2013 Abstracts

Alphabetical by the Last name of the First Author

SURFACE MODIFICATION OF POLYSTYRENE TREATED WITH OZONE.

Entesar Al Abdulal,[a] Ameya Khot,[a] Alla Bailey, [a] Michael Mehan,[b] Thomas Debies,[b] Gerald A.Takacs [a]

[a] School of Chemistry and Materials Science, Rochester Institute of Technology, Rochester, New York 14623, USA

[b] Xerox Analytical Services, Xerox Corporation, Webster, New York 14580, USA

Polystyrene (PS) is one of the most widely used thermoplastic polymers and is often not recycled because of its light weight and low scrap value. The discarded PS in landfill sites has limited capacity for water adsorption, and physical and chemical properties that make it relatively inert and virtually unaffected by naturally occurring degrading agents and sources. Pretreatment of the surface of PS to increase its wettability and introduce reactive functional groups may make the waste more susceptible to degradation and useful for technological applications [1].

PS was treated at room temperature with ozone produced from the UV photo-dissociation of oxygen. X-ray photoelectron spectroscopy (XPS) was used to detect the increase of the oxygen content on the PS surface and formation of functional groups as a function of treatment time. Advancing contact angle measurements provided information about the increase in hydrophilicity with treatment time.

[1] A. Khot, A. Bailey, T. Debies and G. A. Takacs, "XPS Studies of Poly(acrylic acid) Grafted onto UV Photo-oxidized Polystyrene Surfaces", *J. Adhesion Sci. Technol.* (2012) DOI:10.1080/01694243.2012.691037.

NITROGEN INCORPORATION IN GRAPHENE OXIDE AND GRAPHENE NANOCOMPOSITE COATINGS FOR CORROSION PROTECTION OF LOW-ALLOY STEELS.

Jeffrey P. Aldinger,[a] Brian J. Schultz,[a] Robert V. Dennis,[a] Cherno Jaye,[b] Daniel A. Fischer,[b] and Sarbajit Banerjee[a]

[a] Department of Chemistry, University at Buffalo, The State University of New York, Buffalo, New York 14260-3000

[b] Material Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, Maryland 20899

Solution-phase exfoliation of graphene oxide (GO) and subsequent reduction by thermal means have emerged as scalable processes for the preparation of single-layered graphene, albeit with significant topological defects and remnant functional groups. Thermal defunctionalization in an ammonia environment allows for establishment of the π-conjugated network of graphene through the removal of hydroxyl and epoxide functional groups while also enabling nitrogen incorporation into the graphene lattice. Herein we report the use of X-ray photoemission spectroscopy (XPS) in conjunction with near-edge X-ray absorption fine structure (NEXAFS) spectroscopy to monitor the electronic structure recovery, as well as probe the local structure and chemical bonding environment of incorporated nitrogen atoms, in graphene oxide reduced under

an ammonia environment at ambient and low pressures in the temperature range between 250 and 1000°C. NEXAFS and XPS both suggest three distinct modes of nitrogen incorporation in the graphene lattice: amine or nitrile like, pyridinic, and substitutional/graphitic.

Graphene is further of interest for use in applications such as corrosion inhibition. Here, we report an active-passive approach based on the use of a graphene/polyetherimide nanocomposite coating for the corrosion protection of low-alloy steels. Through the establishment of a Schottky barrier at the metal/graphene interface and the barrier properties of the polyetherimide polymer, the corrosion rate of steel can be dramatically lowered by almost three orders of magnitude.

HUNGRY, HUNGRY EARTHWORMS: HOW INVASIONS AFFECT DECOMPOSITIONAL ENZYME ACTIVITY.

Lauren V. Alteio, Rebecca L. Walling, Thomas R. Horton
Department of Environmental and Forest Biology, State University of New York College of Environmental Science and Forestry, Syracuse, NY

In forested regions of North America with no native earthworms, invasive earthworms from Eurasia have a large impact on the below- and aboveground environment. Earthworms rapidly consume leaf litter, accelerating decomposition and altering microbial activity. While these ecosystem-level changes are poorly understood, previous research has suggested that they may have cascading effects on carbon sequestration, nutrient cycling, and plant communities. In this study, we compare rates of leaf litter and wood probe decomposition in areas with and without invasive earthworms at Mohonk Preserve (Gardiner, NY). We also compare microbial enzyme activity, focusing on three hydrolytic enzymes (secreted by microbes to degrade labile compounds such as cellulose and chitin) and two oxidative enzymes (degrade recalcitrant compounds such as lignin). We predict that decomposition will be more rapid in areas invaded by earthworms, and there will be a corresponding increase in oxidative enzyme activity. We will present preliminary results from samples collected during June-October 2013.

INVESTIGATING FLAGELLAR DEFECTS IN *CHLAMYDOMONAS REINHARDTII.*

Stephanie Antonio and Noveera Ahmed
Department of Biology, St. John Fisher College, 3690 East Avenue, Rochester, NY, 14618

The structure and function of cilia and flagella is a biological feature that serves similar functions in different organisms. Cilia have remained highly conserved through evolutionary history, maintaining a 9+2 microtubule structure with the nine doublets surrounding a central pair. Defects in flagellar protein composition and overall structure have been connected to human ciliopathies such as hydrocephalus or primary ciliary dyskinesia. To better understand the cause of flagellar defects, motility mutants will be created by insertional mutagenesis in the model organism, *Chlamydomonas reinhardtii.* The region flanking the insertion site in each mutant will be amplified and sequenced. The mutants will also be phenotypically analyzed based on swimming speed, light responses, and flagellar protein composition. The experimental discoveries in the *Chlamydomonas* will potentially guide future discoveries in the causes behind human ciliopathies.

PRODUCTION OF LIPID-BASED NANOPARTICLES LABELED WITH QUANTUM DOTS.

Alexandria Argentieri & Fernando Ontiveros, Ph.D.
Biology Department, St. John Fisher College. 3690 East Ave. Rochester, NY. 14618.

Nanotechnology is the manipulation and engineering of functional systems at the molecular scale, with dimensions ranging from 10 to ~200 nanometers in size. Technology at this scale has only recently been used across a wide spectrum of biomedical fields, generating new ways to treat or prevent disease safely and efficiently. Lipid-based nanoparticles have been used as a tool to deliver drugs and proteins to cells in living organisms. Because our research group is interested in both the induction and prevention of inflammation at the cellular level, we set to the task of producing a vehicle that could deliver biomolecules to cells of the immune system. Using manual extrusion techniques, we have successfully produced particles of a size between 100-200 nanometers. The liposomes are composed of 3 lipids: cholesterol, phosphatidylcholine, and dipalmitoyl-phosphatidylethanolamine. In addition to achieving the desired particle size, quantum dots (Qdots) were successfully incorporated into the liposomes in order to aid in their visualization both *in vitro* and *in vivo*. Qdots are semi-conducting crystals which fluoresce and are visible to the human eye when exposed to UV light. Nanoparticles containing Qdots are delivered to monocytes and macrophages *in vitro* and then imaged with a fluorescence microscope to describe their numbers and location within the cell. Future experiments involve the use of siRNA-loaded nanoparticles to prevent the activation of macrophages in an inflammatory environment.

CYTOTOXICITY OF FERROCENYLATED *N*-HETEROCYCLIC CARBENE SUPPORTED GOLD COMPLEXES.

Kuppuswamy Arumugam,[1] Jonathan Arambula,[2] Jonathan Sessler[2] and Christopher Bielawski[2]
[1]Department of Chemistry, St. Bonaventure University, St. Bonaventure, New York, 14778,
[2]Department of Chemistry and Biochemistry, The University of Texas at Austin, Austin, Texas, 78712

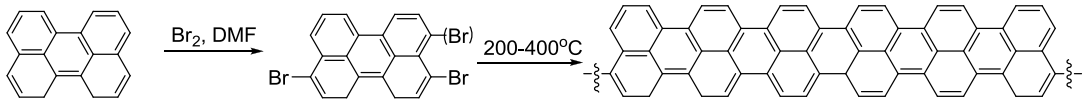
Certain ferrocene derivatives have shown antineoplastic activity against cancer cell lines. Recently, (NHC)AuCl complexes have been reported for anticancer activity. We now intend to combine the intrinsic antineoplastic properties of ferrocenium with the known anticancer effects of NHC-gold complexes. Our rationale is that the synergistic effect between ferrocene and the gold-complex should result in enhanced cytotoxicity against tumor cell lines. The compounds that we propose to test have been synthesized and fully characterized.

SYNTHESIS OF DIARYL PRECURSORS FOR THE BOTTOM-UP FABRICATION OF GRAPHENE NANORIBBONS.

Umar Asif,* Kelly Morrison, Sarbajit Banerjee,† David Hilmey*
* Department of Chemistry, St. Bonaventure University, St. Bonaventure, NY 14778
† Department of Chemistry, University at Buffalo, Buffalo, NY 14260

Nanotechnology is becoming increasingly important in scientific applications, especially in electronics. Despite many advances, there is still need to increase the efficiency of production and determine nanochemical physical properties and how they affect function. A graphene

nanoribbon (GNR) is an extremely thin, single layer of graphite less than 10 nm wide which can have properties ranging from metallic to semiconducting depending on the edge pattern. These differences define each nanoribbon. In studying the bottom-up fabrication of graphene nanoribbons, several dibrominated precursors have been prepared through electrophilic aromatic substitution and Suzuki coupling reactions. The synthetic strategies used are flexible to prepare a variety of monomers. These polyaromatics give rise to a variety of potential nanoribbons of different widths and edge properties. The dihalo monomers can be linked using surface-assisted coupling followed by subsequent cyclodehydrogenation to generate the desired nanoribbons.
In addition to the dihalo monomers which have been synthesized, current research involves the formation of nitrogen containing polyaromatics to see if similar linkage and cyclodehydrogenation steps can be performed. Future directions will focus on continuing the synthesis of precursors, the fabrication of various GNRs, and the synthesis of zigzag GNR precursors.



THE ROLE OF Rad52p ISOFORMS IN NUCLEAR AND MITOCHONDRIAL HOMOLOGOUS RECOMBINATION EVENTS.

Hugo Avalos, Matthew Luther, Emily Whiteside, and Rey A. Sia. Department of Biology, The College at Brockport – State University of New York, 350 New Campus Dr., Brockport, NY 14420

Mitochondria are responsible for generating ATP molecules, which are the energy currency of the cell. Some of the proteins necessary for oxidative phosphorylation are encoded on mitochondrial DNA (mtDNA), which is independent of nuclear DNA. Similar to nuclear DNA, the accumulation of mutations in mtDNA can be detrimental to the host. In humans, mutations that lead to neuromuscular and neurodegenerative diseases have been implicated to mutations in the mitochondrial genome. However, budding yeast are facultative anaerobes that can survive in the absence of oxidative phosphorylation by undergoing fermentation to meet their energy needs under laboratory growth conditions. For this reason, the lab uses the budding yeast, *Saccharomyces cerevisisae*, to examine genes that may be involved in mutagenesis of mtDNA.

One such gene product is Rad52p, encoded in the nuclear genome. Rad52p is essential for nuclear homologous recombination and double-strand break repair, and thus, has been directly implicated in maintaining the integrity of nuclear DNA. The open reading frame of *RAD52* contains a total of five potential start codons that may drive expression. The goal of the lab has been to determine whether one of the first three start codons is responsible for creating a Rad52p isoform that is localized to the mitochondria. Experiments required the creation of site-directed mutations of the various start codons. Cells with these mutations were then tested for their ability to undergo nuclear and mitochondrial homologous recombination events. A mutation in the first *RAD52*ATG reduces mitochondrial (~ 3-fold) but not nuclear homologous recombination events. Thus, we believe that the first *RAD52ATG* start codon is responsible for creating a Rad52p isoform that is localized to the mitochondria.

STUDY OF CHAOTIC VIBRATION IN PUMPS.

Patricia A. Babowicz, 94 Ontario Street, Phelps, New York 14532, Simon Bradshaw, David Skinner, and William Zuidema, ITT Goulds Pumps, 240 Falls Street, Seneca Falls, NY 13148, Dr. Prashanta Samanta, FLCC Victor Campus, 200 Victor Heights Parkway, Seneca Falls, New York 13148

Dynamic systems involving non-linear feedback, under some conditions demonstrate chaos. We analyzed vibration data from industrial pumps to investigate if the pumps exhibited chaos. The test data was collected using accelerometers attached at various locations on a series of pumps from ITT Gould Pumps in Seneca Falls. Vibrations in industrial pumps may reduce bearing and seal life. Vibrations not correlated to particular discrete frequencies are extremely difficult to mitigate or eliminate. Our measurements and analysis of broad spectrum vibrations indicate dominance of chaotic dynamics rather than "random noise" from the operating system or measurement equipment.

BIODEGRADATION OF IMIDACLOPRID BY *PSEUDOMONAS AERUGINOSA*, *PSEUDOMONAS PUTIDA*, AND *ESCHERICHIA COLI*.

Grete Bader and Stephanie Zamule, Ph.D.
Department of Biology, Nazareth College, 4245 East Ave., Rochester, NY 14618.

The purpose of this research was to investigate the ability of three species of bacteria to degrade imidacloprid, a popular insecticide that has recently been linked to honeybee Colony Collapse Disorder. Bioremediation takes advantage of an organism's natural metabolic processes to degrade environmental contaminants. For this experiment, cultures of *Pseudomonas aeruginosa*, *Pseudomonas putida*, and *Escherichia coli* were grown in liquid media containing imidacloprid. Samples were taken periodically over one week, and the imidacloprid concentration was analyzed using High Performance Liquid Chromatography. This research has the potential to assist in the development of microbial bioremediation strategies for habitats polluted with imidacloprid, which would lessen the insecticide's impact on honeybee populations.

MORPHOLOGICAL FACTORS ASSOCIATED WITH ANTIPREDATOR BEHAVIORS OF JEFFERSON-COMPLEX SALAMANDERS.

Jordan Bailey, Sharmini Baskaran, Jennifer Buckley, Zoe Carnes-Douglas, Dawn Fitch, Kairee Glantz, Jeffrey Hess, Duncan Lindberg, Katelyn M. Meier, Sofiah Nor Wira, Melissa Santonocito, A. Mario Tarasco, Taylor Williams, Paul Shipman
c/o Thomas H. Gosnell School of Life Sciences
Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, NY 14623

A variety of antipredator behaviors have been documented among amphibians, including aposematic coloration, toxicity, evasion, and immobility responses. It has been suggested that salamander defensive behavior functions as a result of the synergistic effects of morphology and behavior. Jefferson-complex salamanders are known to exhibit tail display postures in response to predatory stimuli. Our study focused on a wild population of salamanders on the Rochester Institute of Technology campus. We exposed 59 salamanders *in situ* to a standard threat stimulus and recorded resulting behaviors. We then photographed and measured each individual and

recorded environmental conditions. Data were analyzed using Principal Components Analysis and multivariate linear regression to determine morphological factors that were associated with antipredator behaviors. We found a positive correlation between body-tail color contrast and the exhibition of tail display behavior, including tail wriggling and tail lifting. Body-tail color contrast was also negatively correlated with evasion.

AN INVESTIGATION OF THE EFFECT OF SOIL DISKING ON GEWÜRZTRAMINER (*Vitis vinifera* cultivar*)* GRAPE MATURATION IN THE FINGER LAKES REGION OF NEW YORK.

Molly Baillargeon[1], Thom Bechtold[2], Niamh O' Leary[3]
[1]Major in Environmental Studies, Wells College Class of 2014, 170 Main Street, Aurora NY 13026
[2]Vineyard Manager, King Ferry Vineyard, 403 Lake Road, King Ferry NY 13081
[3]Professor of Environmental Studies, Wells College, 170 Main Street, Aurora NY 13026

Gewürztraminer (*Vitis vinifera* cultivar) is a type of grape that is used to produce an aromatic white wine. This type of grape is thought to mature faster when its roots are in a cool soil. To determine if this is indeed the case, nine test plots were established in the north, middle, and south ends of three rows of Gewürztraminer in King Ferry Vineyard, New York. Soil temperatures were manipulated by disking. One row served as a control, and was not disked. The other two rows were disked up and disked down, giving them more and less soil, respectively, around the trunks of the vines. Soil temperatures were measured at ten inches deep and on the surface of the soil. Chemical grape maturation in each row was assessed using brix, a measurement of sugar content, and pH of the grapes. It was expected that the row with more soil surrounding the trunk would maintain cooler soil temperatures and expedite maturation. The data gathered shows that the row with more soil around the trunks was warmer and the row with less soil around the trunks was cooler, with the control row being the coolest. The results of this study could help vineyard managers optimize conditions for growing Gewürztraminer in the Finger Lakes region of New York.

HIERARCHICAL STEEPNESS, COUNTERAGGRESSION, AND MACAQUE SOCIAL STYLE SCALE.

Balasubramaniam, K. N.[1], Dittmar, K.[1, 2] & Berman, C. M.[1, 3]
[1]Graduate Program Evolution, Ecology & Behavior, [2]Department of Biological Sciences
[3]Department of Anthropology, University at Buffalo SUNY

In the primate genus *Macaca*, variation in social behavior is characterized by the concept of 'social style'; species are classified as belonging to one of four grades on a scale, ranging from despotic to tolerant. While despotic species are predicted to display steep dominance hierarchies and low levels of counteraggression, tolerant species may show the opposite characteristics. We tested these predictions with and without controlling for phylogenetic distances, using behavioral data collected on 14 groups representing nine macaque species, and nine newly reconstructed phylogenetic trees. As predicted, dominance steepness measures correlated negatively (Dij-based measure: r=-0.79, n=9, p=0.01) and counteraggression correlated positively (r=0.77, n=9, p=0.02) with social scale category. However, the nature of the distributions appeared to vary; while counteraggression appeared to vary dichotomously, steepness measures appeared more continuous. Further, these correlations seemed to disappear upon controlling for phylogenetic

distances. Our findings support previous indications that co-variation between social behaviors and predicted social style is more readily observable for species at the extreme ends of the scale than for those in intermediate positions. Further, correlations with the scale can be attributed largely to species' phylogenetic relationships. This indicates a possible structural linkage of social traits based on adaptation to similar past ecological conditions in this genus.

DUAL ORIENTATION OF VACCINE CANDIDATE P6 IN HH13 STRAIN OF NONTYPABLE *HAEMOPHILUS INFLUENZAE*.

David Barnard[1], John Bettinger[1], Juliana Shaw[1], Qingfu Xu[2], Michael Pichichero[2], and Lea Vacca Michel[1]
[1]School of Chemistry and Materials Science, Rochester Institute of Technology, Rochester, NY 14623
[2]Rochester General Hospital Research Institute, Rochester, NY 14621

Nontypable *Haemophilus influenzae* (NTHi) is a pathogenic bacterium that is known to cause several serious diseases affecting people globally. Therefore, the creation of a vaccine against NT*Hi* would greatly improve the prevention options available to healthcare professionals. P6, a protein vaccine candidate for NT*Hi*, has recently been shown to be inserted into the outer membrane of NT*Hi* in two orientations. For P6 to be considered a viable vaccine candidate, it must be surface exposed in the majority of NT*Hi* strains. Using confocal microscopy, biotinylation, and bactericidal assays we have determined the common orientation of P6 in the NT*Hi* strain D40N HH13.

THE SYNTHESIS OF TARGETED MULTI-MODAL IMAGING AGENTS USING LINEAR AND CONVERGENT PEPTIDE METHODS.

Taylor Barrett, Lauren Heese, Chelsea Weidman, Dr. Hans Schmitthenner
School of Chemistry and Materials Science, Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, NY 14623

The purpose of this research is to design the methodology to synthesize novel targeted multi-modal imaging agents (TMIAs) that would be useful in diagnosing cancer and heart disease. A linear and a convergent method are being developed to examine which is a more efficient technique to creating these TMIAs. The linear method utilizes a tri-peptide scaffold with three differentially protected amine and acid side chains that can be selectively de-protected. After each de-protection, an imaging or targeting agent can be coupled to the peptide scaffold. The model TMIA that we are creating has a DOTA-Gd chelating group which is a contrasting agent used in magnetic resonance imaging (MRI), a Cy 5.5 dye which is a near infrared fluorescence dye (NIRF dye), and cRGDyK which is a small bio-active peptide that targets human lung cancer cells. The convergent method also utilizes peptides, but the imaging agents are coupled to lysine amino acids first, and then coupled together to synthesize the multi-modal imaging agent. The targeting peptide is then coupled on using linking chemistry. The products will be analyzed by HPLC, mass spectrometry, and evaluated for medical imaging properties by NMR spectroscopy and confocal fluorescence microscopy on targeted cancer cells.

NEW METHODS FOR THE SYNTHESIS OF TARGETED GD CONTRAST AGENTS FOR MRI.

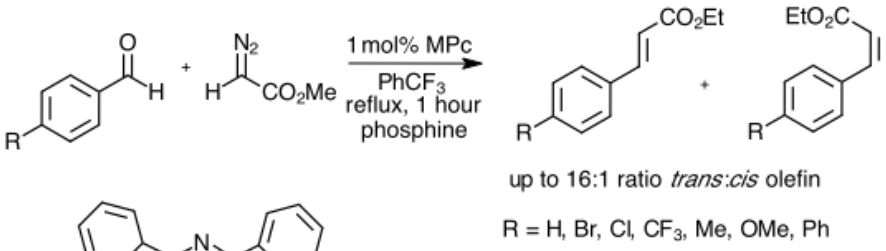
Stephanie Beach, Kevin Kirk, Dr. Hans Schmitthenner
School of Chemistry and Materials Science, Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester NY

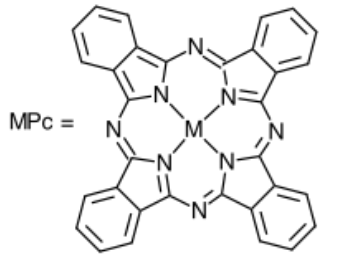
There is a rapidly growing interest in the use of targeted contrast agents for the early diagnosis of cancer and other diseases. This includes the need for magnetic resonance imaging (MRI) contrast agents which are organic complexes of gadolinium (Gd). The sensitivity of Gd contrast agents may be increased by two techniques: attaching the Gd complexes to that target or seek tumors, and by attaching Gd's to multiple chelating groups such as DOTA (1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid). Currently the syntheses of agents containing Gd are problematic since chelating agents contain multiple amines and acids making them difficult to handle and purify. The goal of this project is to explore a new, alternative method involving placing Gd into chelating groups early in the synthesis of targeted contrast agents. Our results showed that it is possible to incorporate Gd into an amino acid and that it is stable to peptide synthesis conditions. This approach saves several steps and the number of steps saved increases with the number of Gd groups introduced in the peptide. This approach has been adopted for use in scaffolds developed in our group and is expected to be useful in a variety of synthetic approaches to other targeted molecular imaging agents, or TMIA's.

METALLOPHTHALOCYANINE CATALYZED WITTIG OLEFINATION.

