanilines by means of X-ray crystallography to determine whether or not this tendency can result in isostructural crystals. Here we describe the molecular and crystal structures of N,N'-bis(2-methoxybenzylidene)-p-phenylenediamine and 2,2'-dimethoxy-N,N'-(p-phenylenedimethylene)dianiline, which are bis-benzylideneanilines related by dual reversals of the two -CH=N-linkages. We have found that these two isomers assume different molecular packing arrangements in the solid state and participate in different kinds of solid-state intermolecular interactions.

*Luke Brand and Amanda Kastelic*

## **SUBSTANCE P MODULATION OF ANTI-TUMOR RESPONSES: ENHANCED TUMOR RESISTANCE BY ADOPTIVE TRANSFER OF SP-TREATED T CELLS**

Faculty Collaborator: Dr. Jill Manske

Substance P (SP) is a neuropeptide that has been shown to have immunoregulatory properties including effects on many of the mediators involved in anti-tumor immunity. In previous studies we have shown that treatment of mice with SP provides protection against tumor growth. This protection requires both T cells and NK cells, and adoptive transfer of cells from SP-treated animals can transfer tumor protection. These earlier studies suggest a model in which

SP treatment prior to tumor challenge primes immune mediators to prevent or delay tumor establishment. In this study we examined the role of T cells in tumor protection. To examine whether SP-primed T cells could increase tumor resistance, purified T cells from SP-treated donor mice were adoptively transferred into animals prior to tumor challenge. Mice adoptively transferred with T cells from SP-treated donors developed significantly fewer tumors than did control animals receiving T cells from PBS-treated donors. These results suggest that SP mediates anti-tumor immunity, at least in part, by effects on T cells, and that tumor protection provided by these primed T cells can be transferred between individuals.

*Nathaniel C. Brandt*

## **TRANSIENT ABSORPTION SPECTROSCOPY OF PHOTOINDUCED ELECTRON TRANSFER REACTIONS OF PYRROMETHENE 546**

Faculty Collaborator: Dr. Joseph M. Brom

Photoinduced electron transfer reactions are important in many aspects of chemistry and can be studied in detail by transient absorption spectroscopy. An apparatus was constructed for transient absorption spectroscopy by modifying an existing apparatus used in the observation of transient fluorescence decays. The apparatus was optimized and calibrated by observation of the transient decay of triplet-state benzophenone. Following apparatus optimization, the photoinduced electron transfer between 9,10-dicyanoanthracene (DCA) and trans-stilbene (TSB) was observed to verify the ability of the apparatus to study photoinduced electron transfer systems. The laser dye 1,3,5,7,8-pentamethylpyrromethene difluoroborate (pyrromethene 546 or PM 546) was then chosen for analysis due to its suspected ability to undergo a variety of photoinduced electron transfers. Prior to transient absorption spectroscopy, the dye was chemically reduced and oxidized (forming the PM 546 radical anion and radical cation, respectively) in order to determine absorption maxima for each species to aid in the observation of their transient decays. This resulted in an observed peak absorption of 520 nm for the PM 546 radical cation. Once rough estimates of the absorption spectra for the PM 546 radical anion and cation were determined, transient decays for the cation were observed near 410 nm using tetrachloro-para-benzquinone as a quenching reagent for photoexcited PM.

*Jordan Crow*

## **STAYING GREEN DURING WINTER: SEASONAL CHANGES IN PHOTOSYNTHETIC PROTEINS ASSOCIATED WITH LIGHT HARVESTING IN *PINUS STROBUS* AND *ABIES BALSAMEA***

Faculty Collaborator: Dr. Amy Verhoeven

Evergreen plants, during winter, are exposed to combined stresses of low temperatures and high light. Low temperatures limit carbon reduction without impacting light absorption, thus creating an imbalance between light absorption and its utilization.

Evergreens deal with this problem by increasing the amount of light that is dissipated thermally within their light harvesting complexes (LHCs). There is strong evidence that the LHCs functionally change from energy harvesting to energy dissipating centers during winter. The goal of this study was to determine if there are physical changes in the composition of the light harvesting complexes that accompany these functional changes. We examined seasonal changes in relative abundance of light harvesting and reaction center proteins in the evergreens *Pinus strobus* (growing in the sun) and *Abies balsamea* (growing in sun and shade environments) in the seasonally cold climate of Saint Paul, Minnesota. Thylakoids were isolated every two months for a year and western analysis of thylakoid fractions using antibodies to specific LHCs were performed. Results indicate that the majority of LHCs decrease in relative abundance

during winter in sun plants, with less change occurring in shade plants. Interestingly, Lhcb2 did not decrease during winter, and PsbS decreased only minimally. The results will help us model physical changes in the LHCs that occur in evergreens upon transition from summer to winter, that accompany the functional transition from light-harvesting to energy-dissipation. Additionally, results suggest some novel functional differences between individual light harvesting proteins.

*Dan Desmond*

## **IMPROVEMENTS IN ANALYZING HIGH BOILING AROMATIC COMPOUNDS USING THE GC-ARSLID**

Faculty Collaborator: Dr. Tony Borgerding

The ArSLID is a very selective ionization detector for aromatic compounds. This selectivity is due to the detector's utilization of resonance enhanced multi-photon ionization (REMPI). Recent work has involved overcoming previous temperature limitations in the instrument. Some recent successes in identifying multi-ring aromatic compounds are due to an improvement in the insulation of the assembly. This allows for the analysis of higher boiling analytes such as fluorene, 2-naphthol, and acenaphthene. Current detection limits with the instrument are concentrations of 0.010-0.10 mM with a linear range of 3 orders of magnitude.

*Daniel A. Everson*

## **EXPLORING NEW ROUTES FOR THE SYNTHESIS OF DIBENZO[1,4]DIOXIN-2-OL FOR APPLICATION IN PHOTOCHROMIC MOLECULES**

Faculty Collaborator: Dr. J. Thomas Ippoliti

New synthetic routes to the synthesis of dioxin derivatives for application in photochromic molecules are discussed. Recent work suggests that the synthesis of dibenzo[1,4]dioxin-2-ol may be obtainable in only two steps, a significant improvement over prior four-step procedures. Further, an alternative four-step route is under investigation, which shows promise of increasing over synthetic yields.

