

5th Annual Undergraduate Research Symposium

Eastern NY American Chemical Society

April 17, 2013

Siena College, Loudonville, NY



Targeting norepinephrine transport and glutathione sensitivity in neuroblastoma and pheochromocytomaJoseph Ayad, Angelina M. Nitto, Twilly Lee, Arif Hussain and Susan M. Ludeman

Albany College of Pharmacy and Health Sciences

Abstract:

Neuroblastoma (NB), a cancer derived from the sympathetic nervous system, is the most common extracranial, solid tumor found in children. Those who present with Stage 3/4 tumors have a 5-year survival rate of ~30%. The histogenetically related pheochromocytoma (PHEO) is an adult-onset tumor with no known curative treatments. Both NB and PHEO highly express the norepinephrine transporter (NET) and this is used to clinical advantage with the diagnostic imaging agent *meta*-iodobenzylguanidine (MIBG). Since MIBG uptake by both NB and PHEO are NET-dependent, it is hypothesized that this compound could act as a tumor-selective carrier of some cytotoxic group. In the drug design described in this presentation, an effective cytotoxic moiety is one which takes advantage of the fact that both NB and PHEO demonstrate acute sensitivity to glutathione depletion. Thus, the goal of this on-going work is to synthesize a glutathione-reactive MIBG analog which targets NB and PHEO through selective NET-uptake. The multi-step synthesis of said analog will be described. Purification challenges and spectral analyses will be reported.

New anticancer agents for the treatment of neuroblastoma and pheochromocytomaTiffany Cavin, Alicia Crook, Collin Owczarzak, Maryam Shahani and Susan Ludeman

Albany College of Pharmacy and Health Sciences

Abstract:

Neuroblastoma (NB), the most commonly found extra-cranial solid tumor in children, and pheochromocytoma (PHEO) have highly expressed norepinephrine transporters (NET) and a sensitivity to glutathione depleting agents. *Meta*-iodobenzylguanidine (MIBG), a norepinephrine analog, is used as a clinical imaging agent for NB and PHEO cancers. Transport of MIBG into cells is effected by the norepinephrine transporter (NET) which is highly expressed in primary as well as metastatic NB and PHEO. Another common characteristic of NB and PHEO is an acute sensitivity to glutathione and glutathione-depleting agents. It is hypothesized that these common characteristics can be exploited through glutathione-reactive, MIBG analogs which target NB and PHEO through selective uptake via NET. The multi-step synthesis of two such analogs will be presented. Purification challenges and spectral analyses will be described.

The sweet side of chemistry: A study of the nano topology of sugars and chocolateSally Chamberland and Joanne Kehlbeck

Union College

Abstract :

Every year 150,000,000 metric tons of sugar is produced and used for all different types of candy and as flavoring for package and processed foods. In addition, chocolate sales were worth \$19.5 billion in 2011. These substances are extremely sensitive to environmental factors that can affect their physical and chemical characteristics. These morphology changes can be undesirable, the results of improper storage or handling. This study focuses on the morphology changes that accompany sucrose hydrolysis, which occurs when sugar is heated, as well as the surface differences between glucose, fructose, and sucrose. Atomic force microscopy (AFM) allows visualization of these samples at the micro- to nano- meter scale, allowing greater insight into the topology of the sample. At this scale samples do not look the same as when we look at them with our eyes. AFM was used to visualize a number of confection materials, including sucrose, glucose, and fructose. This study aims to look at the nanostructure of sugar and chocolate. I will present the results of my efforts to characterize the surface topology of these confections. The unique experimental challenges of chocolate microscopy will also be discussed.

The synthesis of deuterated cyclophosphamide and its kinetic isotope effects on oxidative metabolism

Rrita Daci, Lindsey Wallace, Michael A. D'Alessandro and Susan M. Ludeman

Albany College of Pharmacy and Health Sciences

Abstract:

