CSB/SJU
Department of Chemistry
and
Department of Nutrition

Senior Seminar Presentations
Saturday, April 22, 2006

Student Presentations
8:30 a.m. - 12:00 p.m.
Ardolf Science Center
Rooms: 104, 107, 127, 142

Luncheon
12:00 p.m.
ASC 130

Awards Presentation
12:45 p.m.
ASC 142
Chemistry Awards
2006

Distinguished Service Award
Glenise A. Johnson          Noah D. Retka

Glen Arth Award
Thomas V. Hartman

Sister Rogatia Sohler Award
Katie L. Pokorny

F. Matthew Kiess Award
Alissa J. Carrow

American Institute of Chemists Award
Steven J. Henle             Erica H. Layer

Undergraduate Award in Analytical Chemistry
Nicholas W. Frost           Jennifer C. Webber

Undergraduate Award in Organic Chemistry
Alison M. Thorsness

CRC Freshman Chemistry Award
Jeffrey S. Bandar           Kathleen A. Hromatka
Kerry M. Bauer              Ha Hong Pham
Catherine A. Bouska         Zachary R. Shaheen
Sarah J. Jepperson
# CSB/SJU

## Department of Chemistry

and

## Department of Nutrition

### Senior Seminar Presentations Schedule

Saturday, April 22, 2006

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<th>Time</th>
<th>Session A ASC 104 Jim Dahlman Presiding</th>
<th>Session B ASC 127 Alison Thorsness Presiding</th>
<th>Session C ASC 142 Nic Frost Presiding</th>
<th>Session D ASC 107 Sara Anderson Presiding</th>
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<td>8:30 a.m.</td>
<td>Kara Vonderhaar Chemistry Research Advisor: Dr. Ed McIntee</td>
<td>Claire Hoolihan Biochemistry Research Advisor: Dr. Henry Jakubowski</td>
<td>Glenise Johnson Chemistry Research Advisor: Dr. Kate Graham</td>
<td>Kaley Kosak Nutrition Science Research Advisor: Linda Shepherd</td>
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<td>9:00 a.m.</td>
<td>Devon Hammel Chemistry Research Advisor: Dr. Richard White</td>
<td>Nicholas Briese Chemistry Research Advisor: Dr. Henry Jakubowski</td>
<td>Aaron Getchell Chemistry Research Advisor: Dr. Mike Ross</td>
<td>Elizabeth Reisdorf Dietetics Research Advisor: Dr. Amy Olson HONORS DEFENSE</td>
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<td>9:30 a.m.</td>
<td>Jennifer Lien Biochemistry Research Advisor: Dr. Ellen Jensen</td>
<td>Andrea Meuleners Biochemistry Research Advisor: Dr. Ronald Henry</td>
<td>Erica Layer Chemistry Research Advisor: Dr. Nicholas Jones</td>
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<td>10:00 a.m.</td>
<td>Steve Bischof Chemistry Research Advisor: Dr. Ed McIntee</td>
<td>Steven Henle Biochemistry Research Advisor: Dr. Kate Graham</td>
<td>Ann Foede Chemistry Research Advisor: Dr. Mike Ross</td>
<td>Kelly Denne Brian Gasser Nutrition Science Research Advisor: Dr. Amy Olson</td>
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<td>10:30 a.m.</td>
<td>Martin Morud Biochemistry Research Advisor: Dr. David Mitchell</td>
<td>Nicholas Lever Chemistry Research Advisor: Dr. Richard White</td>
<td>Noah Retka Chemistry Research Advisor: Dr. Mike Ross Dr. Chris Schaller</td>
<td>Elizabeth Berg Nutrition Science Research Advisor: Jayne Byrne</td>
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<td>11:00 a.m.</td>
<td>Katie Jermihov Biochemistry Research Advisor: Dr. Kate Graham</td>
<td>Brian Hansen Biochemistry Research Advisor: Dr. Michael Reagan</td>
<td>Susan Moen Chemistry Research Advisor: Dr. Mike Ross Dr. Bob Fulton Dr. Richard White HONORS DEFENSE</td>
<td>Danielle Vlazny Biochemistry Research Advisor: Dr. Michael Reagan</td>
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<td>11:30 a.m.</td>
<td>Cathy Weber Chemistry Research Advisor: Dr. Ed McIntee</td>
<td>Joseph Block Biochemistry Research Advisor: Dr. David Mitchell</td>
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The Effect of Omega-3 Fatty Acid Supplementation on Rheumatoid Arthritis