Brandon M. Belz, Scott J. Heller, Dominic L. Ventura*
Math and Natural Sciences Department, D'Youville College 320 Porter Avenue Buffalo, NY 14201

The Wittig reaction is an important transformation to synthesize substituted olefins. Recently, the Wittig reaction has been achieved catalytically via carbenoids. Carbenoid reactions catalyzed by metallophthalocyanines (MPc) have had little attention to date, but recently these metal complexes have been found to catalyze several carbenoid transformations. These MPc catalysts have been found to selectively furnish disubstituted olefins in high yield (up to 92%) and up to 17:1 ratio of *trans*:*cis* olefins. We have started and will further investigate the effect of the catalyst, *para*-substituted benzaldehydes as well as the phosphine utilized in these reactions.





SOLVENT – DEPENDENT AND TEMPERATURE – DEPENDENT PROTEIN AGGREGATION TO GOLD COLLOIDS INVESTIGATED UNDER TEM.

Christina Berti
SUNY Geneseo, 1 College Circle, Geneseo, NY 14454

We have used gold colloids of various diameters to study the aggregation of aβ – 140 and aβ – 142 proteins on top of the colloids. After investigations, we've seen that the assembling of protein is pH – dependent, in which the accumulation of aβ – 140 and aβ - 142 is sensitive to pH when subjected to an aqueous environment. The first purpose of this project is to look for any effects that altering this aqueous environment (solvent) may have on the behavior of the protein throughout pH fluctuations. The second purpose of this project is to test the effect of temperature jump on the reversibility of protein accumulation. Specifically, we are trying to find any reversibility in the amassing of protein onto the gold colloids. Four different solvent environments tested included water, DMSO, an albumin – water solution, and an albumin – DMSO solution. We also studied aβ – 140 diluted in water before and after a temperature jump from 5 ºC to 45 ºC. For both the solvent – dependent and temperature – dependent experiments, an ultraviolet-visible spectroscopy scan was taken on the protein after each pH change was made. Using Transmission Electron Microscopy, we are able to observe the buildup of protein onto the gold colloids. It is clear that both pH conditions and solvent content influence the behavior of protein. In the near future, Transmission Electron Microscopy will be used to study the temperature – jump effect on protein behavior.

USING SITE-DIRECTED MUTAGENESIS TO IDENTIFY THE MOST IMMUNOGENIC REGIONS OF VACCINE CANDIDATE P6.

John Bettinger[1], Emily Newman[1], Anthony Mangan[1], Michael Pichichero[2], Lea Vacca Michel[1]
[1]School of Chemistry and Materials Science, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, NY 14623
[2]Rochester General Hospital Research Institute, 1425 Portland Avenue, Rochester, NY 14621

The P6 protein is a leading vaccine candidate for protection against nontypable *Haemophilus influenzae* (NTHi) infection. NTHi bacteria are a cause of middle ear infections, sinusitis, pneumonia, and chronic bronchitis. Vaccines that contain only the most immunogenic parts of the protein, often including the antibody binding sites or "epitopes," can reduce production costs and can sometimes enhance effectiveness. Thus, identifying the most immunogenic part of P6 might be highly attractive to pharmaceutical companies who would like to use P6, or part of P6, in their next vaccine against NTHi. In this study, the P6 epitopes against monoclonal antibodies 4G4 and 7F3 were partially identified. P6 mutant T42R (threonine to arginine at residue 42) was prepared using recombinant DNA technologies, and mutated DNA was transformed into *Escherichia coli* cells for efficient overexpression. An Enzyme-Linked Immunosorbent Assay (ELISA) showed decreased binding (compared to wild-type P6) of the P6 T42R mutant for both the 4G4 and 7F3 antibodies, suggesting that 7F3 and 4G4 interact with residue 42. Nuclear Magnetic Resonance (NMR) spectroscopy was employed to assess structure changes to P6 due to the mutation.

A STUDY OF ROCHESTER'S CLIMATE TREND USING METEROLOGICAL NORMALS.

Frederick J. Bloom
Buffalo State College, Geography and Planning Department, 1300 Elmwood Avenue, Buffalo, NY 14206

A climate 'Normal' is defined as average climate over a defined 30 year period. Normals are used because they are of sufficient length to filter out many short-term anomalies between years, but short enough to reflect longer term climate trends. This study used data from five Normal periods, beginning with the 1941-1970 period and ending with the 1981-2010 period, to assess possible changes in Western New York's regional climate. Data was obtained from the National Weather Service site in Rochester, NY. Aside from annual values, the data was broken down by month and season. The Normals studied included average, maximum, and minimum temperatures, as well as precipitation, snowfall, and heating and cooling degree days. Findings indicate that over the five normal periods studied, Rochester, NY has seen an overall increase in both temperature and precipitation, albeit a weaker change than in other sites, such as in Buffalo, NY. The data does indicate a trend toward increasing snowfall throughout this time period in Rochester, NY with an increase of 11.3 inches (13% change) over the five Normal periods studied. This increase could very well be related to winter warming helping to maintain elevated lake waters temperatures slightly higher than in the past.

HA-PSEUDOTYPED SINGLE-CYCLE INFECTIOUS INFLUENZA A VIRUS TO EVALUATE NEUTRALIZING ANTIBODY RESPONSES.

Michael Breen, Steven Baker, Luis Martinez-Sobrido, Ph. D
Department of Microbiology and Immunology, University of Rochester Medical Center, 601 Elmwood Avenue, Box 672, Rochester, NY 14642

Influenza, after nearly a century of research, remains a global health burden. The latest pandemic was the H1N1 "Swine Flu" and it claimed an estimated 8,870-18,300 lives. Although a far cry from the 50 million dead from the 1918 "Spanish Flu," influenza remains a threat to many individuals, especially the young, elderly, and immunodeficient. The threat is increased exponentially in part by modern transportation capabilities. A person can travel from some of the most populated cities of the world in under eight hours, carrying any disease they have with them free of any additional baggage fees. Therefore, better treatment options in addition to continuing vaccination programs are in humanity's best interest to combat this threat.

Researching Influenza poses many risks due to its infectivity and requires expensive, specialized equipment to work with. These risks are eliminated by engineering a single cycle infectious influenza A Virus (sciIAV). Here, we replaced hemagglutinin (HA) with a reporter gene, green florescent protein (GFP). This eliminates Influenza's ability to infect because HA is used by the virus to attach and subsequently enter a cell via endocytosis. HA complements the virus *in trans* via transfection into mammalian cells, and expression on the surface of the cell membrane. Stable HA-expressing cell lines can also be made to support virus growth. When the virus buds off, it uses the cell's HA studded membrane to encapsulate itself, making it infectious for one additional cycle. The spread of the infection can be tracked using the translated GFP and quantified using a GFP plate reader. Using this approach, we have developed a system to evaluate influenza neutralizing antibodies by incubating antibody and virus together before

infecting HA- expressing cells. The effectiveness of the antibody is then evaluated by GFP expression relative to sciIAV without antibody.

STRUCTURE DETERMINATION OF UNKNOWN ORGANIC LIQUIDS USING NMR AND IR SPECTROSCOPY: A GENERAL CHEMISTRY LABORATORY.

Martha Bruch, John Pavel, Erin Hyde
Chemistry Department, Oswego State University, Oswego, NY 13126

An experiment was developed for general chemistry where students use IR and NMR spectroscopy to perform *de novo* structure determination of unknown alcohols. A tutorial was used to teach students how to use spectroscopic data to determine chemical structure, and this procedure was used for their unknowns. Functional groups were identified from the IR spectra, and NMR intensities were used to determine the total number of hydrogen atoms present. Then students drew trial structures containing the correct functional groups and predicted the NMR spectrum; the trial structure was modified as necessary until agreement was obtained. The structure was confirmed by comparison of boiling point and density data, measured in triplicate, to literature values, and the precision and accuracy of student measurements was critically evaluated. The experiment required critical thinking and problem solving, introduced students to the basics of organic structures, and provided a nice change of pace from more traditional general chemistry experiments.

THE IMPACT OF STORMWATER RETENTION PONDS AND SMALL WETLANDS ON THE EXPORT OF DISSOLVED ORGANIC MATTER.

Michael Burkett*, A. Christy Tyler*, Muhammad Rubaiyat*, Todd Pagano*
* Rochester Institute of Technology:
Thomas H. Gosnell School of Life Sciences, Program in Environmental Science,
85 Lomb Memorial Drive, Rochester, NY 14623

Throughout the urban and suburban landscape there has been an increase in the use of retention ponds and mitigation wetlands for stormwater management and nutrient removal. It is well known that wetlands can be effective for the removal of total nitrogen and phosphorous. However, the effect of wetlands on dissolved organic matter is often overlooked. Over the last few decades it has been documented that DOM export from the terrestrial landscape to the aquatic environment has been increasing. The cause for this remains uncertain, but may be linked to global climate change. Certain organic compounds (i.e. Phenols) commonly found in DOM react with chlorine during drinking water treatment to create carcinogenic compounds, presenting a challenge for water supply managers. Thus, understanding how wetlands and retention ponds affect DOM levels is important for getting a more complete picture of water quality. The goal of this project is to study the impact of small wetlands and retention ponds on DOM. . I hypothesize that created wetlands and retention ponds remove DOM as well as natural wetlands, but that this removal is dependent on season, vegetation cover, hydraulic residence time, and nutrient loading. We have collected seasonal water samples from the inflow and outflow of small created wetlands, natural wetlands, and retention ponds in Monroe County and are analyzing them for dissolved organic carbon, dissolved organic nitrogen, and dissolved organic phosphorous, nitrate, ammonium and phosphate. The physical characteristics and vegetation structure of each site will also be analyzed.

ROLE OF MISMATCH IN MECHANICAL PROPERTIES IN CELL MIGRATION.

Julian Butcher, Moumita Das
School of Physics and Astronomy, Rochester Institute of Technology, Rochester, NY 14623

Recent experiments suggest that the mechanical stiffness of cells and their interaction with their surroundings undergo remarkable changes during tumor progression [1, 2]. An intriguing experimental result in this area suggests that the mismatch in the elasticity and adhesive properties between cancer cells and cells that have not yet transformed may lead to enhanced cancer cell motility in a binary cell population [2]. Motivated by this, we study the mechanical response and dynamics of a binary system of active and deformable particles using Langevin Dynamics simulations. We characterize their motility by studying particle trajectories, mean square displacements and correlation functions. Our study may provide an understanding of the interplay of mechanical and statistical mechanical properties underlying the enhanced motility of cancer cells during metastasis [2].

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PHYSICAL BEHAVIORS OF IONIC LIQUIDS IN LOW POLARITY SOLVENTS.

Elise Cade, Markus M. Hoffmann
The College at Brockport, State University of New York, 350 New Campus Drive
Brockport, NY 14428

Ionic liquids are salts that are liquid below 100^{o}C. Ionic liquids are of very low volatility and especially those ionic liquids with high conductivity and lower viscosities are used as medium for chemical synthesis and electrochemistry. Normally, salts do not dissolve in solvents of low polarity. However, many ionic liquids are very soluble or completely miscible in low polarity solvents and their physical chemistry is not well understood. The goal of our ongoing research is to elucidate the speciation (freely dissolved ions, ion pairs and aggregates) present for ionic liquids dissolved in solvents of low polarity. In prior work we found that the ionic liquid 1-hexyl-3-methylimidazolium bis(trifluoromethylsulfonyl) amide ([C_6mim][NTf_2]), which is completely miscible in chloroform ($CHCl_3$), displays an aggregate size maximum at surprising dilute concentrations of 0.1 molal. We interpreted this apparent re-dissolution by a change of mass transport mechanism from ion pairs and aggregates self-diffusing as individual species to a "hopping" motion of single ion pairs between aggregates. These results motivated further research to discern if this particular behavior can be observed for other pairs of solvent and ionic liquid solutes.

We will present experimental results for concentration and temperature dependent self-diffusion coefficients measured by NMR spectroscopy in conjunction with viscosity measurements to determine the average hydrodynamic radii of the present species. Five systems were investigated: [C_6mim][NTf_2] dissolved in dichloromethane (CH_2Cl_2), tetrahydrofuran (THF), and chlorobenzene (C_6H_5Cl), and two other ionic liquids, 1-butyl-3-methylimidazolium bis(trifluoromethylsulfonyl) amide [C_4mim][NTf_2] and 1-ethyl-3-methylimidazolium

bis(trifluoromethylsulfonyl) amide [C_2mim][NTf_2] in CH_2Cl_2 . Our findings obtained to date show that each system shows similar behavior as [C_6mim][NTf_2] in $CHCl_3$. Specifically, we observe for each system a maximum of the average radius size, and the corresponding concentration varies from system to system, from about 0.04 molal for [C_4mim][NTf_2] in CH_2Cl_2.to about 0.18 molal for [C_6mim][NTf_2] in CH_2Cl_2 .

DO ROAD SALTS HAVE PERSISTENT IMPACTS ON SOILS MONTHS AFTER DEPOSITION?

Paul Canaski, Thomas Carone II, Kirsten Mahalick
Department of Biological Sciences, 392 Shineman Center, State University of New York Oswego, Oswego, NY 13126

During winter in the northeast, the use of road salt (NaCl) is one of the most widely used methods of deicing roadways and sidewalks. While this makes walkways safer for pedestrian traffic, salts become dissolved in the melting snow and ice and can also percolate into the soil. Salts can inhibit plant growth by accumulating in topsoil adjacent to areas that receive salt deposition in winter months. On college campuses, mortality of grass along sidewalks is typical in the spring. Although the immediate effect of salt exposure on grass is obvious, we wondered whether salt residues could still be detected in soils over 9 months since their application. To better understand the effects of road salt on our local ecosystem, we investigated the salt residues in soils on the main campus of the State University of New York Oswego as indicated by soil water potential. We quantified gradients of soil water potential, plant water potential and plant cover, in small transects perpendicular to campus sidewalks and parking lots. In general, as distance from the sidewalk increased, soil water potential also increased. There was a positive correlation between soil water potential and the water potential of leaves. In addition, low water potentials were closely related to low plant cover. Our results indicate that salt has a positive correlation in regards to soil and plant water potentials, as well as a direct relationship with lower plant cover.

IDENTIFICATION AND IMPACT OF GASTROINTESTINAL BACTERIA IN THE ZEBRAFISH.

Michael Carroll, Edward Freeman
St. John Fisher College, Biology Department, Rochester, NY 14618

The vertebrate gastrointestinal (GI) tract is home to a variety of bacteria that exist in a complex microbial community. To communicate within this complex environment, bacteria use both intra- and interspecies signaling molecules. The impact of these, and other bacterial secretions, on the biology of eukaryotic host cells is only partially understood though the presence of these bacterial symbionts is recognized as essential to normal GI function. Specifically, in the GI tract bacteria are thought to: drive the normal development of the gut, educate the immune system and facilitate maintenance of the adult gut.

We set out to determine what species were present in the GI tracts of our adult Zebrafish. We hypothesized that we would find species that were similar to previous reports as well as previously unreported species. For this project the upper GI tract was isolated from individual adult Zebrafish and plated after tissue dissociation in sterile buffer. Representative colonies were evaluated with differential tests, including Gram staining and rRNA PCR analysis. Results

indicate that GI tracts from Zebrafish housed at St. John Fisher College contained both similar and novel species when compared to other research labs. Sequence data identified water-dwelling, facultative anaerobic bacteria characteristic of gut-dwelling microbes. We then began to focus on evaluating the impact of bacterial secretions, from known bacterial species, on the integrity of *in-vitro* epithelial monolayers with forming and or established tight junctions. These experiments utilize Caco-2 human intestinal cells grown on collagen matrices seeded to Millipore culture inserts. TransEpithelial Electrical Resistance (TEER) measurements demonstrate the establishment of tight junctions *in-vitro* as well as the maintenance of tight junctions after they have been established. We hypothesize that bacterial secretions from known species will impact TEER during both of these time-frames. These studies will inform our understanding of the impact of bacterial symbionts on eukaryotic cell function and direct our future studies in identifying the specific secretory products that impact tight junction function.

SCREENING AMPHIBIAN POPULATIONS IN OSWEGO COUNTY, NY FOR INFECTIOUS RANAVIRUS.

Rachel Cary[1], Jennifer Olori[2], Sofia Windstam[3]
[1] 551 W 1st St S Fulton, NY 13069
[2,3] Department of Biological Sciences, SUNY Oswego, 7060 State Route 104, Oswego, NY 13126

Ranavirus is an emergent viral disease that has had a major impact on amphibians, fish, and reptiles. The purpose of this project was to determine whether this virus is present in amphibian populations within Oswego County. We used standard tissue collection methods with toe clips taken from the amphibians, and DNA was extracted using a standard salt extraction protocol. PCR targeting a 500 base pair region of the major capsid protein of ranavirus was used to test for the virus and the results were displayed using 2% agarose gel. We examined 82 amphibians including specimens from six different species, sampled between April and November, 2012. After the first round of testing, 26 amphibians (32% of total samples) were positive for the virus and will require further testing to confirm infection. Positives were found in 28.6% of green frogs, 40% of two-lined salamanders, 33.3% of bullfrogs, 20% of spring peepers, and in the single northern leopard frog that was tested. Amphibians that tested positive were sampled primarily between August and November, which may suggest seasonal variation. Further assessment of prevalence rates in our region is crucial because amphibians around the world have been vanishing due to a variety of factors, including disease, global climate change, and habitat loss. Ranavirus has already negatively impacted many populations, and potentially could have similar effects on populations in Oswego County if left unchecked.

REVERSIBLE SELF-ASSEMBLY OF $A\beta_{1-40}$ AND $A\beta_{1-42}$ OVER NITRO-DIBEZYLOXY DISULFIDE FUNCTIONALIZED GOLD COLLOID.

Christa D. Catalfamo, E. Sophia Hwangbo, Amy L. Tran, Kazushige Yokoyama
Chemistry Department, SUNY Geneseo, 1 College Circle, Geneseo, NY 14454

It is known that a fiber formation of amyloid beta is a hallmark of the Alzheimer's disease. There are roughly two types of amyloid beta which are critically important in a mechanism of Alzheimer's disease. One is a water soluble amyloid beta of sequences 1-40 ($A\beta_{1-40}$) and the other is water insoluble amyloid beta sequences 1-42 ($A\beta_{1-42}$). Both $A\beta_{1-40}$ and $A\beta_{1-42}$ do not

exhibit a reversible self-assembly in dimethyl sulfoxide (DMSO) when they are directly placed over the gold colloidal surfaces. However, both amyloid beta exhibited a reversible self-assembly when they were attached over nitro- dibezyloxy disulfide functionalized gold colloids. We investigated over various sizes of gold nano-colloids ranging between 10 nm and 100 nm in diameter. There was no strong size dependence though, nitro-dibezyloxy disulfide enhanced the stability of an intermediate of self-assembly process.

FINDING AVOIDED CROSSINGS ANALYTICALLY IN THE STARK-ZEEMAN SPECTRUM OF OH.

Nathan Cawley[1], Zachary Howard[1], Michaela Kleinert[2], Mishkatul Bhattacharya[1]
[1]School of Physics and Astronomy, Rochester Institute of Technology, 84 Lomb Memorial Drive, Rochester, NY 14623, USA
[2]Department of Physics, Williamette University, 900 State Street, Salem, OR 97301, USA

The ground state OH molecule is of interest to quantum computing, coherent chemistry, and quantum degeneracy research. Typical manipulation of the molecule in recent experiments utilizes electric and magnetic field interactions leading to the Stark and Zeeman effects. The interactions between OH molecules and these fields are modeled by an effective 8x8 Stark-Zeeman Hamiltonian. Crossings and avoided crossings in the spectrum of this Hamiltonian are related to observable physical phenomena in OH, such as evaporative cooling. To find these avoided crossings, we use a mathematical tool called the discriminant, whose roots correspond to crossings and avoided crossings in the spectrum. Using the determinant of the matrix, we show that some of these roots can be found analytically and correlate these roots to a specific crossing of experimental interest.

GLYCOLYISIS AS A MECHANISM FOR MAINTAINING CANCER ENVIRONMENT IN A REDUCED STATE.

Caralee Cecala[1], Jolanta Skalska[2]
[1] College of Liberal Arts & Sciences; 1 Saxon Drive Science Center, Alfred, NY 14802
[2] College of Liberal Arts & Sciences; 1 Saxon Drive Science Center, Alfred, NY 14802

The root cause of malignancy is the cells' inability to perform apoptosis when needed, leading to uncontrolled growth. Mitochondria in healthy cells, in addition to cellular respiration, govern the cell apoptotic pathway. In cancer cells however, mitochondria seem to resist the induction of apoptotic program, and an aerobic respiration (glycolysis) become the main form of cellular respiration. Since a byproduct of glycolysis is lactic acid, the extracellular environment of cancer cells become acidic and therefore more reduced. We hypothesize that keeping thiols groups of (some) proteins on extracellular surface of the malignant cells in reduced state, enables them to metastasize and prevents induction of apoptosis. Hence, the production of lactice acid could be the cancer cells survival strategy. Switching aerobic glycolysis to oxidative phosphorylation, might result in re-oxidize these thiols, and induce a signal for apoptosis. Additionally, targeting the extracellular thiol proteins could lead to better treatment for cancer cells.

WEAK CONTINUOUS QUANTUM MEASUREMENT.

Areeya Chantasri
Department of Physics and Astronomy and Rochester Theory Center, University of Rochester, Rochester, New York 14627, USA

A brief introduction to a research topic of 'weak continuous quantum measurement' will be presented. A process of acquiring information from a quantum system by weakly perturbing it will be described in mathematical forms. An example of a solid-state qubit measured by a quantum point contact will also be introduced in order to explain how the weak continuous measurement can be realized in a lab.

ANALYZING THE WATER VAPORS IN THE ATMOSHERE USING A 'HOME-BUILT' SOLAR SPECTROGRAPH.

Daniel Choe, Peter Spacher, Ileana Dumitriu
Department of Physics, Hobart and William Smith Colleges, 300 Pulteney St, Geneva, NY 14456

A spectrograph is an instrument used to measure properties of light over a specific portion of the electromagnetic spectrum by separating the incoming light into its characteristic frequencies of wavelengths (spectrum). Spectrographs can range from cheap plastic ones to complex devices like IRIS which will collect UV spectra for solar chromosphere. Our "home-built" spectrograph was design on the budget limit of $2000, and utilizes a 1200 grooves/mm diffraction grating. The light from the sun enters in the spectrograph through an adjustable slit and is reflected by a lens to the diffraction grating. The image of the diffraction grating is recorded by a camera. The acquired image is analyzed using the software, "Image J". The hydrogen lamp was used to calibrate the spectrograph.

In May 2013 our team participated in *National Solar Spectroscopy Competition* (NSSC) held in Montana State University, Bozeman MT. The event is designed as part of NASA's educational outreach program. Last year our science goal was detecting water vapor in the atmosphere in a relatively small area of Seneca Lake in Upstate New York. This directly presents an interest in the local economy as vine yards and orchards are essential part of it. For the 2013-2014 NSSC competition our team is looking to change the design of the spectrometer, and to analyze other materials such as sunscreens, sun glasses and solar panels. The building design of the spectrograph, results from last year, and information about NSSC 2014 competition are presented in the poster.