*Sean Ewen*

## **DYNAMICS OF POTASSIUM CHANNELS IN THE ACTION POTENTIAL**

Faculty Collaborators: Dr. Mikhail Shvartsman and Dr. Dwight Nelson

Animal nervous systems can transmit information with incredibly high speed. Information signals must travel quickly through the axon, one of the most important parts of the neuron for long distance communication. The membrane of the axon conducts electrical signals and transmits information along its length through active differences in voltage across the cell membrane caused by ions entering and leaving the axon through specialized ion channels. The action potential is responsible for the re-amplification of the electrical signal as it travels along the axon. Potassium channels allow potassium ions to leave the axon during the action potential in order to lower the membrane potential to prepare for another signal.

We used a simplification of the Hodgkin-Huxley model to find the concentration of open potassium channels corresponding to a range of voltage and time. To break the dependence of potassium channels on voltage in the mathematical models, we studied action potentials as waves. The Korteweg-de Vries wave-specific equation was used to calculate the concentration of open potassium channels at a given time and a given point along the axon segment.

These results were comparable to the Hodgkin-Huxley model of the opening and closing stages of potassium channels during action potential propagation. This indicated that wave-specific equations could be used as an alternative model to describe the dynamics of potassium channels.

*Matt Gorman*

## **FISH COMMUNITIES VERSUS WATERSHED USE AS DRIVERS OF ALGAL ABUNDANCE IN SHALLOW LAKES**

Faculty Collaborator: Dr. Kyle Zimmer

We measured algal abundance in 73 shallow lakes across two biomes (prairie and deciduous forest) in western Minnesota (USA) during the summer of 2005. We also determined the type of fish community and fish biomass present in each site, and used GIS to estimate the proportion of land used for agriculture within a 500m buffer around each lake. We used a model-selection approach to assess the relationships between algal abundance and a) ambient nutrient levels, b) agriculture use in buffers, and c) several characteristics of the fish communities. The model best supported by the data had terms for ambient nutrient levels and planktivore+benthivore biomass, and explained 67% of the variance in algal abundance. This model had 2-fold stronger support than the second best model (planktivore+benthivore biomass interacting with ambient nutrient levels), and >1,000,000,000-fold stronger support than the top agriculture model (agriculture interacting with ambient nutrient levels). Our results indicate that management of Minnesota's shallow lakes should expand beyond anthropogenic effects on watersheds to include the management of fish populations within these systems.

*Chuck Harmston*

## **THE EFFECT OF INFANTILE AMNESIA ON THE OFFSET OF INFANTILE AMNESIA**

Faculty Collaborator: Dr. Gregory Robinson-Riegler

Infantile amnesia, the inability of a person to recall any events from their life that occurred before age of 3 or 4, has emerged as an important phenomenon in the fields of both cognitive and developmental psychology. A wide body of literature has theorized about its etiology, with recent efforts focusing on the role that language acquisition might play. The present study attempted to provide empirical data directly linking language acquisition with the offset of infantile amnesia. Undergraduate students (N = 41) completed surveys addressing their earliest memories, while their parents (N = 18) completed surveys addressing the child's language development on several measures. No relationship was found between any of the measures of language development and the age of earliest memories. Null results are likely due to low statistical power and poor measurement. Methodological improvements and future directions of research are discussed.

*Patrick Hawk*

## **SYNTHESIS OF N-HYDROXYSUCCINAMIDYL ESTERS OF FATTY ACID OMEGA-DISULFIDES**

Faculty Collaborator: Dr. Thomas C. Marsh

Molecular scaffolds composed of nucleic acid are of great interest for development of nanometer scale devices. The common strategy for attaching things such as nanoparticles (NP's) to these scaffold structures involves reactions that occur, by necessity, in an aqueous environment. Unfortunately, these conditions may also lead to instability that

ultimately causes the scaffold to fall apart. This fundamental problem poses a significant drawback in the development of fabrication processes that would otherwise take advantage of DNA's ability to self-assemble. An alternative approach that may preserve scaffold structure would be to decorate a nucleic acid molecular scaffold with non-polar gold NP's at a water/organic solvent interface. This strategy would retain the structure of the nucleic acid scaffold during NP decoration. To accomplish this, non-polar tether molecules were synthesized so that, when attached to a DNA scaffold, they will facilitate binding of gold NP's suspended in an organic solvent upon self-assembly. A series of omegamercapto-fatty acids were used to synthesize non-polar disulfide tethers of varying lengths. Ultimately these fatty acyl-disulfides will be coupled to an oligonucleotide and incorporated into a molecular scaffold, known as a G-wire. The disulfide groups of these G-wires act as non-polar tethers that can project into the non-polar solvent, and they will bind to gold nanoparticles in the aqueous layer across the polar/non-polar interface. These tethers will be tested for their effectiveness in mediating interfacial gold NP decoration by UV/Vis spectrophotometry and gel electrophoresis. It is expected that an optimal non-polar tether length will be found for efficient G-wire self-assembly and interfacial NP decoration.

*Natalie Homa*

## **UNGER'S LIVING HIGH AND LETTING DIE: AN EMPIRICAL STUDY OF PSYCHOLOGICAL INFLUENCES**

Faculty Collaborators: Dr. Tonia Bock and Dr. Heidi Giebel

The purpose of this study was to empirically test two hypotheses proposed by the author and moral philosopher, Peter Unger, in his book, *Living High and Letting Die*. Unger's Liberation Hypothesis suggested that when responding to hypothetical cases involving diminishing loss or suffering of innocent others, despite our Basic Moral Values, which encourage positive responses, people's moral intuitions are often affected by contrary psychological factors. Unger suggested that people typically justify lack of involvement in serious situations by classifying some problems as "other people's problems," also known as "projective separating" and "projective grouping." He proposed that using a hypothetical case involving several active options would help people to overcome these psychological influences. Unger thought that people would remain consistent with their positive judgment when presented with a similar, but simpler case with only one active option, immediately following the more complex one. We tested Unger's hypotheses using four of his proposed cases, counterbalanced to test for order effects. Two groups of Philosophy students at the University of St. Thomas participated in the study. One group was enrolled in introductory Philosophy (PHIL 115). The other group had completed Ethics (PHIL 214/215) and was used to determine whether Ethics education would affect responses to cases. Findings were significant, however, in the opposite direction of Unger's hypotheses and our expectations.