The most extensively used anticancer agent, cyclophosphamide (CP), is a prodrug activated at the C-4 endocyclic position through a P450 hydroxylation. Neurotoxic oxidations at exocyclic α -carbons compete with C-4 oxidation. Our hypothesis is that replacement of hydrogens with deuterium isotopes will disfavor exocyclic oxidation. The purpose of this research is to synthesize CP perdeuterated at the α -positions and then to quantify kinetic isotope effects on C-4 versus exocyclic α -carbon oxidation. Synthesis of α -deuterated CP begins with the reaction between methyl [2,2-²H₂]-glycinate (H₂NCD₂CO₂CH₃) and ethyl [2,2-²H₂]-2-bromoacetate (BrCD₂CO₂CH₂CH₃). Then, ester reduction and a thionyl chloride chlorination give alpha deuterated *bis*-(2-chloroethyl)amine hydrochloride [H₂N(CD₂CH₂Cl)₂ HCl]. The subsequent step synthesizes deuterated *N,N*-bis(2-chloroethyl)phosphoramidic dichloride [Cl₂P(O)N(CD₂CH₂Cl)₂] with the addition of phosphorus oxychloride and pyridine. Through a ring formation using 3-aminopropanol and triethylamine, α -deuterated cyclophosphamide is synthesized. The optimization of the synthesis with unlabeled and then labeled materials and the application of labeled CP in enzyme studies will be reported. Preliminary data shows that relative to unlabeled CP, α -deuterium labeled CP decreases undesirable, exocyclic oxidations. The degree to which this affect is achieved is dependent on the specific P450-isozyme being studied.

Determination of an efficient and selective oxidation for the synthesis of (E)-5,7-octadienal, a key tandem intramolecular diels-alder reaction precursor

Denise Garofalo, Cindy Liu and Raymond J. Giguere

Chemistry Department, Skidmore College, Saratoga Springs, N.Y.

Abstract:

The aim of this project is to investigate the stereochemistry and regioselectivity of the novel, complex ring systems resulting from tandem intramolecular Diels-Alder (TIMDA) reactions. The pathway to TIMDA products involves seven steps, the third of which will be discussed in detail. Previously in the synthetic route, the oxidation of the (E)-5,7-octadienol to (E)-5,7-octadienal was accomplished utilizing pyridinium chlorochromate (PCC) supported on basic alumina. Recently, the manufacture of this reagent was halted, necessitating the identification and optimization of an alternative oxidation method. This poster will focus on the endeavor to find and fine-tune the use of a new, mild oxidant for the synthesis of the target aldehyde, while avoiding over-oxidation to the corresponding carboxylic acid, and maximizing yield.

Surface deposition resulting from collisions between diglycine and chemically modified alkylthiolate self-assembled monolayer surfaces

Andrew Geragotelis and George L. Barnes

Siena College Department of Chemistry and Biochemistry

Abstract:

We report results from QM/MM direct dynamics simulations of hyper-thermal collisions between N-protonated diglycine (gly₂-H⁺) and a chemically modified (-COCl head group placed on the center chain) octanethiolate self-assembled monolayer (SAM) surfaces. Both fragmentation and reactivity are observed with the probability of each increasing with collision energy. Fragmentation occurs with a probability of 0.98 (out of 1) for a collision energy of 100 eV. Surface deposition, a subgroup of reactivity, is examined and compared to the experimental work of Laskin and co-workers (*Phys. Chem. Chem. Phys.* **2008**, *10*, 1079-90). We find that intact surface deposition is a rare event, peaking in probability at a collision energy of approximately 30-40 eV, which is in excellent agreement with experiment.

The structure and function of the heme proteins myoglobin and hemoglobin

Jacob Good, Vincenz Buhler, Jessica Ziegler, Katherine Manz, Bernard Kang, Christopher Coates, Sergey Milikisyants and K. V. Lakshmi

Department of Chemistry and Chemical Biology, Rensselaer Polytechnic Institute, Troy, NY 12180

Abstract:

Quite literally the lifeblood of the circulatory system, the oxygen binding proteins hemoglobin and myoglobin are the basis of transporting oxygen to muscle tissue throughout the body and subsequently removing toxins and waste products. These proteins are contained within the cytosol of red blood cells and both contain a heme prosthetic group as the primary binding site. We are using UV/Vis spectroscopy to investigate the binding of the small molecule effectors, dioxygen, carbon monoxide, cyanide, and nitric oxide, to hemoglobin and myoglobin. The use of UV/Vis spectroscopy enables us to determine the binding affinity of the small molecule effectors to hemoglobin and myoglobin and displays the effect that the oxidation-reduction reactions have on heme groups, as well as the energetic changes that are associated with oxidation and reduction of the heme group. The data obtained from this study allow for the quantification of the binding properties in terms of bond strength and the necessary potential for oxidation. The immediate use for this data is for the publication of a biochemistry teaching lab curriculum in the Journal of Chemical Education.