***EURYPTERUS PITTSFORDENSIS* FAUNA: NEW LOCALITIES FOR THE BARGE CANAL MEMBER, LOWER VERNON FORMATION, SALINA GROUP (ERIE CANAL AT FAIRPORT AND PITTSFORD, NEW YORK).**

Samuel J. Ciurca, Jr., 2457 Culver Road, Rochester, N.Y. 14609 (paleoresearch@yahoo.com)

Two new localities have been discovered that reveal new eurypterid material from rarely exposed Silurian strata.

Parker Street Site: Excavations in the Erie Canal at Fairport early in 2013 provided a glimpse at lower Salina strata generally never naturally exposed. A wonderful sequence of redbeds of the Vernon Formation with intercalated green and dark grey to black shale and mudstone was observed and from this, important items of natural interest were retrieved. The black shale appears to correspond to the Barge Canal Member of the lower Vernon Fm. as described by Ciurca (1990), the type section (43°05'3787" 77°31'0494") being along the Barge Canal (now Erie Canal) at Pittsford.

From the black shale at this new site were obtained many specimens of the common element of the fauna, viz. *Eurypterus pittsfordensis*, well known from the earlier Pittsford Member at Pittsford. Associated forms found include abundant *Lingula*, clusters of ostracods and rare *Mixopterus*. Sedimentary structures of note include common, relatively large salt hoppers (pseudomorphs of halite) indicating that the black shale formed under hypersaline conditions. Mudcracks were also seen and indicate exposure of sediments (including some of the redbeds) to the atmosphere.

Also observed for the first time were prolific and peculiar stromatolites, apparently in one bed slightly above the black shale. The stromatolites are generally about 6 - 8 inches (~18 cm.) in diameter and seem to have been associated with some evaporite (?gypsum), interpreted from the numerous globular cavities observed within some of the structures. Note: in the subsurface, the Salina Group, including the Vernon Fm., is well-known for thick salt and gypsum deposits, e.g. Retsof Mine.

Monaco Oil Site: Within the village of Pittsford, directly adjacent to the Erie Canal (the old Monaco Oil Site) the land is undergoing redevelopment and revealed large blocks of varicolored shale and mudstone, black shale and stromatolites like those found at the Parker Street Site. Presumably the blocks remained from the original excavation for the large Monaco oil tanks. The blocks yielded additional eurypterid remains along with sedimentary structures providing typical *Eurypterus pittsfordensis* specimens along with *Mixopterus* sp., ostracods, salt hoppers, mudcracks and stromatolites – all indicating the Barge Canal Member and lower Vernon Fm. as the source.

A representative collection from both sites has been reposited in the Peabody Museum of Natural History, New Haven, Connecticut where it is available for study.

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SOLUBILITY OF MINERAL SALTS IN NONIONIC SURFACTANT-WATER BINARY SOLVENTS.

Daniel S. Clark, Markus M. Hoffmann, Ph. D

Department of Chemistry and Biochemistry, The College at Brockport, State University of New York , 350 New Campus Dr. Brockport, NY 14420

The overall purpose for this research project is to establish nonionic surfactants as a replacement to traditional solvents. Surfactants offer the opportunity to bring reactants of differing polarity in close proximity. Many nonionic surfactants are liquid at room temperature,

are non-hazardous, biodegradable, and inexpensively available as raw material. In addition, we noticed significant solubility of mineral salts in nonionic surfactants, which could be advantageous for organic synthesis. As a particular goal of this research, we desire to determine the solubility of salts as a function of surfactant-water composition. As a first series of measurements, the solubility of potassium halide salts in three different nonionic surfactants using atomic absorption spectrophotometry was determined. The salt solubility of the potassium halide salts decreased from on the order of 10 $mol*kg^{-1}$ at the highest water mass fraction of 0.8 to about 0.01 $mol*kg^{-1}$ at the least water mass fraction of 0.015. It was found that the solubility in the least water content surfactant solution is in the order KCl < KBr < KI.

THE EFFECT OF WETLAND CONFIGURATION ON ANURAN ROAD MORTALITY.

Jocelyn Coleman, Lauren Jonaitis, Gina Racculia, Adrianna Rozell, C. Eric Hellquist.
State University of New York at Oswego, Department of Biological Sciences, 392 Shineman Science Center, Oswego, NY 13126

Declining anuran populations are a global conservation concern. In the northeastern U.S., road corridors have been implicated as sources of anuran mortality. High mortality of anurans has been apparent along roadways bisecting wetlands. We predicted that areas of high anuran mortality would be roadways bisecting wetlands, while areas with low anuran mortality would be concentrated along uplands. Every three to four days we surveyed nine sites for anuran mortality by tallying the number of frog deaths. The nine sites included three roads that bisected wetlands, three roads with wetlands on one side, and three control upland sites. To date, our results indicate that bisected wetlands have the highest rates of anuran mortality. Roads bisecting wetlands have about 19 times more anuran mortality per square meter than upland sites and about 1.3 times more than one-sided wetland sites. One-sided wetlands had about 15 times more anuran mortality per square meter than uplands. These results support previous studies and provide insights into how anuran conservation efforts could be focused with regard to road mortality.

RED-SHOULDERED HAWK EGG MORPHOLOGY BEFORE AND AFTER THE INTRODUCTION OF DDT.

Amber De Jong adejong@keuka.edu, Bill Brown, wbrown@keuka.edu Division of Natural Sciences, Keuka College, Keuka Park, NY

DDT was introduced as a pesticide in the 1950s and subsequently caused a general decrease in egg production and eggshell thickness among raptors. We examined potential thinning in Red-shouldered Hawk (*Buteo lineatus*) eggs after the introduction of DDT. Eggshell thinning in this species is not as well studied as in other species. Data were collected from 90- to 120-year-old Red-shouldered Hawk eggs from Keuka College's collection (n=313). Measurements included eggshell length, width, mass, and a thickness index that was calculated from these three variables; actual thickness was determined for 30 eggs. Measurements from Keuka College eggs, which pre-dated the development of DDT, were compared to eggshell measurements from eggs collected after DDT was introduced. Measurements of eggs laid post-DDT were obtained from published information (n=7) and collected from eggs at Cornell University (n=10). For Keuka College eggs, the correlation between the eggshell thickness index and actual shell thickness was 0.67. Eggshells from Keuka College had significantly different length and width measurements

than eggs from the two other samples. However, eggshell thickness from post-DDT eggs did not differ from those of pre-DDT eggs from Keuka College. It was difficult to determine if the unexpected lack of eggshell thinning was due to insufficient post-DDT egg samples available for comparison, or was a naturally occurring phenomenon.

CLIMATE CHANGE PROMPTS UPWARD MIGRATION OF ANT HYBRID ZONE.

Victoria De Stefano, Robert Warren, Bernice Demarco
SUNY at Buffalo State College, 1300 Elmwood Avenue, Buffalo, NY 14222

Climate change imparts substantial impacts on species distributions. Many species already have responded to the warming of the past century by moving upward and poleward in elevation. Here we examine whether the disappearance of cold-adapted *Aphaenogaster picea* ants with the upward (elevation) shift in warm-adapted *A. rudis* ants is consistent with individual ant replacement through competition or gene replacement through hybridization. We quantify morphological traits (e.g., coloring, head width) of ant sampled along elevation gradients in the Southern Appalachian Mountains of north Georgia, USA. We find that the morphology of the highest (*A. picea*) and lowest (*A. rudis*) ants are discrete, indicating distinct species; however, at middle elevations where the species distributions overlap, we find individuals that either blur characteristics (particularly coloring) or exhibit morphology altogether different than the 'pure' species. These results indicate that as *A. rudis* colonies move upward in elevation they interbreed and eventually replace *A. picea* colonies. We demonstrate hybridization as an important mechanism of species loss with climate change.

BIOMECHANICAL PROPERTIES OF *FRESHWATER PLANT LIFE*: AN ANALYSIS OF *PODOSTEMUM CERATOPHYLLUM* VIA CYCLIC LOADING/UNLOADING TESTS.

Alexander Dean and Michael Boller
St. John Fisher College, 3690 East Avenue, Rochester NY, 14618

The submerged macrophyte *Podostemum ceratophyllum* thrives in the rivers of central Connecticut, a habitat characterized by high water velocities and large hydrodynamic forces. While most plant species are unable to withstand the forces caused by these rapidly moving waters, *P. ceratophyllum* is able to survive as a result of its unique morphology and reconfiguration properties. Previous biomechanical studies have been done focusing on the reconfiguration of various macroalga, yet little is known about the biomechanical properties of this angiosperm. To document standard material properties, samples of *P. ceratophyllum* were collected from the Pootatuck River as well as several other surrounding rivers. The samples were placed under a series of cyclic loading/unloading tests, repeatedly stretching the plant to 10% extension before pulling the tissue past its breaking point. The process yields data that gives insight into the elasticity, plasticity, and toughness exhibited by the plant tissue. Results indicate that *P. ceratophyllum's* has high resilience to instances of stress and strain. Further studies will investigate the composite nature of the tissue and explore what cellular components contribute to *P. ceratophyllum*'s mechanical properties.

LONGITUDINAL PROSPECTIVE STUDY TO FOLLOW AND CHARACTERIZE THE ESTABLISHMENT OF THE AEROBIC CULTIVABLE FRACTION OF THE GUT MICROBIOTA OF PRETERM AND VERY PRETERM INFANTS.

Felix De Clercq
Roberts Wesleyan College, 2301 Westside Drive, 14624, Rochester NY 14624

In contrast with the vital organs such as the brain or the lungs, the gastrointestinal tract of the preterm infant and especially their intestinal microbiota remain poorly studied. While many studies have focused on the implementation of the fecal flora of full-term infants, few of them concern premature infants. Studies have shown that the composition of the intestinal microbiota of preterm newborns differs from healthy term infants' microbiota because its implementation is delayed (Rougé, Goldenberg, Butel, 2010). The dysmicrobism observed in preterm infants would lead to a predisposition to gastrointestinal infectious diseases such as necrotizing enterocolitis (De La Cochetiere, Piloquet, 2004; Butel, Roland, Hibert, 1998; Claud, Walker, 2001; Hunter, Upperman Pediatric research, 2008), to bacterial translocation (Dai walker, 1999) and to delayed stimulation and modulation of the immune system (Tannock,2007; Menard, Butel, 2008; Gore, Munro 2008). Due to a physiological and immune immaturity, and a long stay in neonatal intensive care, the premature newborn is subjected to colonization and antibiotics pressure that affect the implementation of the intestinal flora.

Hospitalized children kept in neonatal intensive care units are particularly at risk of developing nosocomial infections (NI). The incidence of NI and the mortality rate are estimated at respectively 20% and 16% (Am j infect control 2007). Neonatal nosocomial infections are a major problem affecting the immediate health and long-term outcome of preterm neonates and represent the majority of late on-set sepsis. (Stoll BJ, Hansen N., 2002). Because of immunological immaturity, premature skin and mucosal barriers (more permeable), the use of indwelling invasive medical devices and broad spectrum antibiotics, the major causative pathogens of neonatal bacteremia are coagulase-negative staphylococci (CoNS). The two principal strains found are: *S. epidermidis* and *S. haemolyticus*. (Cochrane Database Syt Rev, 2009). Studies have suggested that the intestinal tract provides an important reservoir for many nosocomial pathogens, including easily growing bacteria such as Enterococcus and Enterobacteriaceae (donskey, CID 2004) but also showed that the gut microbiota is a very important source of Staphylococcus (Lancet 2004).

Through a longitudinal prospective study, we chose to follow and characterize the establishment of the aerobic cultivable fraction of the gut microbiota of preterm (from 28 to 32 gestational age weeks) and very preterm infants (less than 27 gestational age week). For the first time, this study investigated weekly and during the first three months of life, a qualitative and quantitative analysis of fecal samples. The susceptibility to antibiotics was performed for each strain. Thanks to the collection of clinical data, we also assessed the impact of factors related to birth such as birth term, birth weight, mode of delivery and iatrogenic factors such as nutrition, invasive device, steroids and antibiotic treatment, on the gut microbiota establishment. Because the CoNS are bacteria the most often implicated in nosocomial bacteremia of extremely and very preterm infants, we also focused our study on staphylococci and we characterized *S. epidermidis* and *S. haemolyticus* strains in term of antibiotics resistance, virulence and clonality.

A STUDY OF SMALL MOLECULES AND THEIR CHELATING CAPABILITIES IN AN AQUEOUS SOLUTION.

Nicole Delello, Dr. Stephan Tajc
Chemistry and Biochemistry Department, Nazareth College, 4245 East Avenue, Rochester, NY 14618

It is known that some small molecules naturally chelate to cations in water. One small molecule of interest is Dipicolinic acid (DPA). DPA is found naturally in certain species of bacterial spores and is well-known that DPA chelates calcium ions. Further research is being done to observe chelation to larger cations with DPA and synthetic derivatives of DPA. Using UV-VIS titrations, DPA's chelating ability was studied with other heavy metals. The binding capabilities of DPA to magnesium, silver, strontium, cobalt and iron in aqueous solution have been measured. In addition, the stoichiometry of DPA has been measured with larger cations via Job's plot.

STUDY OF CARBOXYLIC ACIDS ENOLIZATION ON METAL OXIDE CATALYSTS THROUGH D/H EXCHANGE RATES.

Joe DeRaddo, Vince Marino, Alexey Ignatchenko
St. John Fisher College, 3690 East Avenue, Rochester. NY 14618

Enolization is an important chemical process in which an α-hydrogen is removed to generate the enolic form as a more reactive nucleophile. This mechanism is utilized in many different organic reactions. In our work we have measured the rate of Deuterium/Hydrogen exchange of carboxylic acids on the surface of six different metal oxide catalysts using a GC/MS Microreactor to assess the rates and activation energies of the catalytic enolization reaction. Enolates of carboxylic acids have been extensively studied in solution, but not on the surface of a catalyst. The comparison of enolization processes in solution and on a catalyst surface is of a fundamental interest. The enolization of carboxylic acids is likely serving as the important activation step in the decarboxylative ketonization mechanism for the synthesis of important industrial ketones and bio-fuels. Results of our study may help to develop a method for the catalytic alkylation of carboxyilc acids and introduction of various electrophiles into the alpha position. Current methods involve use of expensive strong bases, while the new continuous process could utilize cost-effective and reusable metal oxide catalysts.

PRESENCE OF PATHOGENIC MICROBES IN RED-EARED SLIDER TURTLES.

Morgan Devaney, Dr. Maryann Herman
St. John Fisher College, 3690 East Avenue, Rochester, NY 14618

Red-eared slider turtles less than four inches in length are illegal to sell and purchase in the U.S. because of the likelihood of passing on *Salmonella* to humans. Turtles larger than this may also have the same risk of spreading microbes. Samples were taken from pet red-eared sliders to be tested for the presence of *Salmonella* and other bacterial species. Tank water samples, cloacal swabs and habitat surface swabs were collected and bacteria were grown on nutrient agar media. A total of 220 bacterial isolates were found and frozen. Samples were Gram-stained and PCR amplification of the 16s ribosomal DNA gene was performed for DNA sequencing.

LASER VISUALIZATION OF ELECTROHYDRODYNAMIC THRUSTER FLOW PROFILES

Gregory Donastor, Thomas Liguori, Joseph Cesta, Justin D'Antonio, and Adrian Ieta

Electrohydrodynamic (EHD) flow can be generated by corona discharges in asymmetric electrode systems. EHD flow or corona wind is often generated between a sharp point conductor and a grounded metal collector or an asymmetric wire to plate systems. The strength of ionic wind greatly varies with the electrode configuration. Patterns of Electrohydrodynamic thruster flow profiles were recorded and studied in cylindrical pin-array geometry and arrays of asymmetrical wire to plate modules. The flow cross-sections were visualized using a green laser sheet with 10^{o} fan angle and water vapors - liquid nitrogen induced. The study provides unique image information on EHD induced flow profiles. The relationship between wind profiles and voltage-current characteristics was also investigated.

DO FOLIAR NUTRIENTS INDICATE SOIL NITROGEN MINERALIZATION IN NORTHERN HARDWOOD FOREST?

Yi Dong
406A Bray Hall, SUNY Environmental Science and Forestry, One Forestry Drive, Syracuse NY, 13210

Nitrogen (N) is a critical element limiting plant growth in temperate forest. N dynamics, such as N mineralization, dominate much of the function and structure of these systems. Though considerable attention has been given to the patterns of N cycling, understanding of environmental controls remains incomplete. A growing body of literature has tried to link foliar chemistry, N cycling, and productivity in forest. These studies have led us to pose the question, "can foliar chemistry be appropriate for indicating the nitrogen cycle?" Also, it is unclear how the foliar nutrients relate to the N mineralization from a species specific perspective. In this study, we relate the N mineralization rate in the forest floor to foliar nutrients for each dominate species present at the 14 chronosequence stands used in this study.

In order to relate the mineralization rate to foliar nutrients, we sampled the Oe soil as well as leaves. Three soil samples were taken from each site using coring method. Fresh fallen leaves were collected for chemical analysis in rain free days. All soil samples were collected from each site in the summer, 2013. Soils were incubated to quantify the N mineralization rate (both NH_4^+ and NO_3^-). Foliar nutrients (N, P, Mg, Ca) were analyzed for each dominate species in all the sites as well by ICP.

NH_4^+ concentration had increased in most of the sites relative to the initial samples, while the concentration of NO_3^- is small and under detection limit comparing to NH_4^+ both before and after incubation. Across all sites, mean daily net N mineralization ranged from 0 to 9.1 mg/kg/day. Foliar P and Mg did not correlate significantly well with soil N mineralization rates in any species. N mineralization rates were significantly higher in sites with greater foliar N concentration in American beech ($P=0.043$), white birch ($P=0.01$), and yellow birch ($P=0.04$), while marginally significant for sugar maple ($P=0.056$). The N mineralization rates significantly lower where Ca concentration was higher in the foliage of sugar maple ($P=0.024$) and white birch ($P=0.048$), suggesting that N mineralization rates might be constrained by the Ca in sugar maple and white birch foliage.

ELECTROCHEMICAL CONTROL OF RING SIZE OF CYCLIC POLYESTERS.

Gregory Faughnan, Renjith Maracheril, Kuppuswamy Arumugam
Department of Chemistry, St. Bonaventure University, St. Bonaventure, New York 14778

N-heterocyclic carbene (NHC) facilitated zwitterionic ring-opening polymerization of lactones has proved a useful technique in the synthesis of cyclic polyesters. Previous control of ring-size has been dependent on monomer concentration and no methods for recycling NHC catalysts have been reported, however, use of metal bis(dithiolene) NHC adducts show promise. Different metal bis(dithiolene) complexes and NHC combinations are being investigated for electrochemical recovery and control of ring size in cyclic polyesters.

RAY TRANSFER ANALYSIS OF THE SPIRAL PHASE PLATE.

Tyler Godat[1], Michael Eggleston[1], Eugene Munro[2], Miguel Alonso[3], Hao Shi[1], Mishkatul Bhattacharya[1]
[1]School of Physics and Astronomy, Rochester Institute of Technology, 84 Lomb Memorial Drive, Rochester, NY 14623, USA
[2]School of Mathematical Sciences, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, NY 14623, USA
[3]The Institute of Optics, University of Rochester, Rochester, NY 14627, USA

The spiral phase plate is an important element in modern optics because of its ability to impart angular momentum to any photon which it reflects or transmits. So far, these interactions have been modeled with the wave-diffraction theory which is quite complicated. We apply simple ray transfer matrix analysis to the spiral phase plate in order to allow the element to be used in simple optical systems. We consider, as a potential rotation sensor, a simple optical resonator consisting of two identical spiral phase plates that possess both azimuthal and radial curvature. We compute the stability of that resonator and utilize the resulting stability condition to plot theoretical ray trajectories within the optical cavity. The stability condition is then generalized for resonators composed of non-identical spiral phase plates to allow for more general configurations.

THE IMPACT OF EXURBAN HOUSING DEVELOPMENT ON THE PHYSIOLOGICAL CONDITION OF BREEDING OVENBIRDS IN THE ADIRONDACKS.

Cassie J. Gould, Chad Seewagen, Susan Smith Pagano
Cassie J Gould: Thomas H. Gosnell School of Life Sciences, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, NY 14623.
Chad Seewagen: Department of Biology and Health Science, Pace University, 861 Bedford Road, Pleasantville, NY 10570.
Susan Smith Pagano: Thomas H. Gosnell School of Life Sciences, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, NY 14623.

Low-impact housing, or exurban development, can cause isolated physical changes in habitat that impact biodiversity and community structure in the surrounding intact habitat. In the Adirondack region of NYS, these changes can be demonstrated in the population dynamics of forest-breeding birds. However, the impacts on body condition of interior-breeding forest birds at the individual- level are not well-understood. This study measured the physiological condition

of breeding ovenbirds *(Seiurus aurocapilla)* because this species is an area-sensitive, interior forest bird that is abundant in the sample sites. Territorial male ovenbirds were captured using mist nest and playback in June 2013 at eight exurban subdivisions and eight reference areas in the northern Adirondacks. We hypothesized that birds breeding in exurban sites would have lower energetic condition and higher stress levels than birds breeding in reference sites. We measured multiple hematological parameters in blood samples from birds. Plasma triglyceride levels to assess energetic condition, plasma uric acid and total protein levels to assess diet quality, heterophil:lymphocyte ratios to measure chronic stress, and hematocrit values. Future work will incorporate an additional field season, which will be compared back to this data.

USING REGRESSION ANALYSIS TO ACCURATELY ESTIMATE LEAF AREA FROM MEASURED LENGTH AND WIDTH.

Paige L. Hamilton, Department of Math & Natural Sciences, D'Youville College, 320 Porter Ave., Buffalo, NY 14201; Nailah Leftwich, Department of Math & Natural Sciences, D'Youville College, 320 Porter Ave., Buffalo, NY 14201; Martin G. Kelly, Department of Math & Natural Sciences, D'Youville College, 320 Porter Ave., Buffalo, NY 14201

Rapid cycling *Brassica rapa* (AKA Wisconsin Fast Plants) were derived using classical methods of artificial selection and breeding (Williams and Hill, 1986). Plants were selected for the following six qualities: reduced size at maturity, minimum time from germination to flowering, uniformity of age at first flowering, high flower production, rapid maturation of seeds, and lack of seed dormancy (Tomkins and Williams, 1990). In a previous study (Kelly, 2006) measured each Fast Plant's largest cotyledon for length and width at 14 days age. Based on the cotyledon's heart shape (Tomkins and Williams, 1990), linear size was used to calculate the area of the cotyledon based on the formula for a cardioid (Harris and Stocker, 1998, p. 323). Similarly at 21d, each plant's largest leaf was measured for length and width. Based on the leaf's oval shape (Tomkins and Williams, 1990), leaf length and width were used to calculate the area of the leaf based on the formula for an ellipse (Harris and Stocker, 1998, p. 93). Though the cotyledon is heart-shaped, and the plant's leaves are roughly oval, no has determined if the arithmetic formulas used by Kelly (2006) to estimate area accurately describe measured area. In addition, no one has determined if the growth rate of the plant's vegetative parts and flowers are equivalent. Here, we present data from a student research project to accurately estimate the area of the cotyledon and first vegetative leaf in rapid cycling *B. rapa*. We determined that Kelly's (2006) prior estimate of leaf area based on their shape was not accurate. We also found that the growth rate for vegetative and reproductive parts of the plant were equivalent.