*Matthew Humbert*

## **TEMPERATURE VARIATION OF VOC EXTRACTION FROM AQUEOUS SAMPLES USING A MICRODIALYSIS MEMBRANE**

Faculty Collaborator: Dr. Anthony Borgerding

A probe using a microdialysis membrane is useful to extract VOC from an aqueous solution into the gas phase. The probe is small and extraction fast. Steady state concentrations are achieved in less than 5 seconds. Because the extent of extraction is based on Henry's Law, temperature should have a large impact. We measured VOC signals for aqueous solution temperatures from 0oC to 37oC. We found that these signals increase with an increase in the temperature of the aqueous solution.

*Sara Hyatt*

## **THE EFFECT OF RAP1 ON PROGRAMMED CELL DEATH**

Faculty Collaborator: Dr. Jennifer Cruise

Previous research has shown that increasing the amount of active Rap1 in MDCK (epithelial) cells causes a decrease in cell proliferation. Previous techniques used to study the role of Rap1 in cell proliferation have not demonstrated whether changes in cell number are purely due to changes in the rate of proliferation and not in the rate of programmed cell death (apoptosis). For this study, MDCK cells were stably transfected with an active Rap1 gene, a control plasmid, or a dominant-negative Rap1 gene. To induce apoptosis, cells were starved for 0, 24, 48, 72, or 96 hours. Cells were stained with Annexin V-FITC and propidium iodide and analyzed via flow cytometry in order to quantify apoptosis in each population. Our preliminary data indicate that decreasing the amount of active-Rap1 within cells decreases the rate of apoptosis in response to starvation conditions. In contrast, increasing the amount of active-Rap1 within cells increases the rate of apoptosis in response to starvation conditions. Presently, it is unclear whether exposing cells to trypsin may be influencing our results. We are experimenting with other techniques for quantifying apoptosis that do not require the integrity of the cell membrane to be maintained. We are also currently looking at the effects of Rap1 on anoikis (induction of apoptosis by preventing cell adherence to a substratum).

*Emily Korman*

## **INFLUENZA VIRUS DETECTION USING A CHEMILUMINESCENT POLYMER**

Faculty Collaborator: Dr. J. T. Ippoliti

Chemiluminescent polymers are molecules that can bind to other molecules and produce a “glow” that can help detect enzymes. The goal of this research project is to synthesize a new chemiluminescent polymer that will detect the influenza virus by attaching to neuraminidase. The first objective is to make a sialic acid chemiluminescent polymer. This polymer will be capable of binding to viruses containing neuraminidase on their surface and produces a glow that can help detect the influenza virus. Methods in making the sialic acid polymer include making N-Acetylneuraminyl chloride synthesized from N-acetylneuraminic acid reacting with trifluoroacetic acid and then acetyl chloride. A linking molecule will then be synthesized starting from 1,4-butanediol and acrylonitrile. This nitrile will then be reduced to a primary amine and protected, the alcohol end will then be attached to the sialic acid. Finally, primary amine will be deprotected and attached to the polymer containing luminol. This new polymer containing a chemiluminescent group and a sialic acid group will then be capable of attaching to neuraminidase and produce a glow when treated with the appropriate reagents.

*Andrew Korte*

## **ANALYSIS OF TWO FLUOROQUINOLONE ANTIBIOTICS AND THEIR ENVIRONMENTAL PHOTOCHEMICAL DEGRADATION**

Faculty Collaborator: Dr. Kristine H. Wammer

Two fluoroquinolone antibiotics, norfloxacin and ofloxacin, were examined to predict their respective photochemical fates in natural waters. Samples of norfloxacin and ofloxacin solutions in water obtained from Lake Josephine in St. Paul and in deionized water adjusted to a similar pH (~8) were photolyzed under sunlight and analyzed by HPLC to determine concentrations at set time intervals. Photodegradation rates were rapid for both drugs, with a half-life of ~10 minutes for norfloxacin and ~40 minutes for ofloxacin at 50  $\mu$ M concentrations and pH 8, with rates dropping sharply outside the pH range of 8-9. Degradation occurred more quickly in deionized water than natural water, indicating indirect processes likely will not significantly contribute to removal of the drugs in the environment. Rate

was also found to be highly dependent upon concentration, with screening effects being seen at concentrations as low as 2  $\mu\text{M}$  in the case of norfloxacin. Using degradation rates for solutions at a range of pH values and measured pKa values, decay constants were calculated for each of three species of norfloxacin allowing for the prediction of decay rate at the range of pHs relevant in natural waters. Two products of norfloxacin photolysis were identified.

*Marika K. Kuspa*

## **COMPARISON OF THE CRYSTAL STRUCTURE OF 2-METHYLBENZYLIDENE-2-METHYLANILINE TO ITS CHLORO ANALOGUE; SPACE-FILLING REQUIREMENTS OF METHYL VS. CHLORO SUBSTITUENTS**

Faculty Collaborator: Dr. William H. Ojala

This research project involves the crystallization of organic compounds (specifically benzylideneanilines, compounds having the general formula  $\text{Ar-CH=N-Ar}'$ , where Ar = aryl) and the determination of their crystal structures by X-ray crystallography. The overall goal of this project is to determine the structures of a given benzylideneaniline and its "bridge-flipped" isomer (the isomer differing only in the orientation of the  $-\text{CH=N}-$  group between the phenyl rings) to determine whether the packing arrangements are similar enough (isostructural) to allow the compounds to be co-crystallized. The particular compound described here, 2-methylbenzylidene-2-methylaniline, is the same as its bridge-flipped isomer; reversal of the bridge does not yield a different compound. Nevertheless, this compound is of relevance to this project in allowing us to compare the space-filling requirements of a methyl group to those of a chlorine atom on a substituted benzylideneaniline. Here we compare this 2,2'-dimethyl-substituted benzylideneaniline to a benzylideneaniline bearing a chlorine atom in the ortho position on each ring, 2-chlorobenzylidene-2-chloroaniline. We wish to determine whether the chlorine atom is similar enough to the methyl group in size and intermolecular interactions for these molecules (and related ones) to assume the same molecular packing arrangement in the solid state. In this case, the compounds assume different packing arrangements; we have found that 2-methylbenzylidene-2-methylaniline packs in the space group P212121, but 2-chlorobenzylidene-2-chloroaniline packs in the space group Pbcn.