L-Factor Synthesis: Preparation for sex pheromone synthesis of the *Nasonia vitripennis* Walker jewel wasp

Dr. Thomas Gray and Lisa Eytel

Russell Sage College

Abstract:

As preparation for the synthesis of a male sex pheromone found in the jewel wasp *Nasonia vitripennis* Walker, we have begun a synthesis of L-factor (**[(4S,5S)-(+)-5-Hydroxy-4-decanolide]**) derived from D-tartaric acid. The final product of this synthesis would allow biologists to study the female wasp's reactions to the male sex pheromone, potentially mating and reproducing the parasitic wasps. *Nasonia vitripennis* Walker wasps are parasitic to other insects, controlling insect populations, a key to maintaining a healthy ecological system. The synthesis has been successfully conducted in previous studies. However, the prior synthetic methods utilized ozonolysis in a process that cleaved off part of the molecule. Thus, we are investigating an alternative method of synthesis with a higher degree of atom efficiency. Once the L-factor has been successfully synthesized, we plan to synthesize analogues of the molecule, altering the length and shape of the hydrocarbon side chain to determine to what degree the steric bulk and/or length of the hydrocarbon chains will affect the wasp's recognition of the pheromone.

Highly discriminatory electropolymerized porphyrin sensors

Matthew J. Gunsch, Kathleen A. Leamy, Amanda C. Paske and Jodi L. O'Donnell

Siena College Department of Chemistry and Biochemistry

Abstract :

Polymeric sensor films were formed on indium tin oxide (ITO) electrodes by electropolymerization of p-aminophenyl-substituted porphyrins. Several transition metals have been inserted into the porphyrin films to modulate the sensory response based upon the affinity of particular transition metals to organic analytes. Visible spectroscopy was employed to monitor the interaction between the films and selected volatile organic compounds (VOCs). The sensors can distinguish between several different alcohol and chlorocarbon vapors based on a change in visible absorbance upon the introduction of the VOCs. Notably, films containing copper and zinc porphyrins can discriminate two different isomers of trichloroethane with a high level of statistical significance. We have also begun to explore the development of second-generation sensors, co-polymerizing other responsive species with the porphyrin to employ as dual function sensors.

Computational modeling of the chemical evolution of low mass star forming regions

Taylor Harrison and George Hassel

Siena College Departments of Biology and Physics & Astronomy

Abstract:

Astrochemistry is a multidisciplinary effort that combines observations, laboratory measurements of spectroscopy and chemical kinetics with computational modeling to investigate the synthesis and evolution of chemical species in astrophysical environments. This project utilizes a computational code and statistical analysis to simulate chemistry in the region surrounding L1527, a particular low-mass protostar that may have conditions similar to those associated with the formation of the Sun. Previously, observations of L1527 indicated a unique chemical composition enriched in unsaturated hydrocarbon chain molecules, radicals and anions, termed "Warm Carbon Chain Chemistry" or "WCCC". More recent observations using interferometry featured better resolution and indicated depletions in four characteristic hydrocarbon species toward the center of the region, nearest the protostar. We have constructed a library of models to investigate parameter variation, particularly to determine the effects of increasing density, temperature and radiation field that might be found in the vicinity of the central protostar.

Study of Low Molecular Weight Impurities in Pluronic Triblock Copolymers using MALDI, Interaction Chromatography and NMR

Zach Helming and Chang Y. Ryu

Rensselaer Polytechnic Institute

Abstract :

Poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide) triblock copolymers (PEO-PPO-PEO) are commercially available macromolecular amphiphilic surfactants that have been extensively studied for their applications in polymer-based nanotechnology and drug-delivery. It has been well-established that the synthesis of commercial Pluronics results in low molecular weight "impurities" which are generally disregarded in the applications of these polymers. These have been shown to have significant effects on the rheological properties of the material, as well as altering the macromolecular "micellular" structures for which the polymers are most often used. The degree to which the impurities participate in/interfere with the formation of micelles has been a subject of contention in the scientific community. The impurities have been separated and isolated from the bulk Pluronic triblock through Interaction Chromatography (IC) techniques, and subjected to proton NMR and MALDI Mass Spectrometry to observe relative block composition and molecular weight information. We report evidence to at least two polymeric components of the impurities: a low-molecular-weight homopolymer of poly(ethylene oxide) and a low-molecular-weight component of both poly(ethylene oxide) and poly(propylene oxide). This has significant implications for the usage of Pluronic triblock copolymers as well as the general scientific acknowledgement of the impurities and their effect on Pluronic micelle and hydrogel formation.