QUANTITATIVE PALEOECOLOGY.

John Handley, 68 Roselawn Avenue, Fairport, NY 14450

For those with a quantitative view, paleocology, the science of reconstructing ancient ecosystems and their evolution, is a fertile source of challenging and profound problems. In this talk, I will describe qualitatively a few research projects where mathematics -- in the form of statistical modeling -- has played a significant role in identifying patterns and explaining relationships in data. These projects concern large scale patterns in evolution and their relationships to factors such as mass extinction, climate change and predation.

THE SYNTHESIS OF PEPTIDE BASED TARGETED MOLECULAR IMAGING AGENTS.

Lauren Heese, Taylor Barrett, Dr. Hans Schmitthenner
School of Chemistry and Materials Science, Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, NY 14623

Targeted multi-modal imaging agents, or TMIAs, are used in medical imaging for the early detection of cancer, heart disease, and neuroimaging. The goal of this research is to develop methods to assemble peptide scaffolds for use in creating TMIAs. An approach to scaffolds using tri-peptides containing three different protecting groups was attempted first. Due to some difficulties encountered with that approach, a second approach that involves coupling of amino acids with imaging agents on the side chains proved to be more efficient. We will describe preliminary success in preparing a peptide containing a gadolinium (Gd) agent for magnetic resonance (MR) imaging and a near infrared (NIR) dye for use in multi-modal imaging to thus create a MR-NIR agent. This is followed by using a linking strategy to conjugate a targeting peptide c(RGDyK). This targeting peptide has an affinity for the $\alpha_v\beta_3$ integrins receptors which are expressed on the membrane of cancer cells. The effectiveness of the TMIAs will be tested using confocal fluorescence microscopy (CFM) and nuclear magnetic resonance (NMR) as models for NIRF and MRI imaging modalities.

INDUCTION OF APOPTOSIS IN HeLa CELLS USING PHOTODYNAMIC AGENTS.

Alexandra House, Dr. Robert Greene
Dr.Greene: 5795 Lewiston Rd Niagara University, NY 14109, Center for Integrated Sciences, Department of Biology, PO 2032

Apoptosis is the process of programmed cell death, characterized by biochemical and morphological changes which precede the death of the cell. Specific changes that take place may include blebbing of the cell, nuclear fragmentation, and chromatin condensation. Photodynamic therapy is a form of treatment where nontoxic, light sensitive compounds are exposed to light, where they become toxic to cells. In the presence of oxygen, exposure to light causes reactive oxygen species to be formed, which cause the cells to undergo apoptosis[1]. HeLa cells are treated with TAPP, a photodynamic agent, and incubated for twenty four hours. After this time, the cells are placed under broad-spectrum light for one hour, and harvested. Viability counts are later performed using the techniques of flow cytometetry, fluorescence microscopy, and treatment with Trypan blue and observation using traditional microscopy. Cells are labeled apoptotic if they display any of the physical changes which are common among apoptotic cells. Results will show the effects of photodynamic therapy on HeLa cells, as well as the physiological and morphological changes they undergo during apoptosis.

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ENHANCING THE BIOAVAILABILITY OF RAGE INHIBITORS: TOWARDS NEW ANTI-ALZHEIMER'S THERAPEUTICS.

Moudi Hubieshy[1], Thomas Dwyer[1], and Benjamin Miller, [2]*
[1]Deparment of Chemistry and Biochemistry, Nazareth College, 4245 East Ave, Rochester, New York 14618, United States.
[2]Department of Chemistry, Department of Biochemistry and Biophysics, Department of Dermatology, University of Rochester Medical Center, 601 Elmwood Road, Rochester, New York 14618, United States.

In the past ten years there has been a 68 percent increase of people dying with Alzheimer's disease (AD). AD is a neurodegenerative disease characterized by the progressive loss of brain function. The causative agent of AD is the amyloid-β (Aβ) peptide, which has been directly linked to increased levels of apoptosis in neurons. The receptor for advanced glycation end products (RAGE) has been shown to be up regulated in Alzheimer's disease to transport Aβ peptide into the blood brain barrier. Previous research has defined a pharmacophore and designed a lead molecule which inhibits RAGE from transporting Aβ into the brain. In this investigation we set out to optimize the bioavailability of the lead compound by enhancing its hydrophilic properties by adding multiple hydrogen bonding groups. A multitude of different analogs were derived from the lead compound using two basic synthetic schemes. Full characterization of the new analogs and thermodynamic binding data to RAGE is currently being explored.

SYNTHESIS OF OPTIMIZED RAGE INHIBITORS TO REDUCE AMYLOID BETA-MEDIATED ALZHEIMER'S DISEASE.

Moudi Hubieshy[1], Thomas Dwyer[1], and Benjamin Miller [2]*
[1]Deparment of Chemistry and Biochemistry, Nazareth College, 4245 East Ave, Rochester, New York 14618, United States.
[2]Department of Chemistry, Department of Biochemistry and Biophysics, Department of Dermatology, University of Rochester Medical Center, 601 Elmwood Road, Rochester, New York 14618, United States.

Alzheimer's disease (AD) is the sixth leading cause of death in the United States and more than 5 million Americans are living with the disease as of 2013. The causative agent of AD is the amyloid-β (Aβ) peptide, which has been directly linked to increased levels of apoptosis in neurons. The receptor for advanced glycation end products (RAGE) has been shown to be up regulated in Alzheimer's disease to transport Aβ peptide into the blood brain barrier. Previous research has defined a pharmacophore and designed a lead molecule, which inhibits RAGE from transporting Aβ into the brain. In this study we examine the synthesis of twenty new compounds using two different synthetic schemes to produce different analogs of the lead molecule.

ENTANGLEMENT CHARACTERIZATION OF AN OPTOMECHANICAL SYSTEM.

Okechukwu Igbokwe, Mishkatul Bhattacharya
School of Physics and Astronomy, Rochester Institute of Technology, Rochester, NY
Matthew Schumacher
School of Mathematical Sciences, Rochester Institute of Technology, Rochester, NY

We have conducted a study into the entanglement present between the mechanical and optical modes of a ``membrane-in-the-middle'' optomechanical system. These systems are of interest primarily in quantum information. Specifically we have conducted a linear perturbation analysis of the equations of motion of the system, calculated its steady-state covariance matrix, and developed a characterization of the entanglement.

DEVELOPING HOLOGRAMS VIA TRANSMISSION AND REFLECTION TECHNIQUES.

Maxim Irving, Daniel Choe, Ileana Dumitriu, and Peter Spacher
Department of Physics, Hobart and William Smith Colleges, 300 Pulteney St, Geneva, NY 14456

With the development of lasers it became easier to create quality holograms using a simple experimental set up. A coherent light source enables stationary interference resulting in a higher quality of hologram. For this experiment a hologram was developed by capturing an interference pattern of two beams onto a photosensitive plate - a reference beam from the source, and a beam of scattered light from the object of interest. A holographic pattern of the plate once illuminated with the same light source causes interference of light, resulting in a three-dimensional virtual image.

In this experiment two different methods of developing a hologram have been studied: making hologram via reflection technique and by transmission. The reflection method involved shining the laser beam through photosensitive plate and bouncing scattered light back off of the object such that the scattered beam was in the same plane as the reference beam. The transmission technique involved separating the initial beam using a 50/50 beam splitter and then projecting the scattered beam and the reference beam onto the photosensitive plate. The result has shown that the reflection method produces a higher quality hologram, while the transmission method can produce holograms with greater depth of field. This experiment was designed as a possibility of being implemented as a laboratory experiment for modern physics courses at HWS colleges.

DEVELOPMENT OF A SPECTROSCOPIC METHOD FOR DETECTION OF ATMSPERHIC GASES.

Breanna Jewell, Emily Thurnherr, Nathan C. Eddingsaas
School of Chemistry and Materials Science, Rochester Institute of Technology, 85 Lomb Memorial Dr., Rochester, NY 14623

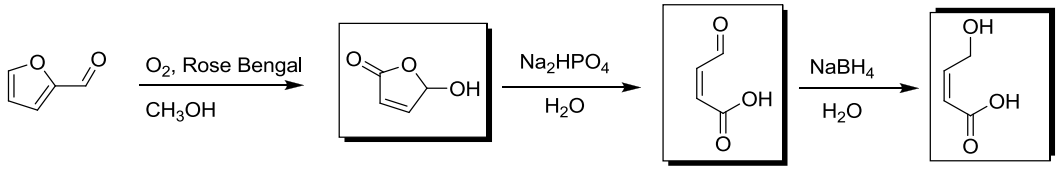
Many hydrocarbons are emitted into the atmosphere, reacting to form products in low concentrations (parts per billion & parts per trillion), causing these atmospherically important compounds to be difficult to detect and analyze. IBBCEAS, or Incoherent Broadband Cavity-Enhanced Absorption Spectroscopy, is a relatively new, high-sensitivity direct absorption technique that can be used to detect gases at atmospherically relevant concentrations. The setup consists of a tungsten halogen light source, an optical cavity with highly reflective mirrors, and a photodiode array spectrometer. The highly reflective mirrors face inwards at both ends of the optical cavity and reflect the light through the cell, causing it to bounce back and forth, so that the effective path length is extended to kilometers. This long path length from the cavity is what enables us to observe the compounds at the extremely low concentrations that occur in the atmosphere. This technique is being used in the near-Infrared spectrum, where alcohols,

carboxylic acids, hydroperoxides, and amines absorb. We have constructed the instrument, characterizing the system and its capabilities using common atmospheric compounds found in the region of interest.

SYNTHESIS OF MALEAMIC ACID AMIDINOHYDROLASE (NicF) SUBSTRATE ANALOGS.

Rory Jones[†], Mark Snider*, David Hilmey[†]
[†] Department of Chemistry, St. Bonaventure University, St. Bonaventure, NY 14778
* Department of Chemistry, Wooster College, 943 College Mall, Wooster, OH 44691

The maleamate amidohydrolase enzyme, NicF, is an enzyme involved in the metabolism of maleamic acid to maleate. This enzymatic reaction is a step involved in the metabolism of nicotinate (Vitamin B_3) to fumerate, a degradation pathway found in some bacterial species. Crystal structure analysis of NicF from *Brodetella bronchiseptica* provides an active site view of the enzyme. Using the natural substrate for NicF as a model, three small molecule inhibitors were proposed to inhibit the enzyme and to determine the ligand bound crystal structure of NicF. To this end, furfural was converted to a hemiacetal lactone analog. The lactone was then treated with disodium hydrogen phosphate in water. Surprisingly, the lactone opened quantitatively to produce an unsaturated aldehyde analog. NMR analysis determined that the aldehyde was stable under neutral conditions with a slow conversion of the *cis* to the *trans* isomer. A reversible Michael addition is hypothesized. Reduction of the aldehyde with sodium borohydride in water gave an alcohol analog in low yield. Efforts to increase the yield are still in progress. The inhibitors have been tested for their involvement with the NicF enzyme.



SEQUENCE OF HISTONE ASSEMBLY INFLUENCES HISTONE RESTRICTION ENZYMATIC CUTTING OF pUC19 IN THE PRESENCE OF MARCROMOLECULAR CROWDING AGENTS.

Lauren Kapus, Dr. Robert Greene
Dr. Greene: 5795 Lewiston Rd Niagara University, NY 14109, Center for Integrated Sciences, Niagara University Department of Biology, PO 2032

Histone addition to a pUC19 plasmid vector has shown to enhance restriction enzyme cutting while in an in vitro environment. The adding of histones allows for the DNA to compact more and change its conformational shape which allow for different sizes of fragments to appear when cut with a restriction enzyme. In this study supercoiled pUC19 plasmid DNA is exposed to different types of histones in an in vitro environment and then cut with restriction enzymes located in the origin, amp and noncoding region of the plasmid. In addition it has been observed that sequence combination of experimental components can alter enzymatic cleavage. Time course treatments and heat inactivation showed that while samples were extracted when exposed to a constant heat over a period of time the restriction cutting was enhanced. DNA fragments

from samples taken during treatments were analyzed on agarose gel electrophoresis to determine the density of the super coil, linear and open circular components of the DNA. The average density of the bands that appeared on the agarose gel were analyzed by densitometry to determine if the histone addition would have any effect on the DNA when in the presences of a molecular crowding agents. It can be hypothesize that molecular crowding agent plus histones will enhance enzymatic activity in an in vitro environment.

CONNECTIONS IN PHYSIC BETWEEN GEORG OHM TO BRAD PITT

Arnab Kar, S.G. Rajeev
University of Rochester, Department of Physics and Astronomy
Bausch & Lomb Hall P.O. Box 270171, 500 Wilson Boulevard, Rochester, NY 14627.

Have you ever imagined that the efficient way in which data flows into your computer through the Internet may be similar to the way a virus spreads itself in a human population? The underlying principles behind these arise in network theory, with applications from computer science to physics. A network consists of people/objects with connections/interactions between them. It can be represented in a graph with nodes denoting the person and connections between them being denoted by edges in the graph.

A network familiar to physicists is that of resistor networks. However a fact which is not so commonly know is that the effective resistance between two points in an electrical circuit can be used to measure distance between two nodes in the circuit. This notion of resistance distance was proposed by a chemist D.J. Kline [1]. We proposed that this notion of distance could be used to measure closeness/affinity in collaboration graphs. Prevalent notions of distance like Erdos number and Kevin Bacon number in collaboration graphs for mathematicians and actors respectively miss out on an important point. They do not account for the number of collaborations between a pair of authors/actors. Actors who have acted in ten movies together are at the same level of closeness from another pair who have acted in only one movie.

Resistance distance in collaboration graphs is a better measure of closeness among actors. The different resistances in that network are based on the different weights on the edges in the graph. The weights along an edge are allocated depending on the number of collaborations between the people at the nodes on that edge. We extended this idea of resistance distance to study the problem of renormalization in scalar field theory for the first time [2]. The standard deviation in such fields is nothing but the square of the resistance distance. The standard deviation gives rise to a new metric, which is a radically different approach to measure distances. This metric is free of divergences and need not be renormalized.

This resistance distance indeed is a powerful tool not only to measure affinity between people in a large group but also to provide a different, yet unique approach to renormalization in scalar field theory.

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2. A. Kar, S.G. Rajeev, Phys. Rev. D 86 (2012) 065022.

STUDIES TOWARDS THE TOTAL SYNTHESIS OF APLYDACTONE: A MODEL STUDY.

Austin T. Kelly, Katherine Valentine, and Dr. Tina Goudreau Collison
Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, NY 14623

Aplydactone is a sesquiterpene natural product isolated from the sea hare *Aplysia dactylomela* that is found on the northern coast of Madagascar. Interest in synthesizing Aplydactone is driven by its extremely novel and conformationally strained tetracyclic framework. Aplydactone's ring system has bond angles more acute than ever before seen for cyclobutane. Additionally, the carbon-carbon bonds in Aplydactone's cyclobutane rings are reported to be longer than average carbon-carbon bonds. This work describes the initial synthetic effort toward a model study of Aplydactone in order to provide insight into the compound's biomimetic pathway as well as strategies for the synthesis of similar structures.

MYTHBUSTING INTEGRATES KNOWLEDGE AND SKILL IN SCIENCE AND MATHEMATICS.

Martin G. Kelly, Department of Math & Natural Sciences, D'Youville College, 320 Porter Ave., Buffalo, NY 14201; Benjamin (Trey) L. Randle III, Office of Sponsored Programs, Research and Grants, D'Youville College, 320 Porter Ave., Buffalo, NY 14201; Antwan K. Barlow, Upward Bound, D'Youville College, 320 Porter Ave., Buffalo, NY 14201

We taught high school students in D'Youville College's Upward Bound Program quantitative processes shared in science and mathematics using an investigative, instructional curriculum. The mathematics content was limited to what one of us requires in introductory college biology laboratory courses. We used Mythbusters to present the scientific method. After introduction to the scientific method, we developed and reinforced student understanding of linear metric units, calculation of averages, estimation of frequency, parts and notation of fractions, calculation of proportions and percentages, the relation between proportions and percentages, the interpretation of proportions and percentages, graphing data, and accepting or rejecting a scientific hypothesis. Our data and analyses indicate that this form of integrated instruction is a very effective approach. Students stated an increased understanding of quantitative content shared in science and mathematics.

DIETARY TRANSFER OF FATTY ACIDS IN JUVENILE YELLOW PERCH.

Colleen Kolb[a], Jacques Rinchard[a], Serguisz Czesny[b], Austin Happel[b]
[a]Department of Environmental Science and Biology, The College at Brockport, State University of New York, 350 New Campus Drive, Brockport, NY 14420.
[b]Lake Michigan Biological Station, Illinois Natural History Survey, University of Illinois, 400 17th Street, Zion, IL 60099.

The objective of this study was to evaluate how dietary fatty acids are transferred from prey to predator. Two triplicate groups of juvenile yellow perch were fed two diets (*Mysis* sp. or bloodworm) for 36 weeks. Both diets presented a distinct fatty acid signature. At the end of the experiment, yellow perch fed *Mysis* sp. had a significantly higher growth rate (37 vs. -5%) and mortality (15 vs. 3%) than fish fed bloodworm. Yellow perch fed bloodworm did not experience weight gain throughout the experiment. Whole body lipid content was significantly higher in fish

fed *Mysis* sp. than in fish fed bloodworm (5.8 vs. 1.4%). Some fatty acids of whole body yellow perch were reflective of their respective diet. Thus, fish fed bloodworm were rich in stearic acid (18:0) and linoleic acid (18:2n-6), whereas fish *Mysis* sp. contained high levels of eicosapentaenoic acid (20:5n-3). However, others fatty acids appeared to be conserved or synthesized throughout the feeding experiment (e.g., docosahexaenoic acid 22:6n-3). These results will be used in a quantitative fatty acid signature analysis to determine dietary component of predators.

DOES GRAZING CONTROL THE SPREAD OF INVASIVE WETLAND PLANTS?

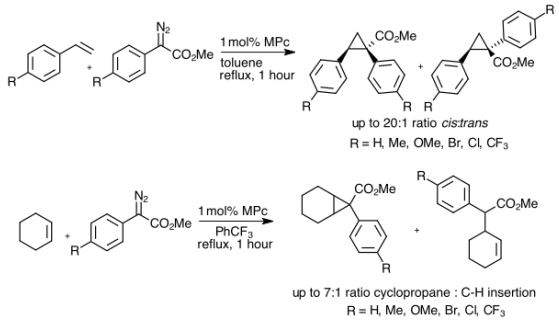
Lisa Kratzer*, A. Christy Tyler*
* Rochester Institute of Technology: Thomas H. Gosnell School of Life Sciences, Program in Environmental Science, 85 Lomb Memorial Drive, Rochester, NY 14623

Phalaris arundinacea, reed canary grass, is a prevalent wetland invader whose presence alters native plant diversity. Field observations and previous work suggest that muskrats, geese and wetland snails consume *P. arundinacea*. However, we have little understanding of the ecological impact of grazers on the growth or competitive ability of this species. We seek to understand the effect of herbivory by generalist macrograzers and micrograzers on the competitive dominance of *P. arundinacea* in mitigation wetlands, especially the degree to which herbivory alters the competitive relationship between *P. arundinacea* and invasive cattails (*Typha* sp.). To address the question of the effect of grazing by herbivores on *P. arundinacea,* enclosure/exclosure cages were constructed in June 2012 in the mitigation wetlands at High Acres Nature Area (HANA) in Fairport, NY and on the Rochester Institute of Technology campus. Half of the plots contain only *P. arundinacea* and half were placed at the boundary between *P. arundinacea* and *Typha latifolia*, another invasive plant. In caged treatments that exclude larger grazers such as geese and muskrats, amber snails (*Succinea putris)* were either included or removed. Control plots without cages assessed the effect of larger grazers. We predicted that herbivory will negatively impact the growth of *P. arundinacea*, and in mixed plots will allow the larger, more aggressive *T. latifolia* to spread into the *P. arundinacea* zone. To confirm that grazer preference is the factor behind observed trends, we are also conducting a series of choice experiments with *S. putris* and *Branta canadensis,* Canada geese, to evaluate their preference for consumption of *P. arundinacea, Typha*, and a native non-invasive plant. Understanding the impact of herbivory on *P. arundinacea* by common herbivores will lead to a better understanding of wetland resistance to *P. arundinacea* invasion. Mid-season (2013) growth of *P. arundinacea* only plots at HANA showed greatest individual plant growth in plots with *S. putris* and the least growth in the control plots. In the HANA plots that also contained *T. latifolia* the greatest individual stem growth was again plots with *S. putris* however the least growth was in plots with all herbivores removed. The results indicate that heavy grazing by *S. putris* increases *P. arundinacea* in mitigation wetlands.

METALLOPHTHALOCYANINE CATALYZED CARBENOID REACTIONS.

Robert W. Kubiak II, *Dominic L. Ventura**
Math and Natural Sciences Department, D'Youville College 320 Porter Avenue Buffalo, NY 14201

Metallophthalocyanine (MPc) catalyzed carbenoid reactions have had little attention to date. Recently, these metal complexes have been found to catalyze cyclopropanation reactions. We have investigated these metallophthaocyanines in reactions to catalyze cyclopropanation from donor-acceptor carbenoids. The yields and diastereoselectivity of these transformations are influenced by the nature of the styrene as well as the aryldiazoacetate and catalyst. The products have been synthesized in good yields (up to 84%) with high diastereoselectivity (up to 20:1 ratio *cis* : *trans* cyclopropane). In addition, we investigated substrates that contain the possibility to yield both cyclopropane and C-H insertion products. We began to study the effects of a variety of substrates as well as catalyst and the diazo compound. Initial results (example shown below) have shown that both products are formed, but much in favor of the cyclopropane compound. The products herein have been synthesized in good yields and up to 7:1 ratio cyclopropane : C-H insertion.



DO YOU HAVE THE RIGHT INTUITION TO LEARN MATH?

Ramiro H. Lafuente-Rodriguez
Department of Mathematics and Natural Sciences, D'Youville College, 320 Porter Ave, Buffalo NY 14201

In the process of learning mathematics, and even in the process of developing math research, one important component for acquiring higher levels of knowledge and skills depends on the present and individual understanding of the ongoing subject of study. The relation and interaction between intuition and abstraction plays an important role in this process, and it is successfully used by students and researchers to reach the desired levels of understanding and skills. However, it is necessary to have the so called "right intuition" in order to be successful. This dynamic of interaction between intuition and abstraction is based on previous knowledge and previous skills, and challenged by one's own individual intuition. In this talk I will provide some examples, and their discussions, of specific topics in which this interaction happens naturally.