*Rachel A. Lundeen*

## **PHOTOCHEMICAL BEHAVIOR OF ENROFLOXACIN, A FLUOROQUINOLONE, IN THE AQUEOUS ENVIRONMENT**

Faculty Collaborator: Dr. Kristine H. Wammer

Antibacterials are an emerging class of aquatic environmental contaminants that have been detected at low levels in the aqueous environment and are of concern due to their specifically designed biological responses. Various environmentally-relevant photochemical studies of a member of the fluoroquinolone (FQ) class of antibacterials have been performed. Enrofloxacin, an agriculturally-used FQ, studied under natural sunlight, has a rate of photodegradation greatest at pH near 8.5-9.0. Experiments with enrofloxacin in natural water after about 4 hours of summer sunlight exposure showed the formation of at least five notable photoproducts preliminarily identified by LC/MS. One minor photoproduct of enrofloxacin was determined to be ciprofloxacin, another FQ. The antibacterial activity of enrofloxacin was significantly enhanced after photolysis due to the presence of these photoproducts. Current research has focused on isolating and identifying these photoproducts, as well as determining the extent of enhanced antibacterial activity that can be attributed to enrofloxacin's minor photoproduct.

*Kendra M. Lystad*

## **A SOLID-STATE SEARCH FOR HALOGEN-NITRILE CONTACTS IN A SERIES OF “BRIDGE-FLIPPED” ISOMERIC BENZYLIDENEANILINES**

Faculty Collaborator: Dr. William H. Ojala

We describe as “bridge-flipped isomers” those molecules that differ in structure only in the orientation of a bridge of atoms connecting two major portions of the molecule. This isomerism occurs among the benzylideneanilines: Ar-CH=N-Ar' vs. Ar-N=CH-Ar' (Ar = aryl). We are interested in whether or not these isomeric pairs are isostructural, assuming the same solid-state molecular packing arrangement. Co-crystallization of isostructural isomers may yield solid solutions possessing properties that could be modified systematically by varying the proportions of the co-crystallized compounds. Isostructuralism between benzylideneanilines bearing both a nitrile group and a halogen atom might be encouraged by Lewis base-Lewis acid C<sup>≡</sup>N:—X contacts linking molecules into similar chains in their respective crystals. Using single-crystal X-ray diffraction, in previous studies we determined the crystal structures of two pairs of bridge-flipped benzylideneanilines from the ortho-cyano-para-halogen series, the fluoro and chloro derivatives. We have now determined the crystal structures of the bromo isomers and of the iodo isomers. None of the bridge-flipped isomeric pairs in our collection are isostructural thus far. Significantly, in accord with the relative weakness of fluoro, chloro, and bromo substituents as Lewis acids, there are no close halogen-nitrile contacts in these structures; however, the iodo-nitrile benzylideneanilines we have examined do possess them. Similar dimers are formed in these latter structures, but the dimers are packed differently in the solid state, producing crystals that are not isostructural. We are examining additional halogen-nitrile substituted benzylideneanilines and phenylhydrazones in an effort to identify isostructural isomers in both series of compounds.

*Katie McGarry*

## **SYNTHESIS OF A THIADIAZOLE FUNCTIONALIZED ANTIBACTERIAL OXAZOLIDINONE**

Faculty Collaborator: Dr. J. Thomas Ippoliti

The evolution of drug resistant bacteria in hospitals and the general public has fueled antibiotic research in multiple areas, including separate studies of oxazolidinone and thiazolidine groups. A six-step synthesis was devised to produce an oxazolidinone with a p-methoxyphenyl-thiazolidine substituent. Steps 1 through 4 were completed in good yields, and new synthetic methodology was explored to produce the oxazolidinone ring in only one step without success. New synthetic methodology was found for step 5 (conversion of an azide to an amine) when conventional methods proved unsuccessful.

*Tina Nagel*

## **A NATURAL, INEXPENSIVE METHOD TO FILTER ARSENIC IN WATER**

Faculty Collaborator: Dr. J. Thomas Ippoliti

Arsenic in drinking water is a significant problem in India and other developing countries, causing multiple types of cancer. Using a corn cob soaked in 50/50 sodium hypochlorite/water solution for one day, rinsed in 5% sodium bicarbonate, and dried, water contaminated with arsenic can be filtered to meet the international standard, less than 10 µg As/L, for an extremely low cost in non-renewable parts. Standard arsenic solutions were prepared in 20 µg As/L, 40 µg As/L, and 60 µg As/L. These solutions were filtered through this novel filtering system, and the resulting water was analyzed using the Hach EZ Arsenic Test Kit<sup>®</sup>. The filter successfully removed all of the arsenic from the 20 µg

As/L and 40 µg As/L solutions three times to the detection limits of the kit, under 10 µg/L and removed arsenic from 60 µg/L solutions six times to ~20µg/L.

*Rex Njoku*

## **UST SCIENCE BEAR : INTRODUCING THE 1ST EXPLORATIVE AND RESEARCH-ORIENTED UST SCIENCE RESOURCE WEBSITE THAT SUPPORTS ALL RAMIFICATION OF THE SCIENCES FOR STUDENTS, FACULTY AND BEYOND.**

Faculty Collaborator: Dr. Anthony Steyermark

The objective of 'UST Science Bear' (USTSB) is to foster academic excellence found here at St.Thomas. It is the continuation of a previous project on technology and physiological applications that involved the interplay between biophysical ecology, basic physiology functions, metabolic functions and animal behavior in a living organism. USTSB resulted because of the need, not only to find the relationships that exist in physiology, but also to bring about more integration and collaboration between all of the science divisions, especially here at St.Thomas. This project totally exceeds the goals of the previous research, it includes: Cutting-edge scientific calculators/converters, more eco-physiological bio-computations and applications, science news, science ethics, science dictionaries, science links, science pictures/videos, scientific interesting topics, UST science student/faculty researches, science departments, science clubs, science spotlight, science events calendar, etc. USTSB will aid the St.Thomas community, especially science students/faculty in quickly accessing science resources available to them here at St.Thomas and beyond. USTSB will also be a UST science student's haven, as they will most definitely enjoy the calculators, quick science aids and resources that are available to them on the site. USTSB will also enable St.Thomas to showcase its science programs and accomplishments on the web to make ourselves more notable and competitive amongst other schools. Feedbacks, suggestions and additions to the site will be definitely appreciated. As a graduating student, this is the least I can do for a University that has equipped me with the most valuable education, which everyone strives to attain. In the nearest future, a committee will be established to support the website in collaboration with the science division here at St.Thomas. As time goes by, more applications and improvements will be implemented on the site.