Synthesis and supramolecular aggregation of a C₃ symmetric terphenylene ethynylene macrocycle: Toward carbon nanotubes via molecular origamiDr. Thomas S. Hughes, Kerri Cody and Brian David

Siena College Department of Chemistry and Biochemistry

Abstract:

Shape-persistent phenylene ethynylene macrocycles contain alkyne moieties which could allow conversion of the nominally planar ethynylene macrocycle into compounds with a dimensionality along the axis of the macrocycle; the result is a structural precursor of a single-wall carbon nanotube segments. Using Sonogashira cross-coupling, the macrocycles, consisting of three monomers, will be linked. The linkage for this cross-coupling is between the alkyne and aryl iodide ends of the monomers. The ethynylterphenyl monomers have been synthesized through a series of Suzuki couplings, which resulted in the attachment of a phenylene molecule to another, for a total of three phenylenes per monomer. In addition, functional group transformations have also been used, specifically triazene and iodide groups, as well as an alkylation of the aldehyde group. A bromination reaction was also used in the synthesis of the ethynylterphenyl monomer.

Synthesis and characterization of thermochromic metal compounds with room temperature $^5T_{2g} \rightarrow ^1A_{1g}$ crossoversAlexandria Konkol and Jesse W. Karr

Siena College Department of Chemistry and Biochemistry

Abstract :

It is widely known that the valence electrons in a compound are responsible for its observed color. For transition metal complexes, the distribution of these valence electrons is influenced by the identity of the metal and the ligand field strength. Thermochromic metal compounds will change color with temperature because of a change in the distribution of their valence electrons. Here we present the synthesis of tris[2-(2-pyridyl)benzimidazole]iron(II), $[\text{Fe}(\text{pybzim})_3]^{2+}$, a complex which exhibit thermochromic properties as it changes from $^5T_{2g}$ to $^1A_{1g}$. Since the counter ion to these complexes has been suggested to influence the temperature at which this spin crossover occurs, we investigated this phenomenon by making three different salts of the same $[\text{Fe}(\text{pybzim})_3]^{2+}$ complex. Using absorption spectroscopy we also examined the thermodynamic parameters of this spin crossover for the different $[\text{Fe}(\text{pybzim})_3]^{2+}$ salts.

Synthesis of discotic liquid crystalline porphyrin precursorsJoshua C. Kranick, Grace E. Schneller, Jodi L. O'Donnell and Lucas J. Tucker

Siena College Department of Chemistry and Biochemistry

Abstract :

A synthetic methodology for the preparation of a library of discotic liquid crystalline porphyrins is presented. The general synthetic scheme of these moieties is metallation of the porphyrin center, followed by the coupling of an odd-parity spacer to the periphery of the porphyrin, which is then coupled to the chiral, cholesteric ligand. Modification of the metal center identity and odd-parity spacer length should yield significant variability in the novel macromolecule library being prepared. The pairing of a porphyrins ability to sense volatile organics with a liquid crystals large response to external stimuli should yield useful platforms for volatile organic sensing that exhibit tangible color shifts upon stimulation.

Investigating molecular imprinting polymer matrixes for glucose biosensing

Rajan Kumar, Dr. Susan Sharfstein and Dr. Magnus Bergkvist

College of Nanoscale Science and Engineering, University of Albany

Abstract:

Molecular imprint polymers (MIP) are part of a new field of Nanobioscience focused on developing selective recognition elements for sensitive analytical sensors, including biosensors. MIP technology is based on entrapment of specific analytes in a polymer matrix, often made from hydrophobic or charged/polar monomers mixed with a high percentage of cross-linkers. During polymerization, the matrix surrounds and interacts with the analyte, which upon removal leave a specific "molecular imprint". When analyte is introduced into a solution together with the designed MIP, the artificial binding pockets have been demonstrated to impart high selectivity for binding the imprinted analyte. However, for MIPs to be highly selective, a unique MIP matrix blend is typically needed for each analyte where research is needed to find the right combination of monomer(s)/crosslinker for appropriate function. Combining MIP matrixes with a sensitive transducer system hold promise for sensitive and specific sensors. The implications of such technology are especially important in healthcare, environmental monitoring, and industrial process control. We are interested in developing MIP-based sensors intended for in-situ measurements of metabolites in large scale fermentation. Similar analytes are of interest in clinical diagnostics. In order to develop a sensitive MIP-biosensor a viable transducer platform needs to be identified. The quartz crystal microbalance (QCM) can precisely measure any change in mass at the nanogram level on the vibrating surface of a quartz crystal resulting from mass deposits. This tool allows researchers to measure significant mass changes especially for recognition of specific elements in certain MIP. In this work we investigate the potential of glucose sensing using MIP-matrixes integrated with QCM instrumentation.