HORMONAL INFLUENCES ON CORTISOL AND THEIR RELATIONSHIP TO THE PEDIATRIC METABOLIC SYNDROME.

Johana Lambert, Elena Gabrikova, James A. MacKenzie
State University of New York, Department of Biological Sciences, 7060 State Rt 104, Oswego, NY 13126

Hormonal imbalance is a strong indicator of metabolic dysfunction, a characteristic of obesity and metabolic syndrome. Cortisol, a possible factor in its development is inconsistently related to metabolic syndrome in other studies. In this cohort of 97 children, cortisol is lower in children with metabolic syndrome. Hormones: leptin, adiponectin, and ghrelin are likely involved. Using ELISA, these three hormones were measured. Consistent with current literature, leptin was positively related to metabolic syndrome, while adiponectin and ghrelin were negatively related to metabolic syndrome. Contrarily, cortisol was not found to be significantly related to leptin or ghrelin, but was positively associated with increasing adiponectin quartiles. Measuring ACTH could reveal if these hormones are directly involved in cortisol secretion and the development of metabolic syndrome.

WHO'S YOUR DADDY? A PARENTAGE ANALYSIS OF BUFFALO ZOO HELLBENDERS.

John Lang and Amy McMillan
SUNY Buffalo State, Department of Biology, 1300 Elmwood Avenue, Buffalo, NY 14222

Cryptobranchus alleganiensis alleganiensis, also known as the Eastern Hellbender, is a large aquatic salamander native to cool streams and rivers. The hellbender populations in the Allegheny region of New York are declining, likely due to factors such as habitat disturbances and introduced species. In 2009, a cohort of more than 600 Eastern hellbender eggs was retrieved from the Allegheny River mainstream. This population is being raised in the Buffalo Zoo for reintroduction to the wild. It is unknown how many hellbenders parented this one cohort, but population genetics techniques can be employed to uncover this information. Microsatellite markers are useful tools for understanding a population's genetic structure. Fifty-three Buffalo Zoo hellbender samples were genotyped at ten microsatellite loci. This data was compiled with genotypes collected from forty-nine different samples by two graduate students and used to perform a parentage analysis using the program COLONY. Allele numbers suggest at least five parents, but COLONY analyses determined there may be as many as ten to twelve. Although possible, it seems unlikely that so many adults would breed under the same nest rock. However, if further analysis supports this figure, this would provide insight to an interesting behavior that would deserve further investigation.

CHARACTERIZATION OF BIOLUMINESCENT BACTERIA OF THE NIAGARA RIVER.

Matthew Lanning, Phillip Crane, Mark Gallo
Golisano Center of Integrated Science, Niagara University, NY 14109

Plastic disks were submerged in the Niagara River to observe bio-film accumulation. It was found that a prominent 'species' that colonized the plastics were bioluminescent bacteria. These bacteria were isolated for further characterization and analysis of quorum sensing. Specifically

iron chelating compounds are being examined through various methods as well as the examination of the bioluminescent compounds in relation to quorum sensing.

WHY THE HUBBLE-CONSTANT IS NOT A CONSTANT.

Ingo H Leubner, Tel: 585-385-0973
Rochester Institute for Fundamental Research, 35 Hillcrest Dr., Penfield, NY 14526

Between 1990 and 2010, three-hundred-sixty-six values of the Hubble Constant were determined. [i] The data-range varies between 30 and 98 with an average value of 65.9 and a standard deviation of 9.9. re-plotting in the order of determinations reveals significant variability of the data. This implies that the Hubble Constant as recorded from Earth is not a constant.

Recent modeling of the effect of radiative mass-los on the properties of the Universe led to the conclusion that the Hubble Constant is equal to the radiative mass-loss rate of the Universe. The model also showed that the Hubble value is constant if determined from the Center of the Universe. The model also confirms that the expansion of the Universe accelerates. [ii]

It is suggested from these insights that the variability of Hubble-value determinations from Earth is the consequence of Earth's location and movement away from the Universe-Center. This "Earth Effect" is presented for the special case where galaxies are located on the Universe-Center to Earth/Milky Way axis.

Is anticipated that more detailed modeling which includes the position of galaxies relative to Earth will allow determining the Universe-centered Hubble value. It may allow determining Earth's location relative to the Universe-Center.

1. J. Huchra, 2010, www.cfa.harvard.edu/~dfabricant/huchra/hubble.plot.dat
2. I.H. Leubner, 2008, Presented at the Fall Conference of the Rochester Chapter of the New York Academy of Science.

A STUDY OF VELOCITY PROFILES OF CORONA WIND IN ASYMMETRIC ELECTRODE CONFIGURATIONS

Thomas Liguori, Gregory Donastor, Joseph Cesta, Justin D'Antonio, and Adrian Ieta

By applying high voltage to an asymmetrical electrode system a non-uniform electric field is produced. Above corona onset voltage, the ionized air molecules convey momentum to neutral air molecules creating an air flow known as ionic wind or corona wind. Asymmetrical wire-plate modules and cylindrical pin-array electrodes were studied using naturally occurring water vapors condensed in the presence of liquid nitrogen. A green laser sheet was used to select and visualize cross sections of the induced airflow. A Cannon 7D camera was used for image acquisition at 60 fps. In order to obtain the experimental velocity profiles, image analysis was performed using PhysMo software. Wind profiles are correlated to voltage--current measurements that allow for the ranking of electrode profiles in terms of wind generation efficiency.

GENOMIC ANALYSIS OF *STAPHYLOCOCCUS* BACTERIOPHAGE

James P. Lioi, Dr. Mark A. Gallo Ph.D.
Biology Department, Niagara University, NY 14109

Staphylococcus is a normal inhabitant of humans. Certain strains of *Staphylococcus* exhibit pathogenic characteristics with Methicillin-resistant *Staphylococcus aureus* (MRSA) being the

most prevalent. There are numerous strategies, including antibiotics, that are failing due to the increased resistance of many *Staphylococcus* strains. New methods are constantly being explored in order to combat this ever-growing problem; one involves the use of bacteriophage to kill the target bacteria. The current investigation involves the genomic analysis of known strains of *Staphylococcus* for the identification of prophage.

THE SYNTHESIS OF A SOLUBLE DIRHENIUM(III,III) PADDLEWHEEL COMPLEX FOR THE STUDY OF LIGAND EXCHANGE AND THE EXPLORATION OF PHOTOPHYSICAL AND ELECTRONIC PROPERTIES.

Thomas Maderer, Carly R. Reed
350 New Campus Drive, Department of Chemistry and Biochemistry, The College at Brockport, Brockport, NY 14420

Quadruply bonded dimolybdenum(II,II) and ditungsten(II,II) tetracarboxylate paddlewheel complexes have been extensively studied because of their tunable photophysical and electronic properties[1,2]. Similar dirhenium(III,III) complexes have gained less attention, in part, due to their low solubility and metal-centered excited states. The purpose of this project is to synthesize a soluble dirhenium centered paddlewheel complex with which ligand exchange can be carried out. The synthesis of a soluble dirhenium tetracarboxylate paddlewheel complex was attempted with little success, therefore, $Re_2(O_2CCH_3)_2(DAniF)_2Cl_2$ is being synthesized as an alternative starting material where the DAnif, *N*,*N*'-di(*4*-methoxyphenyl)-formamidinate, ligands are bridging the dimetal centers in the *cis* conformation.[3] Future work will examine the ability of this starting material to undergo successful ligand exchange with various carboxylate ligands. Once the synthesis and characterization are complete, photophysical and electronic properties will be investigated with the use of UV-Vis spectroscopy, fluorescence spectroscopy, transient absorption spectroscopy, and cyclic voltammetry.

1Bunting, P., Chisholm, M. H., Gallucci, J. C. & Lear, B. J. Extent of M2 δ to ligand π-conjugation in neutral and mixed valence states of bis(4-isonicotinate)-bis(2,4,6-triisopropylbenzoate) dimetal complexes (MM), where M = Mo or W, and their adducts with tris(pentafluorophenyl)boron. *J. Am. Chem. Soc.* **133,** 5873–5881 (2011).
2 Burdzinski, G. T. *et al.* The remarkable influence of M2 δ to thienyl π-conjugation in oligothiophenes incorporating MM quadruple bonds. *Proc. Natl. Acad. Sci. U. S. A.* **105,** 15247–15252 (2008).
3 Dequeant, M. Q., Fanwick, P. E. & Ren, T. Synthesis and structural characterization of several dirhenium(III) compounds. *Inorganica Chim. Acta* **359,** 4191–4196 (2006).

PHOTOMETRY OF THE CATACLYSMIC VARIABLE STAR V1084 HER.

Laura Maher[1], Michael Richmond[2], Billy Vazquez[3]
[1] Physics Department, Grove City College, 100 Campus Drive, Grove City PA 16127
[2,3] School of Physics and Astronomy, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester NY 14623

V1084 Her is a close binary star in which a white dwarf accretes material from its main-sequence companion. The system is unusual among cataclysmic variables due to evidence for a strong magnetic field around the white dwarf. We measured the brightness of this system on 5 nights during the summer of 2013, using telescopes at the RIT Observatory and the Vazquez Astronomical Observatory. We present light curves from each night and use the measurements

to determine the dominant frequencies of variation. We compare our results with those from other observers over the past decade and look for long-term trends in the system's behavior.

DETECTION OF GRAPEVINE LEAFROLL ASSOCIATED VIRUSES IN *VITUS VINIFERA* GRAPEVINE SAMPLES OF WESTERN NEW YORK USING THE MACROARRAY PLATFORM.

Robert D Marek(1), Rachel L McClatchey(1), Jeremy R Thomspon(2), Keith L Perry(2), and Jamie L Potter(1). (1) Houghton College, Department of Biology, 1 Willard Ave, Houghton, NY 14744. (2) Cornell University, Department of Plant Pathology and Plant-Microbe Biology, 334 Plant Science Building, 236 Tower Road, Ithaca, NY 14853

Grapevine leafroll associated-viruses (GLRaVs) are one of the most prevalent and destructive plant pathogens affecting grapevine industries today. GLRaVs can cause significant losses in yield by delaying ripening and increasing acidity in fruit juices. Current technologies for detection rely on PCR and ELISA methods, which can produce both false negative and false positive results due to sensitivity constraints. We report the preliminary findings of GLRaV infection in grapevine samples using a multiplex macroarray platform for the detection of thirty-eight grapevine viruses. Our data shows that GV-E is the most prominent viral infection among the 35 grapevine samples collected along the grape valley in Chautauqua County. Virus-specific PCR testing will be performed in future experiments for confirmation of our results. Further use of this macroarray platform on additional samples will provide information on the prevalence, grapevine virus associations, and epidemiology of GLRaVs and other prominent grapevine viruses in vineyards within Western New York and aid in the development of prevention, certification, and management programs across New York's growing regions.

ARE INHIBITION OF HOST TRANSCRIPTION AND SUPPRESSION OF THE INTERFERON SYSTEM SEPARABLE FUNCTIONS IN VSV-INFECTED CELLS?

Kaitlin Marquis, Connie Rink, Maureen Ferran. 153 Lomb Memorial Drive, Rochester NY 14623.

Vesicular Stomatitis Virus (VSV) which infects cattle, horses, and pigs has a variety of strains. Two unique strains called 22-20 and 22-25 were isolated by a group of researchers from the University of Connecticut during a VSV outbreak in cattle. Limited research has been conducted on the effects of these strains on interferon production. The few results obtained have only created controversy in the literature. It is currently unclear as to whether the inhibition of host cell transcription and interferon gene suppression are regulated by separate viral genes. The controversy surrounding the 22-20 and 22-25 viral strains has prompted our lab to become interested in how these strains interact with the host cell. Specifically, our lab is focusing on whether the matrix protein of the 22-20 and 22-25 strains is able to inhibit both general cellular transcription and expression of the interferon gene. In order to test this, stable cell lines that express the luciferase reporter gene under the regulation of CMV or NF-□B-dependent promoters have been selected. The effects of 22-20 and 22-25 infection on reporter gene expression will be discussed.

MEASUREMENT OF JOINT REACTION FORCES IN THE DISTAL RADIO-ULNAR JOINT.

Noorullah Maqsoodi (73 Goldfinch Dr. West Henrietta NY), Madison Doolittle (36 Laureldale Dr. Pittsford, NY 14533)

The distal radio-ulnar joint (DRUJ) reaction force is measured on cadaver arms in order to compare the control to both ulnar diaphyseal shortening and ulnar distal metaphyseal shortening to determine the effects of the surgeries on DRUJ reaction forces. The surgery is conducted on the assumption that ulna lengthening or shortening changes the soft tissue tension that compresses the joint surface and generates the joint reaction force (JRF). The Non-invasive measurement of the JRF across the DRUJ is conducted using a tensile tester outfitted with a load cell and an extensometer fixed to pins bilaterally exiting the DRUJ. This method allows for the measurement of both the distraction force as well as the stiffness of the joint. Fresh cadaver arms simulate the closest characteristics of passive elements of soft tissue and muscle to an in vivo procedure, allowing for an accurate representation of JRF.

INVESTIGATING ENVIRONMENTAL FACTORS AND THEIR IMPACTS ON THE BULK PHENOLIC CONTENT OF *TYPHA* SPP: A POTENTIAL LINK TO INVASION SUCCESS.

Melissa Maurer
Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, NY 14623

Invasion of a wetland by cattails (*Typha* spp.) can lead to changes in vegetation structure, nutrient cycling, and displacement of native species; ultimately this can affect the functioning and biota of the ecosystem. Management strategies to date for cattails generally utilize herbicides and physical removal; however to improve the efficiency of management efforts, invasion biologists are being urged to examine the secondary chemistry of aggressive invaders. In particular, phenolic compounds have been of interest due to the diversity of their functions, which may include pathogen resistance, herbivore deterrence and allelopathy. The secondary chemistry of cattails and how the production of these chemicals is affected by environmental factors such as nutrient availability and herbivores is largely unknown; in addition, it is not clear if their rapid proliferation can be attributed to their chemical make-up. In the current study, a field experiment and broad vegetation survey were conducted. The vegetation survey was used to investigate differences in bulk phenolic content between species, sites, and comparing phenolic concentration between native vs. invasive species. For this survey, 10 sites classified as freshwater emergent wetland were selected between Buffalo and Verona NY, and 21 plant species were sampled. The field experiment specifically targeted two invasive species of cattail (*Typha latifolia, Typha angustifolia*) where the nutrient availability and herbivore pressure were manipulated to investigate the effects on growth and the bulk phenolic content. The field experiment was conducted at the Rochester Institute of Technology and the High Acres Nature

Area near Rochester, NY. Leaves will be analyzed for bulk phenolic content and soil will be analyzed for water, nitrogen, and phosphorus content. Exploring mechanisms and factors that either promote or hinder the success of invasive species like *Typha* could aid in developing more efficient management strategies. Results of this study will expand upon how phenolic concentrations are affected by environmental conditions and will also give a detailed comparison of the phenolic content between native and invasive species at the same site and between different sites.

INTERACTIONS OF CORE PROTEINS WITHIN THE EXON JUNCTION COMPLEX OF *ARABIDOPSIS THALIANA*.

Zachary Mazanek, Meera Babu, Xiao-Ning Zhang, PhD
Department of Biology, St. Bonaventure University, 3261 West State Road, St. Bonaventure, NY 14778

The exon junction complex (EJC) is a protein complex that is important for posttranscriptional regulation, such as RNA localization, alternative splicing, nonsense mediated decay, and nuclear export. It is made up of four core proteins that bind to each other through interactions at the amino acid side chains of each protein in the complex. In *Drosophila*, Mago is a flat, two-sided protein with its alpha helices facing the RNA binding domain of Y14, and its pleated sheets facing eIF4AIII. *Drosophila* Mago (DsMago) is 77% identical to its ortholog in *Arabidopsis* (AtMago), and *Drosophila* Y14 (DsY14) is 33% identical to its ortholog in *Arabidopsis* (AtY14) (Park 2007). The goal of this project is to determine how AtMago interacts with other EJC components in *Arabidopsis*. Mutants of the *Arabidopsis* Mago protein were created by truncation at four different locations on the protein: after the 5^{th} beta sheet, 6^{th} beta sheet, the B alpha helix, and the C alpha helix. These truncations were created by ligating encoding cDNA sequences into the pMal-c2 expression vector. We have determined through *in vitro* pull down assays that these four domains tested are not responsible for AtMago's association with AteIF4AIII. More importantly, the third alpha helix is responsible for AtMago binding to AtY14. Using these results and crystallography data from *Drosophila*, we determined six conserved candidate residues on the C alpha helix that may be important for the interaction of AtMago and AtY14. Individual point mutations were induced into the AtMago residues, and currently, we are testing the interactions between these mutant AtMago proteins and AtY14. Our future goals are to verify the above interactions using yeast two hybrid system.

Reference to be included in poster not in abstract; for information only:
Park N, Muench D. Biochemical and cellular characterization of the plant ortholog of PYM, a protein that interacts with the exon junction complex core proteins Mago and Y14. Planta 2007; 225: 625-639

RHEOLOGICAL PROPERTIRES OF PHOSPHONIUM IONIC LIQUID/METHANOL SOLUTIONS.

Zachery McAtee, Mark Heitz
Department of Chemistry, The College at Brockport SUNY, Smith Hall, 350 New Campus Drive, Brockport, NY 14420

Ionic liquids are considered to be environmentally friendly solvents and are therefore used as alternatives to harsh volatile organic hydrocarbon (VOC) solvents. The goal of our research is to

determine how the mass transport variables, specifically density and viscosity, of the ionic liquid trihexy(tetradecyl)phosphonium chloride (PILCl) change as a function of temperature and mol fraction ionic liquid. The choice of methanol as the cosolvent is driven by previous experiments in our lab, which have shown that PILCl is most miscible with methanol in contrast to longer chain alcohols or other traditional organic solvents such as dichloromethane, THF, hexane, etc. Specifically we have measured density and viscosity of methanol solutions across the entire range of mol fraction (x_{pilcl} = 0 - 1) and over a temperature range of 17 to 50˚C. The viscosity data generally follows Stokes-Einstein behavior and shows a linear proportionality to mol fraction. Excess molar volumes are also computed from the density data and are overall negative suggesting that on mixing the solution volume collapses due to intermolecular hydrogen bonding.

LINKING WILD FRUIT QUALITY AND PHYSIOLOGICAL CONDITION OF SONGBIRDS DURING FALL MIGRATION AT BRADDOCK BAY, LAKE ONTARIO.

April E. Meier, Charmaine R. Merchant, Cassie J. Gould, and Susan S. Pagano
Mailing address for all authors: Thomas H. Gosnell School of Life Sciences, Rochester Institute of Technology, 85 Lomb Memorial Drive, Rochester, NY 14623.

Wild fruits are an important food resource for many songbirds during fall migration. These fruits can differ in nutritional value based on seasonal changes or differences in composition between fruit species. These differences could affect the birds' migration in that the fruit quality will determine how rapidly they gain energy at stopover sites, and the duration of stay at these stops before they can continue their migration. We investigated the nutritional content of common native and invasive fruits found at the Braddock Bay Bird Observatory, located at an important stopover site on the south shore of Lake Ontario. We also measured plasma triglyceride, an indicator of fat deposition, and plasma uric acid, an indicator of dietary protein, in frugivorous *Catharus* thrushes captured during fall migration at this site. We report the energy density, protein content, and °Brix of fruits collected over multiple fall seasons at this site, and we assess interannual variation in the nutritional content of selected fruit species. We also compare the physiological condition of thrushes captured in fall 2012 with previously published data on thrushes captured at BBBO in relation to seasonal patterns of fruit quality. Future work will incorporate plasma antioxidant status of thrushes stopping over at this site. Results of this study may be useful in managing habitat at important stopover sites so that more high-quality fruits are available to migrating birds.

LIMITING INVASIVE SPECIES USING NATIVE SHRUB GROWTH.

Kaitlyn Moranz, Dr. Christy Tyler
Thomas H. Gosnell School of Life Sciences, Rochester Institute of Technology
85 Lomb Memorial Drive, Rochester, NY 14623

Wetland mitigation projects are created in the hopes of reducing the effects of the destruction of wetlands. These projects are gauged under certain criteria and must meet DEC regulations and Clean Water Act standards. Often, however, mitigation projects don't meet intended standards of wetland ecosystem function, largely because of invasion of wetlands by highly invasive, non-native plants. Combating invasive species is a priority in the mitigated wetlands at the High Acres Nature Area, owned and operated by Waste Management, LLC, where a series of wetlands

were created to mitigate wetlands filled during landfill expansion. In order to combat invasive species, three species of shrubs (Buttonbush, Silky Dogwood, and Silky Willow) were planted in an attempt to shade out and create competition for herbaceous invasive species.

Shrub live stakes were planted in Spring 2012 in 150 plots in varying combinations of species (singly or in pairs; 5 shrub stakes per plot) and distances from a creek bank (0, 2, 5, 10 m) in order to determine which planting procedures lead to highest shrub survivorship and least invasive species cover. To evaluate shrub health, the number of leaves per shrub, the health index of each shrub, and the percent cover of other species were monitored each Summer and Fall after planting. This study will provide valuable information on the use of native shrubs to promote growth of native species and deter invaders in comparison to areas without shrubs present. Evaluations show that single species shrub plots create an environment conducive for native growth while limiting takeover of invasive species, and areas with shrubs provide more protection from invasive than those without.

INNER-SHELL PHOTODETACHMENT OF C_N^- SMALL CLUSTERS.

Joshua Moss[1], Candace Carducci[1], Ileana Dumitriu[1]
Rene Bilodeau[2], Alex Aguilar[2], Dan Gibson[3], Wes Walter[3]
[1]Department of Physics, Hobart and William Smith Colleges, Geneva, NY
[2]Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, CA
[3]Department of Physics and Astronomy, Denison University, Granville, OH

Clusters are the bridge between gas phase and solid phase and have been studied using mostly laser techniques. Investigation of cluster negative ions using synchrotron radiation is a novel direction. Studies of neutral as well as ionic clusters allow us to understand the complex behavior of bulk materials.

Photodetachment is the process whereby a negative ion interacts with a photon resulting in the formation of a neutral atom and a free electron. When enough energy (>15 eV) is absorbed by a negative ion an electron from an inner-shell is ejected. An electron from a higher energy level will sometimes drop into the empty space where the inner electron left and cause another electron to be ejected, so-called Auger process. Inner-shell photodetachment from small carbon negative ion clusters followed by Auger decay produce positive ions that are detected as a function of photon energy.

The experiment was performed at Lawrence National Berkeley Laboratory, Berkeley, CA. The negative small carbon clusters C_n^- ($n = 1,...,10$) were produced by a cesium sputter source SNICS. The negative ion beam and counter propagating photon beam overlap in the interaction region. Inner-shell photodetachment from negative ions followed by Auger decay produce positive ions that are detected as a function of photon energy. The inner-shell photodetachment cross section of small carbon clusters was measured in the photon energy range of 25 -90 eV. The poster presents experimental results on the size evolution of the electronic properties of the small C_n^- ($n = 1,...,10$) clusters.