*Rex Njoku*

## **A MEANS OF OUTDOOR BIRD IDENTIFICATION USING LABVIEW SOFTWARE AND PROGRAMMING.**

Faculty Collaborator: Dr. Mark Werness

The objective of independent research involved building a LabView program that will be able to remotely identify bird species in the open. We were mostly interested in trying to identify common bird species that are easy to find because of their distinct sounds. Some of these birds include: blue jays, crows, carrion crows, barn owls, etc. We utilized internet resources in getting sound files for different species of birds. A LabView program that was able to hear, reproduce bird sounds and identify the bird specie was finally designed and it worked properly. However, it is limited to identifying bird sounds one at a time. For future research, we hope that these small beginnings can finally lead a master design that will not only be able to recognize a few birds, but be able to recognize a wide range of bird varieties in the field without any human being. Something like this will definitely aid field biologists, animal reserves, etc in being able to identify bird species in a particular area and also monitor their migration patterns and spatial distribution.

*Tim O'Neil*

## **BEKESY'S MASKING EFFECT IS PRESENT IN A COLOR-PHONOLOGICAL SYNAESTHETIC EXPERIENCE**

Faculty Collaborator: Dr. J. Roxanne Prichard

Color-phonological synaesthesia occurs when an auditory stimulus evokes the visual sensation of a particular color (e.g., higher frequency tones tend to evoke colors with a brighter hue). Auditory masking occurs when, in tone combinations, higher pitched tones are masked by lower pitched tones due to the frequency band organization of the cochlea. In this study, non-synaesthete participants were exposed to a series of single tones and tone combinations, and were asked to rate the perceived color hue and intensity that was triggered by the experience. We hypothesized that when higher and lower pitched tones are mixed, the perceived color will be more closely correlated to the color triggered by the single lower pitched tone. In experiment one, participants (n=40) were given a word list of colors and intensities to choose from; in second experiment two, participants (n=40) were given a color palette with 63 hues and intensities to choose from. In both experiments, higher frequency tones evoked brighter color sensations (Within-subjects effect:  $F(1,78) = 47.64$ , Between-subjects effect:  $F(1,78) = 2939$ ). Furthermore, when higher pitched tones were paired with lower pitched tones, participants consistently reported experiencing colors that were closer in hue to the color evoked by the lower pitched tones, indicating that the auditory masking effect extends to perceived color-phonological associations as well.

*Mallory Pikus*

## **STABLE ISOTOPIC ANALYSIS OF LACUSTRINE OSTRACOD VALVES IN PATAGONIAN SEDIMENT CORES**

Faculty Collaborator: Dr. Kevin Theissen

Laguna Amarga (51° 00' S, 72° 00' W), a small, shallow (4.1 m max depth) lake is located just outside of the Torres del Paine National Park in Chilean Patagonia. This lake is unique for the area in that it is a closed basin lake shut off by ridges and glacial moraines. Since Laguna Amarga is not connected to an outside water source, it is very responsive to changes in the regional moisture balance and we suspect that its sediment record accurately reflects past conditions in the region where few paleoclimate records have been collected and published. During January of 2005, two nearly identical one meter-long sediment cores from Laguna Amarga were collected for reconstructing the climate trends of this area. Using the sediment from these cores, the calcareous shells of ostracods, have been recovered for biochemical analysis through meticulous manual separation under a microscope. In order to obtain Sr/Ca, Mg/Ca, d18O, and d13C ratios, the shells were soaked in NaClO and rinsed through a filtration system that was developed for working with small amounts of microscopic shells. In conjunction with previous analyses, the oxygen and carbon isotopic data derived from ostracod valves provides additional perspectives into fluctuation of silicate and calcite levels of the lake. These values suggest periodic increases in precipitation and consequently increased erosion of surrounding bedrock. Trace element data of Sr/Ca and Mg/Ca ratios will lend more insight into the source of these water level fluctuations.

*Brian Reider*

## **FACTORS AFFECTING SLEEP IN COLLEGE STUDENTS**

Faculty Collaborator: Dr. J. Roxanne Prichard

Humans spend nearly one third of their lives asleep, and sleep plays an important role in both physiological and psychological functions. Sleep deficiency has been connected decreased mood, increased stress, and decreased academic performance. College students tend to have erratic daily schedules which often lead to increased sleep deficiencies.

This study employs two separate measures to examine the sleep habits of college-aged individuals and estimates which aspects of the participants' lives influence and are influenced by sleep. In the first measure, participants completed an on-line comprehensive survey which included questions on demographic information, the Horne Ostberg Morningness/Eveningness scale, the Epworth Sleepiness Scale, the Pittsburgh Sleep Quality Index, a sleep environment survey, a sleep hygiene scale, the Subjective Units of Distress Scale, a shortened version of Profile of Mood States, as well as questions concerning alcohol, caffeine, and other drug use. In the second measure, participants wore a motion and light actigraph for one week and completed daily surveys of sleep quality and daily activities. Together the results from these studies reveal the irregular sleep cycles of college students and help explain some of the behaviors which may be responsible for such cycles.

*Joseph Riestenberg*

## **MINDFULNESS AND EMPATHY**

Faculty Collaborator: Dr. Mary Chalkley

Research has suggested that mindfulness and empathy correlate to each other due to similar dimensions. Therefore, the first hypothesis of this experiment was that an increase in mindfulness should correlate to an increase in empathy. The second hypothesis was that mindfulness would show a significant increase over time with participants that are involved in a mindfulness based stress reduction course. Participants (17 women and 7 men) completed two mindfulness scales, and an empathy scale. This was completed at the beginning and at the end of the eight-week course. The results supported the second hypothesis, but not the first. There was no correlation between an increase in mindfulness and an increase in empathy over time. Participants, in general, showed a significant increase in mindfulness over time.