Isolation of antibacterial molecules in garlic and sage against *Staphylococcus aureus*

Kathleen Leamy, Cody Unczur, Daniel Moriarty and George Bazinet

Siena College Departments of Chemistry and Biochemistry and Biology

Abstract :

The use of natural plant extracts as broad-range medicines has been prevalent in many cultures for thousands of years, but the mechanisms behind their activity are widely debated. The antibacterial activity of plants like garlic, sage and ginger against both gram-positive and gram- has been identified but not thoroughly studied to identify a mechanism. We have visualized and identified possible interactions between plant extracts and the cell wall proteins of *Staphylococcus aureus*. This was done using 1D and 2D SDS-PAGE along with High-performance liquid chromatography. From this research, we hope to be able to isolate and characterize molecules in garlic and sage responsible for the inhibition of *S. Aureus* growth.

Application of a novel photocatalyst for environmental detoxification

Hsin Li

Russell Sage

Abstract:

One of the biggest environmental issues deals with life's most essential component, water. Driving this force, industrialization and urbanization have come into the forefront of water pollution. These have exposed the natural water sources to many toxic chemicals. Within the textile industries, industrial dyes are often released into the environment causing detrimental effects to the natural habitat. Development of natural and safe methods should be employed in order to degrade these synthetic dyes without subjugating the environment to more toxicity. At Russell Sage College, we focused on targeting a model synthetic dye in order to utilize our nanocatalyst, platinum titanium dioxide. Our photocatalyst was used to generate Reactive Oxygen Species (ROS) in order to initiate the photodegradation process of our model synthetic dye, Rhodamine B. The generated ROS reacts with Rhodamine B to degrade the synthetic dye via natural sunlight.

Intramolecular Diels-Alder Studies of (E)-5,7-Octadienal Dimer to Probe the Stereochemistry of TIMDA Reactions

Cindy Liu, Denise Garofalo and Raymond J. Giguere

Chemistry Department, Skidmore College, Saratoga Springs, NY.

Abstract:

Tandem Intramolecular Diels-Alder (TIMDA) reactions are important examples of cycloadditions that allow formation of four rings in a single reaction. Our research focuses on a seven-step synthesis resulting in precursors that ultimately lead to a TIMDA reaction. We begin with the starting materials 3,4-dihydropyran and allyltrimethylsilane and after four steps, (E)5,7-octadienal is generated. The next step involves an aldol condensation of (E)5,7-octadienal, creating a critical C-16 intermediate. Currently, we are conducting IMDA reactions on the Aldol dimer with Lewis acid EtAlCl₂ in order to gain insight into the stereochemistry of the tandem process.

Characterization of the metal induced interaction of Syntaxin-1A and Synaptotagmin-1.

Kelsey E. Lubin, Ryan P. Clarke and Jesse W. Karr

Siena College Department of Chemistry and Biochemistry

Abstract :

Synaptotagmin-1 (syt1) is a calcium sensing metalloprotein that plays a role in neurotransmitter release and membrane trafficking. Syt1 forms a Ca(II) dependent complex with syntaxin-1A (stx1A) as part of the process of membrane fusion. It has been previously shown that syt1 has a greater affinity for Pb(II) when compared to that of the native Ca(II) ion. Also, it has been reported that binding of Pb(II) by syt1 will abolish the interaction between syt1 and stx1A. We aim to better characterize the Ca(II) induced interaction between syt1 and stx1A, and elucidate the way in which Pb(II) prevents these two proteins from interacting. Here, we report on the conditions needed to express and purify both syt1 and stx1A. Further, initial findings regarding the metal induced interaction of syt1 and stx1A are considered.