ANALYSIS OF LARGE AND SMALL COLONY VARIANTS OF *STAPHYLOCOCCUS*.

Jawdat Mustafa, Dr. Mark Gallo, Ph.D.
Biology Department, Niagara University, Academic Center for Integrated Sciences, Niagara University, NY 14109.

Staphylococci are common inhabitants of many warm-blooded animals. There is much diversity in their metabolic capability. Strains of Staph were isolated from white tail deer, Odocoileus virginianus. A large variation in growth rate was noted for the isolates. Some, termed small-colony variants, were identified on tryptic soy agar plates. These variants showed several different phenotypes: some could be "rescued" by growth on other media; some produced a low percentage of normal-growth rate offspring; and some remained small on the various media. This study will investigate the mechanism(s) responsible for these phenotypes.

PHYLOGENETIC CHARACTERIZATION OF BACTERIAL BIOFILMS FROM THE NIAGARA RIVER.

Andrew Mrzygut, Dr. Mark Gallo
Golisano Center, Niagara University, NY 14109

This study analyzes the early formation of biofilms on plastic in freshwater environments. Six plastic types (Polyethylene Terephthalate, PET; High Density Polyethylene, HDPE; Polyvinyl Chloride, PVC; Low Density Polyethylene, Polypropylene, and Polystyrene) were placed into the lower Niagara River in Lewiston, NY. At the end of each trial the samples were removed from the river and DNA was isolated for 16s rRNA gene analysis. 454 pyro-sequencing was performed and phylogenetic analysis was carried out based on the operational taxonomic units.

TYPE 1 INTERFERON PRODUCTION INHUMANS IN RESPONSE TO BACTERIAL INFECTION.

Emily Newman[1], Qingfu Xu[1], Michael Pichichero[1]
[1]Rochester General Hospital Research Institute, 1425 Portland Avenue, Rochester, NY 14621

Respiratory tract infections are the second leading cause of death for children around the world under the age of five. These infections are often caused by a primary viral infection followed by a secondary bacterial infection, suggesting that the viral-bacterial interaction plays a critical role in the pathogenesis of infection. This interaction must be further explored to create effective vaccines, especially against *Streptococcus pneumonia* (*S.pn*), *Haemophilius influenzae* (*H.i*), and *Moraxella catarrhalis* (*M.cat*), the pathogens that cause acute otitis media in children and bronchitis and pneumonia in adults. The production of interferons (types I and II) is one way the human immune system defends against viral infections. However, it was recently shown in animal models that type I interferons, INF-α and INF-β, are produced in response to colonization by *S.pn* as well as viral infections. *S. pn* is the target of a polysaccharide vaccine which is widely available in the United States. Therefore, it is critical to determine the effect of *S. pn* infection on type I interferon production in humans to ensure that the vaccine does not increase susceptibility to viral infections. Using enzyme-linked immunosorbent assays (ELISA) and quantitative real time polymerase chain reaction (qRT-PCR), we characterized type I interferon production in humans in response to colonization with *S.pn* alone and synergistically with a viral infection. Current data suggest that *S.pn* colonization does ***not*** stimulate type I interferon production in young children.

GENOMIC COMPARISON OF *STAPHYLOCOCCI* ISOLATED FROM CATTLE ON AN ORGANIC DAIRY FARM.

Kyle Nugent and Mark A. Gallo, Ph.D.
B.Thomas Golisano Center for Integrated Sciences, Niagara University, Niagara University NY 14109

Staphylococci are the main cause of bacterial infection of the udders of cattle leading to mastitis. Antibiotic therapy is the common treatment however this option is not available for an organic dairy operation. It is intriguing, from an epidemiological perspective, if the presence of antibiotics limits the strain variability found at a farm and hence in an operation where such agents are not used there may be more diversity in the strains of *Staph* found associated with the cows. Pulsed Field Gel Electrophoresis (PFGE) analysis was performed to get an estimate of strain variability. Total chromosomal DNA was digested with *Sma*I and strains were typed via their band patterns.

REFINING A TRANSESTERIFICATION PROCESS: EXAMINING VARIOUS PROTOCOLS FOR CONVERTING WASTE VEGETABLE OIL INTO BIODIESEL.

Niamh O' Leary[1], Colin P. Evans[2]
[1]Professor of Environmental Studies, Wells College, Aurora, NY 13026
[2]Wells College Class of 2012, Master's Degree Candidate in Earth, Air & Atmospheric Sciences, Concentration in Atmospheric Sciences, University of Massachusetts, Lowell, MA 01854

Biodiesel, a diesel-like fuel produced from vegetable oil, is a biologically based renewable energy resource that provides an attractive alternative to fossil fuels. When waste vegetable oil is used to produce biodiesel, a costly waste management issue is addressed and a valuable fuel is produced. Various protocols exist for producing biodiesel fuel from waste vegetable oil. The goal of this study was to select and optimize the protocol that would most effectively produce biodiesel fuel from the waste vegetable oil generated by Wells College's dining hall. Variations on an alkali-catalyzed transesterification process were investigated. A total of eight trials were conducted. The trials varied in the nature and amount of starting material used, the catalyst employed, the ratio of methanol to waste vegetable oil, and the type of agitation used to mix reactants. Nuclear magnetic resonance spectrocopy confirmed when biodiesel was produced. The experimentation determined that biodiesel was best produced from waste vegetable oil using potassium hydroxide as a catalyst, a blender for agitation, and a 2:5 ratio of methanol to waste vegetable oil.

SYNTHESIS OF SMALL MOLECULE RECEPTORS FOR BINDING CATIONS.

Allison O'Neil, Jacob H. Murray, Jacob D. Murray, Steven Lewis, Dr. Stephen Tajc
Nazareth College, 4245 East Avenue, Rochester, NY 14618

Heavy metal pollution has been causing problems with the purity of our fresh water supplies. A history of mining has led to heavy-metal contamination of both ground and surface water in many areas of the United States[1]. Small molecule receptors that bind cations in aqueous solution may have potential as a water purification technique. Dipicolinic acid (DPA) is a small molecule formed in bacteria spores and is known to chelate calcium. DPA, which has been found to aid in

heat resistance for the bacteria endospores[2], may also have potential as a small molecule that binds larger heavy metal cations. Our research focuses on the structure activity relationship of DPA and DPA derivatives to determine the fundamental binding characteristics of DPA:cation interactions in aqueous solution.

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ULTRASOUND-ENHANCED TRANSDERMAL DELIVERY OF NANOPARTICLES.

Fernando Ontiveros Ph.D.°, Jessica Saxum°, Brooke Saffren* & Maria Helguera Ph.D*.
°Biology Department, St. John Fisher College. 3690 East Ave. Rochester, NY. 14618.
*CFC Center for Imaging Science, RIT. 51 Lomb Memorial Dr. Rochester, NY. 14623.

The development of new methods for drug and vaccine delivery is of paramount importance in the field of biomedical research. For the last 20 years there has been an increased interest in the production of small scale particles that can be functionalized to deliver biomolecules to specific tissues. The skin is a target organ for vaccine and drug preparations due to its accessibility, surface area and its constant surveillance by cells of the immune system. Low-frequency ultrasound has been shown to augment skin permeability, but little is known about the efficacy of this method in facilitating the delivery of nanoparticles *in vivo.* Our objective was to improve the transdermal delivery of bioactive agents contained in nanoparticles with the use ultrasound. An ultrasound protocol was designed to expose the tissue without inducing adverse effects. A 2.5MHz immersion transducer was experimentally characterized using a hydrophone. A Tektronix arbitrary function generator was programmed to excite the transducer with bursts of $800mV_{p\text{-}p}$, 40µs duration sinusoidal signals consisting of 100 cycles at 1ms intervals, with pulse repetition frequency of 1KHz. Exposure pressure and intensity were experimentally determined to be within safety levels. For *in vitro* experiments, skin explants were canvased on custom-made Franz cells, and permeability was measured after exposure to ultrasound using the HRP-TMB enzyme/substrate system. For *in vivo* experiments, mice were anesthetized and a suspension of quantum dots in glycerol was applied after exposure to ultrasound. Our results indicate that ultrasound is a promising tool in the enhancement of drug and vaccine delivery through the skin.

CHARACTERIZATION OF STAPHYLOCOCCUS ISOLATES FROM WHITE-TAILED DEER.

Sonja Opper, Dr. Mark Gallo
Golisano Center of Integrated Science, Niagara University, NY 14109

Staphylococcus is a gram positive bacterium that appears under the microscope in grape like cocci in clusters. Staphylococcus is found in many environments including being a normal inhabitant of many warm blooded mammals. One particular species, S. aureus, is a pathogenic member of this genus. Certain strains of this species are resistant to numerous antibiotics, these

strains have become a major problem in the clinical setting. One hundred seventy one putative Staphylococcal isolates were obtained from the nasal passages of white tail deer, Odocoileus Virginianus. Metabolic and antibiotic resistance profiles were determined for the strains.

ELECTRICAL SILENCING OF NEWBORN NEURONS: WILL ANYONE NOTICE?

Kelly O'Sullivan, Brittany VanDervoort, Shannon Haberman, Nicholas Mitchell Ph.D.
St. Bonaventure University, 3261 W State Rd, St. Bonaventure, NY 14778

The hippocampus of the mammalian brain is involved in both long-term memory storage and the cognitive processing that underlies neural mapping of one's physical surroundings. Within the hippocampus neural stem cells (NSCs) of the subgranular zone (SGZ) give rise to neural progenitor cells (NPCs), which differentiate into newborn neurons (or glia) of the hippocampus. This process, known as adult hippocampal neurogenesis, happens throughout life and can be enhanced by interventions such as exercise and socialization. Although neurogenesis has been positively correlated with improvements in learning and memory, none of the studies conducted to date clearly demonstrate a cause and effect relationship between neurogenesis and cognition.

To determine whether hippocampal neurogenesis directly supports learning and memory in mammals, we engineered a genetic construct consisting of: 1) a tetracycline-regulated promoter, 2) a leak potassium channel (TASK1), and 3) a fluorescent reporter (mCherry). The tetracycline-regulated promoter affords tight regulation of TASK1 and mCherry gene expression. The TASK1 gene codes for a leak potassium channel, which when overexpressed by neurons should produce a >10 mV increase in membrane potential (i.e., hyperpolarization). This hyperpolarization will electrically silence newborn neurons, thereby limiting their contribution to hippocampal function. Neurons exhibiting this hyperpolarized phenotype will be identified by mCherry fluorophore expression. However, selective targeting of this silencing cassette to newborn neurons has been achieved by placing the entire construct within a retroviral expression vector. Once newborn neurons are infected with the silencing cassette, tetracycline administration will trigger TASK1 and mCherry gene expression.

ONTOGENY OR PHYLOGENY? CLADISTIC PLACEMENT OF A JUVENILE DROMAEOSAURID FROM THE LOWER CRETACEOUS OF MONTANA.

Parsons, William L., Buffalo Museum of Science, Buffalo, NY, United States;
Parsons, Kristen M., Buffalo Museum of Science, Buffalo, NY, United States

MCZ 8791 is a small dromaeosaurid from the Lower Cretaceous Cloverly Formation of central Montana. The only other dromaeosaurid recovered from this formation is *Deinonychus antirrhopus*. One line of arrested growth in the radius indicates MCZ 8791 died between one and two years of age. Our cladistic analysis places MCZ 8791 basal to *Deinonychus antirrhopus* and as a sister taxon to *Bambiraptor feinbergorum*, but of the 68 characters coded for MCZ 8791, it shares all but one with *Deinonychus*. That single differing character is a pneumancity represented by a complex of irregular foramina in the articular. MCZ 8791 shares this character with *Bambiraptor*. Further data has been obtained through landmark shape-graphing of the lateral profiles of the second pedal ungula of several dromaeosaurids. Comparisons of the measurements between similar landmark points increase the number of characters that confirm the taxonomic similarity of MCZ 8791 and *Deinonychus*. Also, the identical structure and number of denticles on the maxillary teeth further confirm this identification. Beyond the

characters that have already been coded for, some further differences have been observed; some are evidence of a juvenile growth status and thus are ontogenetic. The juvenile identification of those features is due to the possession of at least one element, such as regions of bone/cartilaginous transitional growth; juvenile histological characters; and/or open, undeveloped cortical surfaces. Other differences are not as easily recognized as ontogenetic, but we propose there is sufficient previously described evidence to argue that they are additional variable ontogenetic characters. Examples of these are the presence or absence of maxillary interdental plates, the elongate cranium, possible concave profile of the dorsal edge of the anterior portion of the skull, the slender mandibular ramus, the spacing between the maxillary teeth, the angle of raking of the maxillary teeth, the length of manual II-2 phalanx, the mid-shaft width of pedal II-1 phalanx, the distance between the ventral apex of the flexor tubercle and the ventral limit of the proximal articulating facet on pedal ungual 3, the ratio of the comparative thicknesses of the bony wall to the medullary cavity of the fibula, and the thickness of the bony wall of the distal end of the femur. If MCZ 8791 is a juvenile *Deinonychus*, then the identification of these further ontogenetic features contributes to our knowledge of dromaeosaurid ontogeny.

ADVANTAGES AND LIMITATIONS OF USING OPTOGENETIC REPORTERS FOR MONITORING NEURONAL EXCITABILITY.

Angeline Pham, Kelly O'Sullivan, Nicholas Mitchell Ph.D.
St. Bonaventure University, 3261 W State Rd, St. Bonaventure, NY 14778

Patch-clamp electrophysiology is the premier tool used by physiologists to measure electrical signals from excitable cells. The patch-clamp technique requires physical attachment of a micrometer glass pipette to the cell surface, enabling whole cell or membrane patch recordings to be made. This configuration allows scientists to control a cell's membrane potential (voltage-clamp) while simultaneously measuring ion currents through a single ion channel; or in the current-clamp configuration, record action potentials. Despite its effectiveness and widespread usage, the patch-clamp technique is particularly labor intensive, often requiring years of training to achieve proficiency.

Recently, a potential alternative to patch-clamp electrophysiology was identified. Optogenetics, the engineering of genes that code for optical sensing or reporting proteins, has led to the development of voltage sensitive fluorescent proteins (VSFPs). VSFPs are optical reporters that emit light when changes in cell membrane potential provoke protein conformational changes. To date, VSFPs have lacked the temporal resolution and sensitivity to detect action potentials. However, a recently developed VSFP, ElectricPk (EPK), has been used to detect high frequency action potentials in mouse hippocampal neurons. To further advance this technology, our lab seeks to determine whether EPK can function as a neuronal excitability assay *in vitro*. To function as an excitability assay, EPK must detect membrane potential changes greater than 5 mV and resolve individual action potentials (100 mV, 1-3 ms). We will evaluate EPK's ability to meet these needs by infecting hippocampal neurons with an EPK-containing lentivirus, and subsequently measuring EPK responses to excitatory and inhibitory drug treatments.

EGG LAYING DEFECTS OF MICROTUBULE-ASSOCIATED PROTEIN EPB-2 KNOCKOUT IN *C. ELEGANS*.

Jennifer Plotzker, Daryl Hurd
St. John Fisher College, 3690 East Avenue, Rochester, NY 14618

The nematode *C. elegans* serves as an excellent model organism for the study of cellular, developmental and behavioral biology. Specifically, egg-laying behavior, a product of the gonad, vulva and a simple neuronal circuit has been carefully studied to reveal the mechanisms of developmental and behavioral control. Microtubule-associated proteins (MAPs) are necessary for proper formation and stabilization of microtubule structures which function in neurons and cells undergoing morphogenesis. To address the role of MAPs in vulval development/function, we used RNAi (RNA-mediated gene interference). We found that worms lacking the expression of microtubule-associated protein EBP-2 (end-binding protein #2) produced fertilized eggs, however they had great difficulty laying eggs (the Egl phenotype or egg laying defective). The specific mechanism by which this occurs was further explored by analyzing rates of egg laying in single hermaphrodites of two strains of *C. elegans* which accomplish effective RNAi in two different tissue types (neuronal vs. non-neuronal). Wild-type nematodes are known to expel eggs at a rate of 4-10 eggs/hour. We found *C. elegans* that were sensitive to neuronal RNAi were defective in egg laying when exposed to *epb-2*(RNAi), which suggests that MAPs may be required in the neurons that comprise the egg-laying circuit.

BLACK-CAPPED CHICKADEES (*POECILE ATRICAPILLUS*) ALTER THEIR SEED CACHING BEHAVIOR IN RESPONSE TO SEASONAL CHANGES.

Jennifer Plotzker, Michael Carroll, Aaron Spacher
St. John Fisher College, 3690 East Avenue, Rochester, NY 14618
Dr. Gregory Cunningham
St. George's University, PO Box 7, St. George's, Grenada, West Indies

Several avian species do not migrate in preparation for the cold winter but choose to cache their food supply instead. Being a permanent resident of mixed forests and open woods of northern United States and southern Canada, the Black-capped chickadee (*Poecile atricapillus*) has been observed to alter its foraging behavior in accordance to environmental pressures such as temperature, length of day, and amount of food availability as an alternative to migrating to a warmer climate with more available resources. This species typically forages for small insects, spiders, berries and seeds in ideal conditions. To test the seed preference of this species as winter neared and day length shortened, birds were presented with two different seed types and observed over a period of time. Foraging behavior in this species was observed at Mendon Ponds Park, NY because they were already habituated to human contact. After presenting Black-capped chickadees with two different seed types: mixed seed containing sunflower hearts or black-shelled sunflower seed, they showed different preferences depending on the length of daylight. As day length shortened, the birds' preferences changed from that of mixed seed to the black sunflower seeds. The birds were predicted to alter their foraging behavior in response to shortening amounts of daylight to cache more energy in the area. Black oil sunflower seeds tend to have higher oil content than stripped sunflower seeds, thus giving the chickadees more calories per seed and making for a more desirable seed to store for the winter.

SYNTHESIZING DPA DERIVATIVES TO IDENTIFY EFFECTIVE CATION SCAVENGERS.

Nick Polito
Department of Chemistry, Nazareth College, 4245 East Avenue, Rochester, NY 14618

Dipicolinic acid (pyridine-2,6-dicarboxylic acid)(DPA) is a pyridine-based compound produced by gram-positive, spore producing bacteria. DPA has been shown to successfully chelate Calcium metal ions in aqueous solution.[i] DPA-derivatives may have the ability to act as heavy metal scavengers in aqueous solutions making them a novel alternative for the purification of contaminated water. My research involves synthesizing DPA-derivatives to create more feasible schemes for the production of derivatives. Several successful synthetic routes have been confirmed. The resulting derivatives were tested for their structural activity relationship for binding. Using various organic synthesis schemes to produce new compounds and UV-titration to test the binding ability of these compounds, we hope to identify DPA derivatives that will successfully scavenge metal ion contaminants in water.

[i] Lewis, J. C. (1967). Determination of dipicolinic acid in bacterial spores by ultraviolet spectrometry of the calcium chelate. Analytical biochemistry, 19(2), 327-337.

THE ROLE OF *DNM1* IN MITOCHONDRIAL GENOME STABILITY IN BUDDING YEAST.

Christopher Prevost, Deanna Pedeville, and Rey Antonio L. Sia.
The College at Brockport, State University of New York, 350 New Campus Dr., Brockport, NY 14420.

Mitochondria are essential organelles in eukaryotes. Known as the “power house” of the cell, mitochondria manufacture ATP which is required for the successful completion of many cellular processes. Mitochondria have individual genomes, separate from the nuclear DNA, which encode for proteins required for respiration. In humans, mutations in the mitochondrial DNA (mtDNA) results in the loss of mitochondrial function which leads to neuromuscular and neurodegenerative disorders. The focus of this study is to determine the role of the nuclear gene *DNM1* in maintaining mtDNA stability in the budding yeast, *Saccharomyces cerevisiae*. Dnm1p is a dynamin-related GTPase protein localized to the outer membrane of mitochondria. Mitochondria undergo a constant state of fusion and fission within the cell which allows for mitochondrial segregation during cellular division. Dnm1p is a key regulator of mitochondrial fission. Loss of Dnm1p leads to aberrant mitochondrial structures. The lab is interested in determining whether loss of the *DNM1* gene plays a role in mitochondrial genome stability. We observed in *dnm1*Δ mutants a 12-fold increase in spontaneous respiration loss which may be a result of altered mtDNA stability. Mitochondrial genome instability can arise via spontaneous point mutations or deletion events. Assays were done to measure the spontaneous point mutation rate between wild type and *dnm1*Δ mutant strains. Spontaneous point mutation rates were shown to increase in *dnm1*Δ mutants. The lab is currently constructing strains to determine the role of Dnm1p in direct repeat-mediated deletion events.

THE ABUNDANCE AND DISTRIBUTION OF DEER TICKS WITHIN AND OUTSIDE DEER EXCLOSURES AT RICE CREEK FIELD STATION, OSWEGO COUNTY, NY.

Stephenie Przepiora, Daniel Haller, Kathleen Clifford, Jennifer Buckley
State University of New York at Oswego, Department of Biological Sciences, 392 Shineman, Oswego, NY 13126

Ixodes scapularis (Deer ticks) are involved in the spread of the Lyme disease-causing spirochete (*Borrelia burgdorferi)* to humans. To better understand how best to avoid Lyme Disease, it is important to understand the ecology of the ticks that carry *Borrelia*. Feeding ticks seek out primarily rodents and deer for a blood meal. During a five week period, we sampled three different forested areas using drag sampling methods in 40 m x 1 m transects at the Rice Creek Field Station. At each, location we sampled for ticks inside and outside of three deer exclosures. We then compared the abundance of ticks that were distributed inside versus outside of the exclosures for each exclosure. Because rodents are believed to be the main host for ticks we predicted that there would be no significant difference inside versus outside of the exclosure. Our data suggest that there is no significant difference between the inside and outside of the exclosure, however there is a difference of tick abundance between the three forest habitats where the exclosures are located.

PROPERTIES OF CX31 AND INTERACTING JUNCTIONAL PROTEINS EXPRESSED IN XENOPUS OOCYTES.

S. Rarick and I.M. Skerrett
Biology Department, Buffalo State College, 1300 Elmwood Ave Buffalo NY 14222

In multicellular organisms, adhesion complexes and junctions mediating cell-to-cell communication are vital for normal tissue function. Connexin proteins constitute the communicating form of these junctions in vertebrates and about twenty connexins have been identified in mammals. Connexins form gap junctions that allow ions and small molecules to be directly exchanged between adjacent cells (such as Ca^{2+} and siRNA used for signaling). Gap junctions can be studied in various ways, and exogenous expression in *Xenopus* oocytes is a common method for studying properties such as connexin interactions, regulation by ions and metabolites, and voltage-sensitivity as well as the effects of mutations on function. In this study we focused on Connexin31 (Cx31). In humans, Cx31 is expressed in skin and also in the inner ear and mutations are associated with both skin disease and deafness. Cx31 is known to interact with several other connexins including Connexin32 (Cx32), which is physiologically significant since these connexins have overlapping expression patterns. While Cx32 expresses robustly in oocytes and is fairly well characterized, Cx31 is difficult to express and there is no published information on the properties of Cx31 expressed in oocytes. My studies aim to identify a vector suitable for expression of Cx31 in oocytes, allowing detailed characterization of Cx31, as well as its possible interactions with Cx32. This will provide a foundation for analysis of Cx31 mutations associated human genetic disorders.