*Adria Reznecheck*

## **FLEXIBILITY AND STRENGTH OF THE SHOULDER AND SPIKE VELOCITY IN FEMALE COLLEGIATE VOLLEYBALL PLAYERS**

Faculty Collaborator: Dr. Bridget A. Duoos

“To achieve success in volleyball, it is desirable to possess a strong offense, and the main form of attack in the modern game is the smash, or spike.” (Forthomme et al., 2005) One of the objectives of the volleyball spike is to hit the volleyball at the greatest speed possible. To accomplish this, the athlete must generate a high arm velocity using the internal and external rotator muscles of the shoulder. This study was designed to discover the role strength and flexibility of the shoulder muscles play in generating volleyball velocity in a spike. Six female NCAA Division III volleyball players (age= 19.50 yrs.  $\pm$  s.d.1.255, ht. = 69.46 in.  $\pm$  s.d. 3.19, wt. = 157.83  $\pm$  s.d. 24.05) volunteered to be subjects. Internal and external shoulder range of motion (ROM) was measured using a (Whitehall, Model G300) goniometer. A Lafayette Manual Muscle Tester was used to measure internal and external muscle strength. Ball velocity generated in spike was measured using a (Bushnell Velocity Speed Gun) radar gun. Spike velocity did not significantly correlate with either strength or ROM. Positive correlations appeared with average internal ROM and average velocity, as well as with average internal strength and average velocity; all other relationships were negatively correlated. The strongest relationship ( $r=.632$ ) existed between the average external ROM and average velocity possessing a high relationship.

*Katherine Robertson*

## **SYNTHESIZING TRAPPED PHOTOCHROMES FOR THE DETECTION OF LEUKOCYTE ESTERASE**

Faculty Collaborator: Dr. J.T. Ippoliti

Leukocyte esterase is an enzyme in the urine, which indicates a urinary tract infection. The objective of this project is to make a molecule that will change colors if leukocyte esterase is present. This molecule was made, using a new method, by trapping the highly colored open form of an indolinospiropyran with an electrophilic reagent containing an enzyme substrate. Once formed, the molecule was added to a cellulose acetate film, which was then tested with leukocyte esterase. The enzyme then cleaves the substrate from the indolinospiropyran converting the dark orange color to a bright pink. Hence, indicating a urinary infection. Although there are different ways to detect a urinary infection, this new method could improve the detection of the enzyme.

*Alicia Sandberg*

## **THE DEPICTION OF ORPHANS IN CHILDREN'S FICTION: THEMES AND POSSIBLE EFFECTS**

Faculty Collaborator: Dr. Jean Giebenhain

Fictional books about orphans contain themes that may have an effect on how society views orphans and adoption or how children who are orphaned view themselves. For this study, the researcher read ten fictional children's books depicting "orphans". Themes found within the plot were parents dying as opposed to "abandoning" and the orphans finding a home in the end. Within characterization there was the "eccentric orphan", the orphan "hero", the evil adversary, and the caretaker/savior. Within setting the orphans traveled to faraway places. A major "moral of the story" was not giving up hope and finding a home where it is least expected. A majority of the books could be classified as adventure/drama. Major themes within conflict were being separated from the caretaker/savior and racial conflicts. The researcher also explored the possibility that stigmatization surrounding adoption in our culture stems from books similar to the ones discussed above. Also discussed is whether these stories really capture the experiences of children who are "orphaned" or adopted. Further experimental research is needed to say more conclusively whether books similar to these impact people's views on adoption and "orphans".

*Emily M. Schwartz*

## **PRE-DISPOSING FACTORS CAUSING ANTERIOR CRUCIATE INJURIES IN COLLEGIATE WOMEN ATHLETES**

Faculty Collaborator: Dr. Bridget A. Duoos

"Statistics are impressive, female athletes participating in high risk-sports suffer anterior cruciate ligament (ACL) injury four to six times greater than do male athletes" (Zeller et. all 2003). Injuries to the knee, specifically the anterior cruciate ligament represents one of the most severe disabling injuries in athletic activities (Colosimo et. all, 2005). It is generally known that women suffer ACL injuries at higher rates than men, but the pre-disposing factors that cause this injury are not known. The purpose of this study was to determine pre-disposing factors and their role in causing ACL injuries in collegiate women athletes.

Seventeen women (age= 19.526 yrs +/- s.d. 3.254, ht= 68.412" +/- s.d. 4.568, wt= 150.294lbs +/- s.d. 19.25), all Division III basketball athletes, participated in this study. Navicular drop, the difference in degrees the navicular bone moves from a resting position to a standing position, Q-angle, the angle between the longitudinal axis of the

femur and the patellar tendon, and pelvic width were measured to determine if they play a role in pre-disposing a female to suffer ACL injuries. Subjects jogged on a Life Fitness Ti 95 treadmill at a rate of 6 mph. while being videotaped with a Canon ZR500 digital camcorder. Pronation measurements were taken from the video.

Female athletes who had previously had an injury to the knee displayed a greater Q-angle measurement (12.7 degrees, +/- 0.62 degrees) compared to the women who had not (10.2 degrees, +/- 0.52 degrees,  $p = 0.004$ ). Navicular drop ( $r^2 = 0.14$ ,  $p = 0.02$ ) was the only measurement that was significantly associated with ACL injury history. Foot pronation was found to be a factor most related to ACL injury history. Subjects with a greater navicular drop had also suffered knee injuries at some point in their basketball careers.

*Maria Spencer*

## MUSCLE ACTIVITY IN FEMALE COLLEGIATE BASKETBALL PLAYER'S STABLE AND UNSTABLE ANKLES

Faculty Collaborator: Dr. Bridget Duoos

The purpose of this study was to determine if muscle activity of the peroneus longus and gastrocnemius muscles in collegiate women basketball player's is significantly different between stable and unstable ankles.