The structure and function of supramolecular self-assembling binary guanosine gels

Katherine Manz, Christopher Coates and K.V. Lakshmi

Rensselaer Polytechnic Institute

Abstract :

Recently, the application of guanosine-based binary gels (g-gels) has revolutionized the field of chromatography as it introduces the use of reversible biological "liquid crystalline" gel phases for the manipulation and separation of macromolecules. For example, binary g-gels are used as novel mobile phases for the separation of nucleic acids and the purification and dispersion of single-walled carbon nanotubes (SWNTs). However, the unique thermo-associative properties that make g-gels ideal for these applications remain unclear. My research over the past couple of semesters in the Lakshmi and McGown laboratories in the Chemistry and Chemical Biology department at Rensselaer focused on the use of nuclear magnetic resonance (NMR) spectroscopy to study the structure and self-assembly of liquid crystalline binary g-gels. Throughout the course of these studies, we explored the application of one- and two-dimensional deuterium, proton and carbon-13 NMR spectroscopy to elucidate the intermolecular interactions of g-gels that give rise to their unique thermo-sensitive and thermo-associative behavior.

Characterization of Pb²⁺-bound Synaptotagmin-1

Timothy J. Masiello, Timothy J. Bright and Jesse W. Karr

Siena College Department of Chemistry and Biochemistry

Abstract :

Lead poisoning is still one of the most common toxicological issues plaguing people today. Current treatment for lead poisoning usually involves non-specific metal chelation. If a more efficient treatment is to be developed, a better understanding into the mechanism of how this metal causes toxicity is needed. Synaptotagmin-1 (syt1), a calcium-binding protein involved in neural transmission, has been shown to have a higher binding affinity for lead making it a possible target for lead poisoning. One of the possible toxic roles of lead is to negatively affect the metal ion-induced change in syt1 quaternary structure. Here we report on the changes in quaternary of syt1 in the presence of calcium or lead via spectroscopic methods. Previous studies have found that a lower concentration of lead will induce similar or equivalent movement of syt1's domains when compared to that of the native calcium. Additional pursuits have been made in order to elucidate the possible conformational changes induced by metal binding at the molecular level.

Turmeric root: A natural antioxidant

Monique Merchant

Russell Sage

Abstract :

Recent studies at Russell Sage College have documented the harmful effects of ultraviolet radiation from sunlight on DNA and RNA analogs. This degradation has been associated with both carcinogenesis and other chronic degenerative diseases and can be prevented with the use of antioxidants. Oxidative stress of riboflavin, or vitamin B₂, produces reactive O₂ species (ROS) which cause significant degradation of nucleosides and nitrogenous bases. Turmeric root, a plant native to South Asia and characteristic to curry dishes, is an extremely effective and natural antioxidant. We researched the ability of turmeric root extract to inhibit the degradation of guanosine by singlet oxygen, the ROS produced by the photoactivation of riboflavin.

Activating silent fungal gene clusters via biorational culturing

Jessica Olson, Khush Asghar, Ann Chacko and Stephen Deyrup

Siena College Department of Chemistry and Biochemistry

Abstract :

Humans have been using chemical compounds from natural sources since prehistoric times to heal and prevent illness and disease. Many modern drugs, like Penicillin, Lovistatin, and Taxol, are all derived from natural sources and are used today to combat bacteria, lower cholesterol, and to fight cancer, respectively. With the emergence of many antibiotic resistant pathogens, like Methicillin-Resistant *Staphylococcus aureus* (MRSA), Vancomycin-Resistant Enterococcus (VRE), and multi-drug resistant tuberculosis (MDR TB), it is increasingly important to discover new classes of antibiotics. Our study focused on fungi as a source of antibiotics, due to their long-term evolutionary competition with bacteria. Fungi for the study were selected based on ecological niche, in particular, *Absidia coerulea* because of its coprophilous nature. *A. coerulea* was cultured in the presence of *Escherichia coli* exudates or cell debris to elicit an antibacterial response from gene clusters not expressed under standard culturing methods (silent gene clusters). Extracts from *A. coerulea* grown on 4 experimental and two control media were tested for activity against *S. aureus*, *E. coli*, and *Bacillus subtilis*. One experimental treatment displayed activity versus *S. aureus* and *B. subtilis*, while the controls were inactive.