THE ABUNDANCE OF *IXODES SCAPULARIS* AND THE LYME DISEASE BACTERIUM, *BORRELIA BURGDORFERI* IN CENTRAL NEW YORK.

Zuzi E. Salais, Carolanne J. Smith, C. Eric Hellquist, Timothy F. Braun
State University of New York at Oswego, Department of Biological Sciences, 329 Shineman Science Center, Oswego, NY, 13126

Recent studies show that more than 75% of emerging human pathogens are zoonotic and that their prevalence is due to both ecological factors and wildlife host abundance and behavior. Lyme disease in North America is primarily transmitted by the blacklegged tick, *Ixodes scapularis*, which acquires the bacteria, *Borrelia burgdorferi,* during a blood meal. In New York, the majority of *Ixodes* are found in the southern part of the state but are becoming more common in central New York. In 2012 and 2013 tick surveys were conducted at the Rice Creek Field Station (RCFS) at SUNY Oswego. Ticks surveys were conducted weekly at 13 locations in meadows, hardwood forests, edges (between meadows and forests) and walking trails. In 2013, we expanded our surveys to Green Lakes State Park (Fayetteville, NY) to compare the prevalence of *Borrelia* infected ticks to those of RCFS. Surveys were conducted using the transect drag sampling method consisting of a 1-m^2 white corduroy cloth that was dragged and examined every 20 meters along each transect. In 2012, a total of 213 ticks were collected only in the forested (n = 210) and trail (n=3) locations at RCFS. Ticks were most often found in August-October. Following collection of ticks, we used polymerase chain reaction (PCR) of homogenized *Ixodes* to determine the presence of *Borrelia* within each habitat at RCFS. Of the 213 ticks collected, one tick tested positive for *Borrelia*. For 2013, a total of 51 ticks have been collected at RCFS in forested (n = 44) trail (n = 6) and edge (n = 1) locations. A total of 120 ticks have been collected at Green Lakes State Park in forested (n =108) trail (n = 9) and edge (n =3) locations. Tick surveys will continue until November and polymerase chain reaction will begin in late October to further understand the prevalence of *Borrelia* in central New York *Ixodes* populations.

THE COMPARATIVE ANALYSIS OF FIBRIN SPECIFIC AND FIBRIN NON-SPECIFIC DRUGS IN THE TREATMENT OF HIGH RISK PULMONARY EMBOLISM.

Caitlin Scheeler
Daemen College, 4380 Main Street, Amhert, NY 14426

High risk pulmonary embolism (PE) accounts for approximately 5% of all acute PE; which is the third most frequent cause of cardiovascular death. I analyzed nine medical research articles comparing the different types of treatments for high risk PE in order to determine which treatments were most effective. The research showed that thrombolytic treatment was the best treatment option, but there are two different types of thrombolytic treatment, fibrin specific and fibrin non-specific. I then further researched the difference between these two thrombolytic treatment options and their success in the treatment of high risk PE. The research showed that the fibrin specific thrombolytic treatment was a more effective treatment. Additional research is still necessary in comparing all of the fibrin non-specific drugs to the fibrin specific drugs, as all of the available research on these drugs only compares one fibrin specific to one fibrin non-specific treatment.

DISCOVERY OF NOVEL ARENAVIRUS NP-HOST FACTOR INTERACTIONS VIA THE YEAST-TWO HYBRID SYSTEM.

Patrick Schupp[*&], Luis Martínez-Sobrido[&]
Department of Biology[*], University of Rochester College of Arts and Sciences;
Department of Microbiology and Immunology[&], University of Rochester School of Medicine;
University of Rochester Medical Center, 601 Elmwood Avenue, Box 672, Department of Microbiology and Immunology, Rochester, NY 14642

Arenaviruses are negative sense, single-stranded, RNA viruses that represent a major health problem throughout the world. The viruses in this family that pose the greatest human threat are the hemorrhagic fever (HF)-causing Lassa (LASV) and Junín (JUNV) viruses in the endemic areas of West Africa and Argentina, respectively. In addition, evidence indicates that the worldwide-distributed prototypic arenavirus lymphocytic choriomeningitis virus (LCMV) is a neglected important human pathogen. Arenaviruses have also been considered possible bioterrorism agents with pandemic potential. Of concern, there are currently no FDA-approved vaccines available for the treatment of arenaviruses and only one clinically used anti-viral compound (ribavirin) that is partially effective and associated with significant side effects. Thus, the development of vaccines and novel antivirals for the treatment of arenavirus infections is urgently needed. Unfortunately, arenaviruses are able to adapt very quickly to antiviral treatment because of the high level of mutagenesis that occurs during viral replication. Thus, targeting cellular host factors rather than viral proteins is a feasible alternative for the identification of antivirals for the treatment of arenavirus infections. However, little is known about cellular host factors that interact with viral proteins that are important for the replication of arenavirus.

Arenavirus nucleoprotein (NP) is an excellent candidate for the identification of host cell interactors as (i) it is the most abundant viral protein during infection, (ii) it has a critical role in viral replication and transcription; and, (iii) is responsible of counteracting the type I interferon (IFN-I) response during viral infection. Our aim is to identify NP interactions through the use of the Yeast-Two Hybrid (Y2H) assay. The Y2H system uses auxotrophic mutant rescue via plasmids in yeast to determine whether two proteins are interacting. A highly complex library of human proteins was used to screen for interactors with NP. Positive hits will be verified via proteomic techniques like co-immunoprecipitation and immunofluorescence co-localization assays. We hope that the interactions hits discovered using the Y2H approach would provide with new directions towards how arenavirus NP might act in the host cell and elucidate new roles and interactions of NP during arenavirus infections. Moreover, identified cellular host proteins that interact with NP could represent potential targets for the development of novel antiviral drugs for the treatment of arenavirus infections in humans.

USING MICROPROCESSOR BASED LABORATORY TOOLS IN CHEMISTRY LECTURE.

David P. Schuster, D'Youville College, Department of Math and Natural Sciences, 320 Porter Avenue, Buffalo, NY 14201

Access to a laboratory for science education exposes students to tools which enable them to reinforce critical concepts, develop skills in graphical analysis, and apply mathematics to problem solving. Some students enter college level chemistry classes who have had very little exposure to experimentation in science, which could manifest as an inability to be successful in

their course work. Furthermore, chemistry courses required in a particular curriculum may be offered without a concurrent laboratory component, potentially exacerbating a difficult situation.

Over the past several years microprocessor based devices have been increasingly incorporated into laboratory exercises. This technology (Microprocessor Based Laboratory or MBL) allows students to observe real-time graphical representations of experiments, purportedly enhancing conceptual understanding and retention of material. While earlier versions of MBL technology required a computer interface for graphing and data analysis, there are currently hand-held MBLs that can collect and graph data without the aid of a computer. The portable, self contained devices can collect data from dozens of sensors and project graphs via Bluetooth or USB cable to a compatible projection device. While useful in a laboratory environment, the portability of these devices also facilitates the presentation of laboratory experiments in a lecture environment.

Using a Vernier LabQuest 2 to collect and display data, several experiments were performed as demonstrations during a one semester course at DÝouville College, Chemistry for Life Sciences. This is a 3 credit class offered with no concurrent laboratory, and is required for students in the exercise and nutrition science program. The laboratory demonstrations were short (~5 minutes) so as to not take away from lecture time, and were chosen to illustrate concepts that were traditionally difficult for students to grasp. Experiments were performed and graphed in real time, and the graphs were projected via a USB port on a standard computer projection system. The graphs were analyzed during the lecture to illustrate concepts and/or calculations, and subsequently distributed to students as pdf files. A post hoc analysis of test scores indicated that weakest students entering the course improved their grade by 13.8% ($p = 0.02$) when the lecture incorporated MBL demonstrations. In this poster, several experiments are presented that can be performed simply and inexpensively in a classroom, along with the rationale for incorporating them into a chemistry lecture.

MODELING THE DEFORMABILITY OF A CELL IN A MICROFLUIDIC ENVIRONMENT.

Jake Shechter, Kara Maki, Moumita Das

Jake Shechter, 6000 Reynolds Drive #1500, Rochester NY, 14623
Kara Maki, Rochester Institute of Technology, School of Mathematical Sciences, 2290 Gosnell, Rochester, NY 14623.
Moumita Das, Rochester Institute of Technology, School of Physics and Astronomy, 3338 Gosnell, Rochester, NY 14623.

Cells are the building blocks of life. Cell mechanics and migration through tight spaces are critical to life processes such as immune response, fertilization, several diseases, diagnostics, and drug delivery. For example, breast cancer cells have been shown to deform more easily and transit more rapidly through microfluidic channels than healthy breast cells. In this computational biophysics project, we simulate a cell moving through a microfluidic channel. We calculate the deformation energy of a model cell, which includes contributions from the cell membrane, cytoplasm and the cell nucleus. We study how the cell deforms in response to external forces, focusing on the deformability of the cell as it squeezes into and through a microfluidic channel and how the nucleus plays a part in this. Recent experiments suggest that the nucleus can be up to an order of magnitude stiffer than the rest of the cell and this study will provide insights into how the nucleus influences cell mechanics and migration.

ANALYSIS OF THE KINETICS FOR THE ESTERIFICATION OF ACETIC ACID CATALYZED BY TIN (II) BROMIDE

Richard Hartmann, Ph.D., Nandini Singh (ysingh2@mail.naz.edu), Nicole Bayona, Jaissy Sekhon

Biodiesel made from waste cooking oil is a popular substitute for petroleum diesel. However, due to its high content of free fatty acids (FFA), waste oil must undergo an initial acid catalyzed esterification. This process typically employs concentrated H_2SO_4 but we chose a milder Lewis acid, tin (II) bromide, as our catalyst. Our investigation is part of a larger project which uses acetic acid, and tin II bromide as catalyst at various temperatures to verify the computational data acquired from a collaborator for the activation energy (E_a). This would help us conclude on the pathway of the mechanism of the Lewis-acid catalyzed esterification reaction of acetic acid. Through the use of NMR, we would be able to determine the amount of methyl ester produced. This poster will present our interpretation of the data, how it relates to the kinetics for the esterification reaction.

DO ALGAL COMMUNITIES VARY BETWEEN VERNAL POOLS AT RICE CREEK FIELD STATION, OSWEGO, NY?

Amber Snyder, and Dr. Cynthia Tant
Department of Biological Sciences, SUNY Oswego, Oswego, NY 13126.

Vernal pools are small, seasonal, wetland ecosystems commonly found during the spring months in the northeastern United States. Common members of these aquatic communities are algae. To better understand small wetland communities, five pools of varying size and location on the Rice Creek Field Station grounds were studied. In each pool, replicate unglazed ceramic tiles were submerged for algae colonization and then removed and replaced once over a four month period. Characteristics of each vernal pool, including canopy cover, pH, dissolved oxygen, depth, conductivity, and temperature were monitored for the duration of the study period. A coarse taxonomic evaluation of the algal communities were also used to determine which algal divisions were most abundant. We found that pool persistence was highly variable, with some pools drying up initially and others lasting until the beginning of July. The initial analysis of all five pools observed shows an abundance of Cyanophyta and Bacillariophyta in the community. These communities are likely being dominated by Cyanophtya due to its highly competitive nature not the variation between pool parameters.

PAST LIVES AT A LOCAL LANDMARK: THE ARCHAEOLOGY OF THE SPRING HOUSE, PITTSFORD.

Kyle Somerville, 50 Strollis Road, Rochester, NY 14626

Although farmsteads are a common feature of the New York State landscape, the daily lives and practices of their occupants varied considerably due to differences in access to markets, production and consumer strategies. In 2004, archaeological investigations were conducted at the Spring House, located on Monroe Avenue in Pittsford, in anticipation of the construction of a retail/shopping complex. Originally built as a health resort, the Spring House was operated as a commercial farm and hotel, furniture shop, and restaurant, a function which it maintains today.

This presentation considers how the artifacts recovered from the Spring House reflect the interactions between rural and urban areas, as well as the difficulties in interpreting an artifact assemblage generated not only by the hotel proprietors but also transient guests.

PHOTOBIOSTIMULATION IN C. ELEGANS AS A MODEL FOR LIGHT THERAPY.

Michael Spoto, Dr. Daryl Hurd, Dr. Max Rempel
St. John Fisher College, 3690 East Avenue, Rochester NY 14618, Localized Therapeutics, Inc., Rochester NY

Low-Level Laser Therapy (LLLT) is a developing therapeutic technique that has been gaining recognition in the scientific community in recent years. Previous experiments performed in LLLT research projects have been primarily mammalian and cell culture based. These experiments have produced results showing accelerated tissue repair. In this experiment, we introduce a new model, *Caenorhabitidis elegans,* a free-living soil nematode, to be used in LLLT research by testing the effects of exposure of the organism to various wavelengths and intensities of light commonly used in LLLT. *C. elegans* was shown to respond to photobiostimulation when exposed to specific wavelengths of Infrared light, 920nm-980nm, at an intensity of $5J/cm^2$. These responses include an 18-20% increase in growth rate and overall length and width of each organism. The cellular mechanism behind this acceleration of growth is unclear and as an excellent model for examining the interactions of cells and tissues on a molecular level; the introduction of *C. elegans* into the field of LLLT research will provide valuable insight into the cellular processes that produce this significant change in biochemistry resulting in accelerated tissue repair and growth induced by LLLT.

PATTERNS OF PLANT BIOMASS PRODUCTION IN THREE YEAR GRAZING EXCLOSURES IN YELLOWSTONE NATIONAL PARK.

Hayley Stanbro, C. Eric Hellquist
State University of New York at Oswego, Department of Biological Sciences, Oswego, NY 13126.

Bison (*Bison bison*) and elk (*Cervus elaphus*) are important ungulate grazers native to Yellowstone National Park (YNP). Ungulate grazers have seasonal impacts on plant production as they migrate with new growth, allowing the previously grazed plants to have time to recover within the growing season. Aboveground samples from the interior (n=10) and exterior (n=10) of five exclosures placed throughout the Northern region of YNP were collected in June 2007. Aboveground plant biomass was sorted into living and dead components. Living material was further separated into species. Total biomass ranged between 100-390 gm^{-2} although there were no significant differences between the five sites (ANOVA; $p > 0.05$). For living biomass no grazing effect was observed although there were site differences (2-way ANOVA; $p=0.02$). Despite the exclosures being in place for three years, there were no significant differences for dead biomass across sites and no grazing effect. Species richness only differed by site (2-way ANOVA; $p<0.0001$). The three year interval of this study may not have been enough time to detect a cumulative grazing effect on plant production.

DEVELOPMENT OF A GUIDED INQUIRY LABORATORY TO INTRODUCE THE CONCEPT OF NEUTRALIZATION USING ANTACIDS TO PRE-CLINICAL NURSING STUDENTS.

James Stanfield, Angela M. Amoia
St. John Fisher College, 3690 East Avenue, Rochester, NY 14618

Acid reflux involves the esophageal being exposed to acid rising from the stomach. Antacids are a pharmaceutical product used to neutralize stomach acid in subjects experiencing acid reflux. There are several brands of antacid available over-the-counter and each possess a unique formula of active ingredients. The overall purpose of this project is to develop a guided inquiry laboratory involving neutralization of various antacids. The laboratory will used with pre-clinical nursing students in a General, Organic and Biochemistry (GOB) course to assess the effectiveness of using guided inquiry as a pedagogical method to introduce the concept of neutralization. The purpose of developing the laboratory is trifold: to introduce the concept of neutralization using guided inquiry, incorporate a health-related application into a basic chemistry concept, and aid in the development of critical thinking skills. The fully developed lab will allow students to devise and carry out their own methods for determining neutralization of various antacids. The project has three goals: develop and evaluate methods for the neutralization of antacids from a set of given materials, the creation of a guided inquiry lab for the neutralization of antacids, and the creation of an instructors guide for the guided inquiry lab. Here we report on work focused on the first goal, developing methods of neutralization, by testing various methods of neutralization and recording the results and observations. The experimental plan involved titrating a given set of commercial ant-acids to determine the accuracy and precision of several different titration methods to evaluate the antacids. The work demonstrated that each antacid had its own complications and that one antacid, Gaviscon, was unsuitable for an educational lab.

THIAMINE CONCENTRATION IN LAKE TROUT EGGS FROM THE GREAT LAKES AND CAYUGA LAKE.

Logan Stratton[a], Jacques Rinchard[a], Stephen Riley[b]
[a]Department of Environmental Science and Biology, The College at Brockport, 350 New Campus Drive, Brockport NY 14420
[b]U.S. Geological Survey, Great Lakes Science Center, 1451 Green Road, Ann Arbor, Michigan 48105, USA

Thiamine deficiency in Great Lakes salmonines results in early life stage mortality. To determine the prevalence and severity of low thiamine in lake trout eggs, thiamine concentrations were determined in eggs collected in fall 2012 from lakes Michigan, Huron, Erie, Ontario and Cayuga Lake. Lake trout egg thiamine concentrations in Lake Huron were high (3.6 to 36 nmol/g) and the proportion of females with eggs thiamine lower than the recommended management objective of 4 nmol/g was negligible. In Lake Ontario, Erie and Michigan, thiamine concentrations varied from below detection limit to 30 nmol/g and the proportions of females with eggs thiamine below 4 nmol/g was significant (up to 85% of females at some sites). All females collected from Cayuga Lake presented thiamine concentrations below 4 nmol/g. These results confirmed earlier report that condition of lake trout egg thiamine is improving in L.

Huron, probably due to the decrease of alewife abundance, but still cause significant impediment to lake trout reproduction in other lakes.

DIETARY EFFECTS ON LAKE TROUT FATTY ACID SIGNATURE.

Logan Stratton[a], Robert Pattridge[a], Jacques Rinchard[a], Sergiusz Czensy[b], Austin Happel[b]
[a]Department of Environmental Science and Biology, The College at Brockport, 350 New Campus Dr., Brockport, NY 14420.
[b]Lake Michigan Biological Station, Illinois Natural History Survey, University of Illinois, 400 17th St., Zion, IL 60099

The objective of this study was to evaluate the influence of dietary fatty acids on whole body lake trout *Salvelinus namaycush*. Alevins (0.09 ± 0.01 mg) were fed five different diets (bloodworm, copepod, *Mysis* sp., *Daphnia* sp., or tubifex) in triplicate aquaria for 105 days. At the end of the experiment, fish were sampled and analyzed for lipid and fatty acid composition. Growth rate was significantly different among dietary treatments with fish fed bloodworm growing the most (548%) and fish fed *Daphnia* sp. the least (8%). Lipid content and fatty acid signature of whole body lake trout changed significantly in the direction of their diet. Whole body fatty acid signature was also significantly different among dietary treatment. These results provide support for the use of fatty acids as indicators of diet and will be used in a quantitative fatty acid signature analysis to determine dietary component of predators.

SYNTHESIS OF ISOTOPICALLY LABELED IONIC LIQUIDS.

Eric Sylvester[1], Ralf Giernoth[2], Markus M. Hoffmann[1]
[1]The College at Brockport, State University of New York, 350 New Campus Drive, Brockport, NY 14420-2971
[2]University of Köln, Greinstr. 4, D-50939 Köln, Germany

Ionic liquids (ILs) are defined as salts that are stable in the liquid state at 100°C or less. ILs have long been considered as designer solvents in preparatory chemistry because they can be made task-specific for a specific synthetic challenge. The presented work is part of an on-going goal to synthesize isotopically labeled ionic liquids that will ultimately be used to determine the distance between various atoms in an ionic liquid solution by NMR techniques. These distance measurements will allow for a visual representation of the supramolecular structure of the aggregates in solution.

Before using expensive isotopically enriched starting materials the specific goal of the research was to optimize the IL synthesis reaction with non-enriched starting materials. The synthesis of two imidazole based ILs was attempted: 1-ethyl-3-methylimidazolium thiocyanate and 1-butyl-3-methylimidazolium thiocyanate. The synthesis strategy was to react formaldehyde with alkyl amine to form an imine precursor that subsequently reacts with glyoxal and ammonium to form the imidazole ring. The imidazole ring was subsequently alkylated by iodoalkane and in the final step the iodide anion was ion exchanged with KSCN to obtain the final product.

Although the synthesis of both ILs was completed the purification of the final reaction mixture to obtain pure crystals of the desired product proved to be in both cases exceedingly difficult. We will discuss the reaction scheme to better understand the sources of the impurities as well as possible changes to the details of the reaction procedure to improve purification.

THE POTENTIAL OF LOW FREQUENCY ELECTRON PARAMAGNETIC RESONANCE FOR THE ANALYSIS OF CULTURAL HERITAGE ARTIFACTS.

M. Terwilliger[1,2], A. Cannella[1], W.J. Ryan[2], N. Zumbulyadis[3], J.P. Hornak[2]
[1]RIT Magnetic Resonance Laboratory, RIT, Rochester, NY, 14623
[2]School of Arts and Sciences, Susquehanna University, Selinsgrove, PA 17870
[3]Independent Researcher, Rochester, NY

Non-destructive authentication of ceramic and porcelain cultural artifacts is a challenging problem for the sciences. Electron paramagnetic resonance (EPR) spectroscopy is capable of distinguishing between clays based on the paramagnetic metals present, and firing temperature based on the complexes of these metals formed at different temperatures. Unfortunately, the 9 GHz frequency of conventional EPR restricts sample size to a few mm and limits its applicability to small fragments. Low frequency EPR (LFEPR), as the name implies, is an EPR operating at a lower frequency of a few hundred MHz. LFEPR can utilize larger samples on the order of several cm, but has a lower sensitivity due to the smaller Boltzmann ratio. Additionally, LFEPR may not be capable of detecting a spectral transition if the LFEPR operating frequency is less then the zero-field energy of the paramagnetic metal complex.

We utilized a LFEPR operating at 300 MHz which scans the applied magnetic field between the local Earth's magnetic field and 26 mT to determine the feasibility of detecting the ESR signal from clay samples, pigments, and glazes. Various terracotta clay samples were studied at firing temperatures between 100 and 1200 °C. Spectral differences were seen as a function of both clay type and firing temperature. The characteristic transitions at g = 4 and 2 for iron complexes were observed in many terracotta clays. The LFEPR spectra of pigments also showed differences, even for pigments with subtle structural differences such as Egyptian and Han blue. Glass displayed the characteristic g = 4 peak for iron. The LFEPR spectra of these substances were seen with sufficient clarity to justify the use of LFEPR for studies of ceramic artifacts.

GENETIC ANALYSIS OF ENZYME CLUSTERING IN YEAST AND ITS APPLICATION TO LESCH-NYHAN SYNDROME.