Eight college aged female basketball players, four ankle brace subjects and four non- ankle brace subjects, (age=19.623 ± s.d. 1.061, height= 69.750± s.d 1.753, weight= 159.38 ± s.d. 22.27) all volunteered to participate in this study. Maximum voluntary contractions (MVC) of the gastrocnemius and peroneus longus of the subjects' right ankle were measured for each subject using surface electromyography (SEMG). Each test consisted of three trials with intervals 20 seconds. During a second session, each subject performed a standing stork balance test for a maximum of 30 seconds for three trials while measuring their SEMG. Muscle activity was recorded by BioPac System Inc. MP30. The average for the percent of muscle activity used was calculated and analyzed.

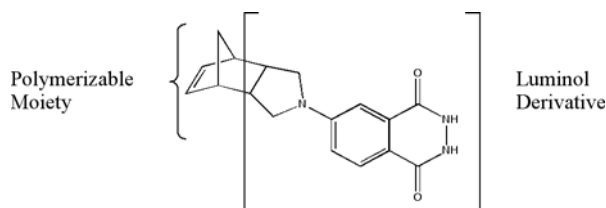
The amount of muscles activity of the peroneus longus in unstable ankles was much less compared to stable ankles. However, muscle activity between stable ankles and unstable ankles of the gastrocnemius and peroneus longus muscles were not significantly different, with a p-value= 0.172 and t-value=1.59 and peroneus longus p-value= 0.179 and t-value=-1.74.

*Joshua Speros*

## SYNTHESIS OF A CHEMILUMINESCENT POLYMERIZABLE COMPOUND

Faculty Collaborator: Dr. J. Thomas Ippoliti

Medical technology is developing faster than ever before. In order to contribute to this rapid development my project hopes to develop a new means of detection for compounds in bodily fluids. I mean to utilize the properties of a chemiluminescent luminol derivative in order to detect the antigen estradiol, which occurs in pregnant women. I am currently synthesizing this derivative. The derivative has the advantages of being both polymerizable and highly luminescent. The detection method to be used is known as enzyme-labeled immunosorbent assay or ELISA. If completed I will have contributed to a rapidly growing, popular, and current idea in the medical field.



*Marciann Stech*

## **“KLOBUCHAR FOR CHANGE”: A CRITICAL ANALYSIS OF THE RHETORICAL CAMPAIGN STRATEGIES USED BY AMY KLOBUCHAR, MINNESOTA’S FIRST ELECTED FEMALE U.S. SENATOR**

Faculty Collaborator: Dr. Debra Petersen

Female political candidates, particularly those running for higher office, face many challenges in gaining traction in the political arena. In addition to structural challenges, such as how political parties operate, and their difficulties in raising early campaign funding, they face rhetorical challenges such as the norm of a male speaking style and the great attention that is given to women’s physical appearance. In this study, I examined the primary rhetorical strategies employed by Amy Klobuchar in her 2006 U.S. Senate race to gain insight into how she responded to these rhetorical challenges in her attempt to be Minnesota’s first elected female U.S. senator. I analyzed her major speeches, using the concepts of persona, tone, and creation of audience to illuminate and describe the persuasive strategies that she employed. I also analyzed Klobuchar’s eleven televised campaign ads that aired between August and November of 2006. In this stage of the analysis, I focused on her presentation of self including her attire and use of setting and props. My results indicate that Klobuchar used a consistent presentation of self in her speeches and televised ads, that of an experienced, tough, and authentic leader. She created a gender-balanced portrayal of a determined prosecutor who is also a caring, yet authoritative mother and daughter. I also discovered that she rarely called attention to her gender and the potential historic significance of her election as the first woman to hold this position from Minnesota.

*Kaleb Stromberg*

## **PREDICTING WOLF HABITAT IN THE UPPER MIDWEST**

Faculty Collaborator: Dr. Catherine Hansen

Prior to the Federal Endangered Species Act of 1973, the eastern timber wolf had nearly been extirpated from the contiguous United States. Only a small pocket of wolves remained in northeast Minnesota. Since Endangered Species legislation took effect in 1974, wolves have repopulated much of northern Minnesota, Wisconsin, and Michigan without the direct aid of humans.

Today, ongoing research seeks to understand how many wolves there are, where they are, and where they have yet to establish themselves. The location of wolves relies on variables such as forest type, prey abundance, population density, road density, land-use, and land protection. This collaborative inquiry research created a model that uses road density to predict favorable wolf habitat in the upper Midwest. Unlike previous studies, road surface and classification were taken into account. Population change was used to show areas of increased convergence between the habitats of humans and wolves. A wilderness ownership layer determined how much wolf habitat is protected and how much lies in the discretion of landowners.

An additional phase of research applied the wolf habitat model to the Northeastern United States where wolves were once native. Habitat there is similar to the upper Midwest and reforestation is rampant. This model shows the feasibility of a wolf reintroduction campaign in the Northeast if one were deemed appropriate.

*Jeremy J. Stubblefield*

## **ENTRAINMENT PHOTOPERIOD MODULATES THE MOUSE CIRCADIAN SYSTEM AND ITS RESPONSIVENESS TO LIGHT**

Faculty Collaborator: Dr. Dwight E. Nelson

In mammals, circadian rhythms in behavior and physiology are driven by endogenous circadian oscillators. These oscillators in turn are entrained by environmental light-dark cycles. Seasonal modulations of behavior and physiology are also thought to involve the circadian system through the effects of daylength or photoperiod on circadian production of pineal melatonin. We are examining photoperiod-induced changes in the circadian system in C57BL/6 mice – a strain commonly regarded as insensitive to photoperiod because it lacks pineal melatonin. Mice were entrained to photoperiods ranging from LD 4:20 to constant light (LD 24:0) and then released into constant darkness (DD). Light pulses were delivered to each mouse in DD to assess the photic responsiveness of the circadian system using phase shifts. Freerunning period and duration of activity were also measured. Mean delays following 4:20 and 6:18 ( $153 \pm 14$ ;  $171 \pm 8$ min) were significantly smaller than following 16:8 ( $82 \pm 10$ min; ANOVA, Tukey,  $P < 0.05$ ). Photoperiod differences also induced significant changes in circadian period and duration of activity. Because mice entrain to LD cycles through daily phase shifts induced by light at various times of their circadian cycle, we also examined the effect of photoperiod (8:16 and 16:8) on the phase response curve (PRC). Phase delay and advance amplitude for the PRC was reduced following LD 16:8 compared to LD 8:16 ( $P < 0.05$ , Student's *t* Test). Surprisingly there is a very large influence of photoperiod on circadian functions in “non-photoperiodic” C57BL/6 mice.