Biomimetic recognition of glutamic acid

Davin Piispanen and Jodi L. O'Donnell

Siena College Department of Chemistry and Biochemistry

Abstract:

The ability to sense amino acids and other small molecules is necessary in many fields of research and medicine including the identification of small molecules in human brain tissue. A molecularly imprinted polymer was generated for the recognition of glutamic acid. The polymer was formed from two molecules bearing terminal amine groups, dopamine and o-phenylenediamine. The copolymerization of these two molecules occurred on a gold working electrode. The template molecule, L-glutamic acid, was included in the polymerization and removed once the film had been applied to the electrode. The molecularly imprinted polymer produced was characterized by cyclic voltammetry. As the voltammetry was carried out, the copolymer film showed insulating characteristics necessary for a selective biosensor. Upon introduction of L-glutamic acid to the biosensor a response is observed indicative of the quantity of acid in solution. This one step strategy for synthesis of a copolymer film shows a convenient way for preparation of other molecularly imprinted polymers.

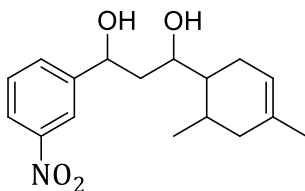
Synthetic strategies in organic chemistry

Daniel M. C. Schwarz, Brian E. Geraghty and Kara Cetto Bales

Skidmore College

Abstract :

We are interested in synthesizing and characterizing **1** with the aim of developing a project which would allow students to gain experience in multi-step organic synthesis. The goal is to move away from the more traditional "recipe" style laboratory experiments to a research based curriculum. Although **1** has not been previously prepared, we reason that it can be synthesized via a number of fundamental reactions commonly used in the undergraduate organic chemistry laboratory. We suggest synthesizing this compound in a convergent manner, where two different building blocks are synthesized independently through a series of chemical reactions and then combined forming the desired product (**1**). The first building block has been prepared successfully. These reactions, as well as our progress thus far will be presented.

**1**

Dynamic light scattering and micellar packing in pluronic aqueous solutions

Greg Treich, Han Jin Park and Chang Y. Ryu

Department of Chemistry and Chemical Biology at Rensselaer Polytechnic Institute

Abstract :

There have recently been much interest BASF's Pluronic polymers for drug delivery and cosmetic applications. These polymers self-assemble into micelles in solution and are comprised of a polypropylene oxide (PPO) block surrounded by a polyethylene oxide (PEO) block on either side giving it the structure (PEO)-(PPO)-(PEO) block copolymers. As the temperature increases, the Pluronics aggregate together to form micelles of different sizes depending on which Pluronic is used and can be measured using dynamic light scattering techniques. In our research, we focused on aqueous solutions of F108 and other types of hydrogel-forming Pluronic block copolymers (1) to determine the effects that temperature has on the formation of micelles and (2) to understand the formation of soft hydrogel in Pluronic solutions with the micellization process. In addition, we varied the concentration of polymer to see how that affects the transition from free polymers to micelles to provide experimental evidence of the transient block copolymer aggregates, which are larger than the well-developed micelles. Finally, we will present a comprehensive experimental result on the characteristics of transient soft gel structures to ultimately correlate the micelle formation in dilute solution with the hydrogel formation in semidilute solution.

Synthesis and characterization of di- μ -oxo dimanganese complexes: Development of catalysts for solar water oxidation.

Jessica Ziegler, Christopher S. Coates, Sergey Milikisiyants and K. V. Lakshmi

Department of Chemistry and Chemical Biology and The Baruch '60 Center for Biochemical Solar Energy Research, Rensselaer Polytechnic Institute, Troy, NY, 12180

Abstract :

The light-driven process of photosynthesis oxidizes water to molecular oxygen in the following charge-transfer reaction: $2\text{H}_2\text{O} \rightarrow \text{O}_2 + 4\text{e}^- + 4\text{H}^+$. The four-electron water oxidation reaction is catalyzed by a tetranuclear manganese-calcium-oxo ($\text{Mn}_4\text{Ca-oxo}$) cluster in the Oxygen-Evolving Complex (OEC) of Photosystem II (PSII). In order to mimic the function of the $\text{Mn}_4\text{Ca-oxo}$ cluster, we have synthesized mixed-valence dimanganese (Mn(III)/Mn(IV)) di- μ -oxo complexes with a variety of substituted terpyridine ligands. We have determined the X-ray crystal structures of the dimanganese (III/IV) di- μ -oxo complexes that confirm the presence of bound substrate water molecules. We characterize the electronic the complexes by UV-Vis spectroscopy, infrared spectroscopy, EPR spectroscopy and oxygen-evolution assays. In detailing the structure and function of these complexes, we develop a clearer understanding of the catalytic activity of the $\text{Mn}_4\text{Ca-oxo}$ cluster in the OEC of PSII.