Ryan M. Thomas, Amanda S. Baker and Eric M. Cooper
Department of Biology, Hartwick College, Oneonta, NY 13820

Lesch-Nyhan syndrome is a very rare disease affecting about 1 in 380,000 children. The disease is characterized by symptoms including gout, severe neurological impairments and profound compulsions for self-mutilation. The underlying cause is a defect in a single enzyme, called HPRT, which prevents these individuals from utilizing exogenous purines (which are building blocks of DNA, RNA and other important molecules in cells). Since these individuals cannot efficiently derive purines from food, their cells must exclusively synthesize purines from scratch, via a complex biosynthetic pathway consisting of 10-12 different enzymes. A recent study indicates that the enzymes involved in purine biosynthesis cluster together into structures termed purinosomes under conditions of purine withdrawal (An and Benkovic, Science, 2008). Re-localization of enzymes into such structures suggests a novel mechanism for regulating the activity of multiple enzymes that operate in a pathway. It also suggests that the "signals" leading to purinosome formation are always activated in Lesch-Nyhan patients. We are attempting to model purinosome formation in yeast to use the available genetic tools to study this process, and we are also testing whether purinosomes constitutively form in HPRT-null human cells.

DESENSITIZATION OF MCH-MEDIATED ERK SIGNALING IN THE ABSENCE OF RECEPTOR INTERNALIZATION – A NEW ROLE FOR G PROTEIN-COUPLED RECEPTOR KINASES 5 AND 6.

Chris Tomeny, Andrew Goodspeed, Laurie B. Cook. The College at Brockport, State University of New York, Department of Biology, 217 Lennon Hall, 350 New Campus Drive, Brockport, NY 14420

The pathway involving melanin-concentrating hormone (MCH) that helps stimulate appetite remains partially undiscovered. Studies on the MCH signaling pathway can provide better insight into the causes of obesity and potentially identify ways to suppress hunger in obese individuals. We want to better understand the key molecular players; our current focus is on how phosphorylation affects MCH receptor signaling. Previous experiments demonstrated that β-arrestins facilitate agonist-mediated endocytosis of MCH receptor 1. Since receptor phosphorylation typically precedes arrestin-recruitment to G protein-coupled receptors (GPCRs), we hypothesized that overexpression of G protein-coupled receptor kinases (GRKs) might facilitate downregulation of MCH signaling in cells. This study focused specifically on GRK5 and GRK6. Separate dishes of BHK-570 cells were transfected with MCHR1 plasmid together with GRK5, GRK6, or empty pcDNA3 vector using LipoD293. Cells were treated with 1μM MCH for up to 10 min prior to lysing and Western blots were performed to show the effects of MCH on the ERK pathway. We also desensitized the pathway by activating it with 1μM MCH for 10 min, washing and incubating for a half hour, then activating again with MCH for 10 minutes. Since antibody towards both total ERK and phosphorylated ERK were used in the Western blot, we were able to normalize for differences in protein loading by performing densitometry with Adobe Photoshop. Our results showed that cells transfected with MCH receptor 1 and empty vector, there was no inhibition of the ERK pathway at all; maximal activation was evident at 10 min MCH treatment. However, transfection with either GRK5 or GRK6 caused a dramatic inhibition of MCH-mediated ERK signaling, similar to GRK2. Interestingly, in contrast to GRK2, GRK5 does not promote receptor internalization, suggesting that GRKs differentially regulate MCH receptor activity.

GENOTOXIC EFFECTS OF NICKEL(II) CHLORIDE ON THE GAPDH GENE IN ARABIDOPSIS THALIANA.

Zachary L. VanAernum, Angela M. Amoia
St. John Fisher College, 3690 East Avenue, Rochester, NY 14618

Using plants as bioindicators has become popular in recent years. With the increasing use of heavy metals in industry and the subsequent disposal in landfills, it has become important that the effects of such actions be studied. Nickel salts are already known to be carcinogenic to humans and lab animals; however their effects on plants are far less studied. Nickel(II) chloride was chosen because of its wide use in chemical synthesis, which has led to higher runoff concentrations in soil and water. This study focuses on the mutagenic effects of Nickel(II) chloride on the Glyceraldehyde 3-phosphate dehydrogenase (GAPDH) gene in Arabidopsis thaliana. Plants were grown in soil containing various concentrations of Nickel(II) chloride, as well as untreated soil as a control. The plants' DNA will then be extracted and the GAPDH gene

amplified, purified and sequenced. The treated and control sequences will then be analyzed and compared for any changes in base pair sequence.

ISOLATION OF *CANDIDA* SPECIES FROM TOOTHBRUSHES AND POSSIBLE DISINFECTION METHODS FOR BETTER ORAL HYGIENE.

Annie H. Vu, Maryann A.B. Herman, St. John Fisher College, 3690 East Avenue, Rochester, NY 14618

Humans use toothbrushes to clean their teeth everyday; however, the used toothbrushes that were left outside may become a good environment for the development of bacteria and fungi, causing several oral infections. This research project aims to investigate what species of *Candida* are present in the used toothbrushes and the toothbrushes that are left unused in the bathroom as compared to the new toothbrushes from the package. Thus, we will have a better knowledge about the type of fungal contamination in toothbrushes as well as the sources from which these species came from. Hopefully, this study will raise the awareness on toothbrush care in the population. Furthermore, several inexpensive disinfection methods will be tested as possible solutions for cleaning toothbrushes.

TESTS FOR *WOLBACHIA* AND SEX-LINKED GENES IN THE TERRESTRIAL ISOPOD *TRACHELIPUS RATHKEI*.

YaDong Wang, Christopher Chandler
Department of Biological Sciences, SUNY Oswego, Oswego, NY, 13126

Terrestrial isopods are one of the most abundant groups of crustaceans worldwide. However, very little is known about these creatures, especially their genetic makeup. Terrestrial isopods are a fascinating group of organisms because many species are known to be able to carry *Wolbachia*, a microscopic parasite that is able to alter male host development and cause them to develop as females, even if the host carries male sex chromosomes. Because of these interactions with *Wolbachia*, isopods' sex chromosomes are thought to be constant evolving. Therefore they make a good model system for studying how sex chromosomes change. Our project studies the effect of *Wolbachia* in *Trachelipus rathkei*, a species found abundantly throughout North America. Another goal for our project was to find sex-linked genetic markers in *T. rathkei* by designing PCR primers for candidate loci based on data from an earlier preliminary genomic survey. We found evidence of *Wolbachia* infection in all individual specimens screened, including males and females, suggesting that *Wolbachia* does not induce host feminization in *T. rathkei*. We were unable to confirm sex linkage in any of the candidate markers tested, but these results provide a useful foundation for further studies of sex chromosome evolution in isopods.

USING A549 LUNG CANCER CELLS TO TEST TARGETED MOLECULAR IMAGING AGENTS THAT BIND TO αvβ3 INTEGRINS ON CANCER CELLS.

Sarah Wang[1], Sean Aronow[1], Hans Schmitthenner[2], Irene M. Evans[1]
[1]Gosnell School of Life Sciences, [2] School of Chemistry and Materials Science, Rochester Institute of Technology, Rochester, NY 14623

Novel imaging agents that bind specifically to markers and detect cancer early have contributed to better cancer outcomes. Many of these better outcomes are due to the

development of new "targeted molecular imaging agents" (TMIAs) which target specific molecular markers on cancer cells and allow for earlier and better detection of cancers. The goal of our research is to contribute to Molecular Imaging Agent development at RIT by seeing how well the newly synthesized TMIAs bind to their target cells, whether they are brought into cells via an endocytosis pathway, and how long they persist in the cells. The targeting peptides are of the RGD family that target marker αvβ3 integrin receptors which can be overexpressed on cancer cells; the conjugation dyes are near infrared (NIR) cyanine dyes like Cy5.5. Confocal fluorescent microscopy (CFM) is being used to detect how the dye-conjugate binds and interacts with the cancer cells. The cancer cell line used is the A549 lung carcinoma which overexpresses the αvβ3 integrins. A549 cells were grown in cell culture chambers and imaged after adding Cy5.5-c(RGDyK). Novel dye conjugates like Alexa 680-c(RGDyK) and the large Stoke's shift (LSS) Dye "X-sight 640 were then tested. Results showed cell membrane staining along with punctate vesicular dye staining suggesting that there was endocytosis of all of the dye-conjugates. The studies with Alexa 680-c(RGDyK) dye did not show the brightness we obtained with the Cy5.5-c(RGDyK) due to detection limitations of the CFM. The large Stoke's shift dye-conjugate 640-LSS-c(RGDyK) targeted the integrin receptor clusters, but the signal was weaker. These peptide-dye conjugates are being tested to show their selectivity for cancer cells using CFM prior to use in *in-vivo* studies with the long term hope of developing probes for use in clinical imaging and diagnostics with external collaborators.

AN EXAMINATION OF SPECIES RICHNESS AND FOREST PATCH SIZE VIA MYRMECOCHOROUS FLORA.

Dispersal limited plants not limited by forest fragmentation
Robert Warren, Michael Olejniczak, SUNY at Buffalo State College, 1300 Elmwood Avenue Buffalo, NY 14222

The species-area relationship is one of ecology's few universal theories, and it suggests that species diversity increases with habitat size. That is, the larger the habitat, the greater the number of species found within it. Fragmented habitat presumably should not limit species with long-distance dispersal abilities, such as plants with seeds carried by wind or birds. However, many woodland herbs produce seeds dispersed by ants, and ants do not carry seeds across forest fragments. We expect that roads, streams and agricultural fields fragment ant-dispersed plant habitat and hence limit their diversity by patch size, whereas plants with dispersal mechanisms that transcend such barriers should exhibit lesser habitat size limitation. We surveyed deciduous woodlots in Erie County parks to identify and quantify ant-dispersed and non-ant-dispersed herbs. We placed random transects within each park and surveyed 1 m^2 plots along the transects until we stopped noting new plant species. Species identity and abundance were recorded. We surveyed five parks (areas, min = 0.04 km^2, max = 4.1 km^2). In contrast with our predictions, we found that the species diversity of non-ant dispersed understory herbs increased with habitat area, whereas ant-dispersed species richness did not change with habitat size. We conclude that ant-dispersed plant diversity is not limited by habitat fragmentation, and we suspect that a secondary disperser may be involved. Another possibility is that non-myrmecochores may out-compete ant-dispersed herbs in larger habitats.

CHIRAL TRIS(PYRAZOLYL)METHANE SCORPIONATE LIGANDS AND THEIR IRON(II) COMPLEXES.

Margo E. Weber[1], M. Scott Goodman[1], Alexander Y. Nazarenko[1], Fat Cheong Yau[1], Margaret A. Goodman[2]
[1]*Department of Chemistry, SUNY Buffalo State, Buffalo, NY 14222*
[2]*Math and Natural Sciences Department, D'Youville College, Buffalo, NY 14201*

Tris(pyrazolyl)methanes (tpms) are a versatile class of tripodal ligand that consist of a central carbon atom bonded to one nitrogen atom on each of three pyrazole moieties. By including chiral pyrazoles derived from menthone or camphor into the synthetic procedures for tpms, chiral ligands were produced. In each case, one or three chiral pyrazoles were incorporated into the ligand to produce a variety of enantiomerically pure ligands. The tpm ligands thus formed were isolated by chromatography or crystallization and were characterized through ^{1}H NMR spectroscopy and, in several instances, X-ray crystallography. In some cases the new ligands formed 2:1 complexes with Fe(II). The iron complexes were characterized by X-ray crystallography and NMR. Both techniques confirmed that the complexes could have either a high-spin (HS) or a low-spin (LS) electronic configuration depending on the steric bulk of the chiral tpm ligand and the orientation of the chiral appendages within the complex.

ATTENTION BY BELUGA WHALES TO HUMAN MIMICRY MOVEMENTS.

Jerrianne Whittmore, Michael Noonan
Canisius College, 2001 Main St, Buffalo, New York

Mimicry has been shown to promote social cohesion in primates (incl humans), and evidence suggests that this can occur across species in some instances. This study assessed the degree to which beluga whales were preferentially drawn to a human actor mimicking their movements. The subjects were eight captive belugas (Delphinapterus leucas), housed at Marineland of Canada. Over successive five minute epochs, conducted on separate days, a human was positioned 1.5 meters in front of an underwater viewing window. In the experimental condition, the actor mirror-matched her own movements as closely as possible to those of the subject whale. In control conditions, she either re-performed those same movements on a subsequent day, or performed equal but opposite movements to that of the subject. Measures of each whale's time spent looking at the actor revealed a clear preference for a human engaged in mirror-mimicry, compared to re-play or anti-mirror mimicry conditions. These results indicate that belugas can perceptually map their own body image onto that of a human. They also suggest a likely pro-social role for mimicry in this species.

EVIDENCE OF SEGREGATION BY SEX IN JUVENILE BELUGA WHALES (DELPHINAPTERUS LEUCAS).

Kristen Whyle, Michael Noonan
Canisius College, 2001 Main Street, Buffalo, New York 14208

In the wild, beluga whales seasonally segregate into groups that are either male-only or females with calves. To date, however, little is known about the developmental course over which this tendency to segregate by sex occurs. To shed light on this topic, the present study investigated the degree to which male and female beluga calves associated with an adult male with which

they were housed. The subjects were three male and two female beluga calves (Delphinapterus leucas), 1-2 years of age. For each calf, the identity of any adult within one meter was recorded every 2 mins, for 30 mins, twice weekly. For both the 1 and 2 year old whales, the frequency with which the male calves were in close proximity of the adult male was greater than that of the female calves. This finding suggests that the tendency toward segregation by sex develops early in this species, and is already evident at an age during which the calves are still nursing off their mothers.

PROJECT SWEETER SAP: DO SOIL NUTRIENTS MAKE MAPLE SAP SWEETER?

Adam Wild
320 Bray Hall, SUNY Environmental Science and Forestry, One Forestry Drive, Syracuse NY, 13210

Sugar maple decline has been reported across northeastern U.S. forest the past half century and thus affecting sap from sugar maples used in the production of maple syrup. Maple sap is an economically important forest product influenced by numerous ecosystem factors. Lack of sufficient soil nutrients, which may be impacted by environmental events, is a possible cause for sugar maple decline. Through sap, soil and foliage analysis this study attempts to determine what nutrients control sugar concentration in the sap of sugar maples.

Sap was sampled from over 300 trees in the White Mountains of New Hampshire within plots treated with either nitrogen, phosphorus, nitrogen and phosphorus, calcium or left untreated as a control. Soil nutrients, photosynthetic rates and growth rate data were compared with the sugar concentration samples.

Trees with higher available soil nitrogen had higher sugar concentration. Trees with higher photosynthesis rates produced higher sugar concentrated sap. Larger increases in basal area growth from the last four years correlated with higher sugar concentrations. Producing higher sugar concentration is important as the percentage of sugar in sap directly affects the amount of time, energy and labor required to produce a gallon of sap.

WHITE-TAILED DEER IMPACTS ON REPTILES AND AMPHIBIANS AT RICE CREEK.

Calee Wilson and Zack Hall
Calee Wilson: 120 Overlook Drive Baldwinsville Ny, 13027
Zack Hall: 239 Petersburg Junction Road Hoosick Falls NY 12090

In recent decades over-browsing from the growing population size of White-tailed Deer (Odocoileus virginianus) has been seen as an increasing problem for vegetation and wildlife in New England as well as in states, such as New York. White-tailed Deer have been a disturbance when it comes to newly growing saplings in forests, the spreading of invasive plants, and affects that deer have on wildlife, but lately it has been seen as a severe threat to the ecosystem. In this experiment, we are focusing on how the over-grazing of White-tailed impacting the local amphibian and reptile species at the Rice Creek Field Station in Oswego, New York. Researchers such as Katherine R. Greenwald have gathered data that supports over grazing from the White-tailed Deer actually attracting populations of invertebrates, amphibians, and reptiles (Indirect Effects of a Keystone Herbivore Elevate Local Animal Diversity), which we believe is the case as well. With our research we will have three locations which have an experimental plot

(fenced) along with a control plot (unfenced); both of which are 40m x 40m and each having 100 stakes that are two meters apart from one another. The plots were each sampled monthly so that each stake was accounted for. Our methodology was to use a one meter-squared quadrat and record the natural cover found in that area and then searched for amphibians and reptiles. The results of this experiment will also give an estimated overall health of the ecosystem, since amphibians are very sensitive to the environment that they live in. With this year being the first year that this was studied at Rice Creek, we found that the deer are not having an impact on the local species of amphibians and reptiles.

DETECTING CHANGE OVER TIME IN TREE TISSUE CHEMISTRY.

Yang Yang
406A Bray Hall, 1 Forestry Drive, SUNY Environmental Science and Forestry, Syracuse NY, 13210

Acid rain has stripped away vital plant nutrients such as calcium in soils, causing a potential threat to forest productivity. Nutrient concentrations in tree tissues affect forest productivity and can be used to assess nutrient deficiencies. To detect the change of tree nutrients over time requires repeated measurement and information about interannual variation. Archived data of tissue chemistry from three years in the 1980s, combined with two years' re-sampling in the 2010s in Huntington Wildlife Forest (Newcomb, NY), will allow us to distinguish interannual variability from long-term trends and thus detect changes in tissue chemistry over time with known statistical confidence.

We examined nutrient concentrations in tree tissues of four dominant species, American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*) and yellow birch (*Betula alleghaniensis*). Concentrations of total N, P, K, Ca and Mg were determined for bark, wood, foliage and branches of 5-6 trees for each species.

Coefficients of variation (CVs) were calculated across years for nutrients by tissue types and species: the mean CV was 21% for N and P, 23% for K, 22% for Ca and 17% for Mg, averaging across all tissue types and species. For individual species, inter-tissue type variation was significantly greater than interannual variation ($P < 0.05$). Nutrients had the smallest variations across years in foliage than in other tissue types. Thus, to detect long-term trends of tree nutrients in forests of this type, nutrient analysis should be tissue type-specific as well as species-specific but may not need to be repeated annually.

STUDIES TOWARDS THE TOTAL SYNTHESIS OF TROCHELIOPHOROLIDE A.

Author Names: ***Christine Yeo****, Anthony Carestia, Jennifer Swartzenberg, Stephanie Dorn, Jessica Smith, Moni Augusto, William Spencer, and Dr. Christina Collison**
Rochester Institute of Technology, 1 Lomb Memorial Dr, Rochester, NY 14623

Trocheliophorolide A is a natural product isolated from soft coral. It is an interesting synthetic target because it has biological activity against *Staphylococcus aureus* and *Baciliius subtillis*. We envision the synthesis of trocheliophorolide A as a convergent synthesis. A novel one-pot hydroboration-cyclization step is currently being investigated as a means for the final coupling step in the synthesis. Progress toward the completion of each coupling unit will also be discussed.

NOVEL POROUS QCM GAS SENSOR COATINGS; A HIGH SENSITIVITY WATER SENSOR BASED ON PMMA-POLY(D,L-LACTIDE).

Ho Yeon Yoo, Stanley Bruckenstein
Stanley Bruckenstein Chemical Consulting and Services, LLC.
115 Foxpoint W, Buffalo, NY, 14221-2451, USA

A novel and generally applicable approach for creating porous in films on the surface of solid substrates are advantageous, when a quartz crystal microbalance (QCM) is the basis of a sensor. We show that films with large void volumes produce more sensitive sensors than with the original non porous film. Poly(methyl methacrylate) (PMMA) was demonstrate our technique for the model system of water vapor analysis in flowing nitrogen gas. A film of pure PMMA on a QCM is a sensor for water vapor in a gas phase. However, a more sensitive sensor was created by dip coating a QCM into solutions containing mixtures of PMMA and PDLL(Poly(D,L-Lactide)), and then evaporating the solutions to form mixed polymer films of varying PDLL content. The PDLL was then removed by exposure to a NaOH solution to form pure PMMA films having various void volumes. A leached PMMA film that originally contained 50% by weight PDLL had a 3.7 times larger QCM sensitivity's for water vapor than a pure PMMA film.

THE INFLUENCE OF SALT AND CHEMICAL DEICERS ON WATER QUALITY: A PILOT STUDY OF SUNY OSWEGO CAMPUS RUNOFF (FEBRUARY 2013).

Julia Yurco, Kirsten Mahalick, Sarah Torpie, C. Eric Hellquist
Department of Biological Sciences, 328 Shineman Center, SUNY Oswego, Oswego, NY 13126

Lake Ontario is considered the most ecologically stressed of the five Great Lakes due to environmental impacts that take place within the lake and its watershed. Chemical stressors of Lake Ontario include nitrogen, phosphorus, and toxic chemicals within runoff. As human population and urbanization has increased in the Great Lakes watershed, the use of chemical deicers for safe winter travel also has increased. At SUNY Oswego, salt and chemical deicers are used on campus roads and footpaths during winter months. Runoff containing these solutes then enters Lake Ontario through a series of campus storm drains. In February 2013, we measured salinity, conductivity, pH, and sediment content of campus snow bank, road slush, snow, Lake Ontario water, and tap water samples to assess basic chemical attributes of runoff. We found differences between runoff sources for all variables. The mean salinity of road slush was about 3.5x (8.1 ppt) higher than the next highest runoff source (snow bank; mean 2.4 ppt). Conductivity was about 5x higher (ca. 25,000 μS/cm) in road slush than snow bank samples. Conductivity was about 9x higher than Lake Ontario water collected along the shore (mean ca. 2700 mS/cm). Water from road slush, snow bank and snow samples was slightly more acidic (pH 6.5-6.8) than Lake Ontario and tap water (pH 7.0-7.4). These preliminary data indicate that road salt and deicers applied on the SUNY Oswego campus are influencing eventual runoff entering Lake Ontario.

HORIZONTAL GENE TRANSFER IN BARTONELLA.

Qiyun Zhu[1], Michael Kosoy[2], Kevin Olival[3], Katharina Dittmar[1, 4]
[1]Department of Biological Sciences, University at Buffalo, State University of New York, 109 Cooke Hall, Buffalo, NY 14260, USA
[2]Division of Vector-Borne Infectious Diseases, Centers for Disease Control and Prevention, 3150 Rampart Road, Foothills Research Campus, Fort Collins, Colorado 80521, USA
[3]EcoHealth Alliance, New York, NY 10001, USA
[4]Graduate Program of Evolution, Ecology, and Behavior, University at Buffalo, State University of New York, 411 Cooke Hall, Buffalo, NY 14260, USA

Extant *Bartonella* species are facultatively intracellular pathogenic bacteria, which infect mammalian erythrocytes and endothelial cells. They are typically transmitted by blood-sucking arthropods. Insights into the ancestral host association and symbiosis mode of bartonellae are revealed by computational and experimental studies of the evolutionary history of *gpsA*, an essential gene in the phospholipid biosynthesis pathway. Phylogenetic affiliations of *gpsA* suggest horizontal transfers from invertebrate symbionts, and mammalian pathogens, early in the evolution of specific lineages. Because of the irreplaceable role of *gpsA* in phospholipid metabolism, an ancestral loss suggests that early bartonellae were likely adapted to an obligate intracellular lifestyle, in order to keep accession to host cell's metabolic intermediates to enable cell membrane synthesis. The horizontal re-acquision events allow *Bartonella* to switch to facultative intracellularity in later evolutionary history.

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