*Katherine Theisen*

## **TESTING THE ALL-ELSE-EQUAL ASSUMPTION FOR THE MAINTENANCE OF SEX FROM THE PERSPECTIVE OF ECOLOGICAL STOICHIOMETRY: DO ASEXUAL SNAILS REQUIRE MORE OF A LIMITING NUTRIENT THAN SEXUAL SNAILS?**

Faculty Collaborator: Dr. Maurine Neiman

If the sole difference between sexual and asexual organisms is their form of reproduction, then a logical result is the selective elimination of sex. This outcome is expected because only females contribute to population growth, and while asexuals produce only female offspring, sexuals allocate resources to both male and female offspring. Despite this advantage of asexual reproduction, sex remains the predominant strategy among most organisms, indicating that there must be major advantages associated with sex. We have identified a novel potential cost associated with asexual reproduction in many organisms, the high nutrient demands that may be imposed by polyploidy. Many asexual taxa are polyploid, while most sexuals are diploid. Polyploid organisms have more DNA and RNA than diploids, and nucleic acids are rich in phosphorus, which is often a limiting nutrient in natural populations. If higher nucleic acid content in asexuals is linked to higher bodily-phosphorus concentration, then asexuals could be more limited by phosphorus availability than sexuals. In this case, sexuals might have an advantage over asexuals in nutrient-poor environments. This finding would point towards a potential role for nutrient limitation as an explanation for distributional differences of sexual and asexual taxa. We took the first step in addressing this question by conducting a pilot study of bodily phosphorus concentrations in 3 sexual (diploid) genotypes and 8 asexual (triploid) genotypes of New Zealand mud snails (*Potamopyrgus antipodarum*). While we found that asexuals had significantly higher phosphorus content when the analysis was performed irrespective of genotype, the inclusion of genotype lowered our power to detect a main effect such that asexuals had only marginally higher phosphorus content. Thus, we refocused our study efforts on snails from several populations for which the phylogenetic distribution of sex renders the inclusion of genotype unnecessary. This study is currently in progress.

*Matthew Turner*

## **IN SITU SELF-ASSEMBLY OF G-DNA MOLECULAR SCAFFOLDS NUCLEATED BY A POLYMERIC TEMPLATE**

Faculty Collaborator: Dr. T. C. Marsh

Research on the structure and function of guanine rich nucleic acids has shown that multiple guanine repeats in a sequence enable these biopolymers to adopt a quadruple helical structure generally known as G-DNA. In previous work, the DNA oligomer GGGGTTGGGG (Tet1.5) was used to create a self-assembling linear supramolecular G-DNA termed a G-wire. This molecular scaffold is able to direct the positioning of gold nanoparticles on a mica substrate. However, the linear scaffolds were previously deposited from bulk solvent and were randomly dispersed on the mica substrate. To achieve better localization and dictate initial orientation of G-wire self-assembly, in-situ self-assembly using a polymeric template was performed. Specifically, the polymer poly-5-norbornene-2-carboxylic acid (D.P. 4000) with the oligonucleotide NH<sub>2</sub>-GGGGTTGGGG coupled at a ratio of 1 oligonucleotide to 10 carboxylic acid groups was synthesized to serve as a rigid polymeric template for the self-assembly of G-wires. Atomic Force Microscopy was used to characterize copolymer-templated self-assembly of G-wires on a mica substrate.

*Alexander Vasatka*

## **DEVELOPING A SUCCESSFUL ENERGY POLICY: A GERMAN CASE STUDY**

Faculty Collaborator: Dr. Paul A. Schons

The United Nations Intergovernmental Panel on Climate Change, endorsed by 120 countries, stated that global warming is already occurring and will bring about disastrous effects on the human population. If the current growth of greenhouse gas emissions continues, human life will be dramatically altered. Therefore, it is imperative that individuals, nongovernmental organizations and all levels of government from all around the world work together to stop future climate change. Because this is a global problem it must be addressed on a global level, thus creating the need for the exchange of ideas between nations to be even more important. The Federal Republic of Germany is an especially proactive country when it comes to fighting climate change. Consequently, Germany is a good case study for investigation in order to determine which sort of policies work and which do not. Since energy production is the leading source of greenhouse gases, this project takes an international, intercultural and interdisciplinary look at energy policy by examining German energy laws and relevant cultural aspects.

*Seth Wenner*

## **PHOSPHORUS-RNA RELATIONSHIPS IN GRASSLAND INSECTS**

Faculty Collaborator: Dr. Adam Kay

An organism's biomolecular composition may constrain its ability to meet the challenges of survival and reproduction. The growth rate hypothesis, which predicts a causal relationship between phosphorus concentration, RNA concentration, and growth rate, is a central idea for linking an animal's composition to its performance. This hypothesis has been tested frequently in aquatic systems, but relatively little is known about the importance of phosphorus variation in terrestrial animals. Here, I tested part of the growth rate hypothesis by determining whether variation in phosphorus concentration in grassland insects is explained by variation in RNA concentration. Overall, I found significant differences in RNA concentration within and among insect species. Preliminary results suggest that these patterns can account for some of the variation in insect phosphorus concentration known to exist among males and females and among different species. While data for additional species are needed, my results suggest that phosphorus variation may be an important indicator of insect biochemistry that impinges on functional performance.

*Tyler N. Winkelman*

## **SYNTHESIS OF FIVE NOVEL ANTIMICROBIAL OXAZOLIDINONES**

Faculty Collaborator: Dr. J. Thomas Ippoliti

Multi-drug resistant bacteria are rapidly becoming a major concern for the health care industry. A new synthetic class of antimicrobials, known as oxazolidinones, is a promising combatant against drug resistant bacteria. Five novel oxazolidinone antimicrobial agents were prepared via six step syntheses, with each of the final steps utilizing high yielding “click chemistry.” Two of the antimicrobials have been tested against the Gram-positive bacterium *Staphylococcus aureus*. Preliminary findings suggest the antimicrobials tested have little activity against the organism. Further testing is required for activity information of the other synthesized antimicrobials.

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