Elizabeth J. Berg
Research Advisor: Jayne Byrne
Nutrition
St. John's University/College of Saint Benedict

Abstract

Rheumatoid Arthritis (RA) is a chronic inflammatory disorder characterized by specific inflammation in the lining of the joints. Over time, RA will lead to a degeneration of the joint tissue, resulting in chronic pain and loss of function in the joints, often with severe disability. RA has no cure. However, prescription drugs are available to manage the pain and reduce inflammation. These drugs often have negative side effects, which may affect compliance. Omega-3 fatty acids are essential fatty acids which, through a shared metabolic pathway, compete with the pro-inflammatory substrates formed from omega-6 fatty acids. Over a period of time diets high in omega-3 fatty acids, when compared to diets high in omega-6 fatty acids, may reduce the state of chronic inflammation by producing an anti-inflammatory group of mediators. This reduction in inflammation could result in improved function and pain control without the negative side effects of commonly prescribed drugs. Patients who have been diagnosed with rheumatoid arthritis demonstrated an improvement in joint health with a supplement of 2.5g-7g/day of omega-3 fatty acids, and a reduction in omega-6 fatty acid intake. The best results of improved joint movement and reduction in tenderness incorporate omega-3 supplements and continued but decreased use of drug therapies. This project will present the recent data on the therapeutic effect of omega-3 fatty acid supplementation, and the physiological mechanisms related to this therapeutic effect.
Computer Modeling of Low Molecular Weight Protein Tyrosine Phosphatase Inhibitors

Steven M. Bischof
Research Advisor: Edward McIntee
Chemistry
St. John’s University/College of Saint Benedict

Abstract

Low molecular weight protein tyrosine phosphatase (LMW-PTP) is over expressed in cancer cells. Over expression of LMW-PTP in normal cells is enough to cause transformation into cancerous cells. Thus, inhibition of the LMW-PTP enzyme would be a logical target for anti-cancer therapy. One naturally occurring inhibitor of LMW-PTP is pyridoxal 5’-phosphate (PLP). The design of possible PLP mimics specific to LMW-PTP and that have stronger binding compared to PLP would make good possible drug candidates. Using an x-ray crystal structure of bovine HAAP-β, various analogs of PLP were designed and docked using computer modeling programs (Spartan 5.0 and Autodock). Each of the analogs’ had energy minimizations performed by use of a semi-empirical calculation and a PM3 basis set in Spartan. Docking was then performed using Autodock software with the genetic algorithm, a grid spacing of 0.497Å where x, y, and z = 98 units cubed, and ten energy runs. Following initial binding studies, three analogs that showed greater binding than PLP to bovine HAAP-β (120%, 117%, and 116% relative binding strength compared to PLP) were reanalyzed using a spacing of 0.253Å and 20 energy level runs to increase accuracy and precision. The higher order runs for the three PLP analogs will be used for structure/function relationship studies. This will help for greater understanding of what characteristics are needed functionally to design a PLP mimic that will offer greater binding than PLP and hopefully provide specificity to inhibiting LWM-PTP.

Steven Bischof
10:00 a.m.
Room: ASC 104
Role of TSST-1 in Toxic Shock Syndrome

Joseph Block
Research Advisor: Dave Mitchell
Biochemistry
St. John’s University/College of Saint Benedict

Abstract:

The purpose of this paper is to identify the role of toxic shock syndrome toxin-1 (TSST-1) in the role of toxic shock syndrome (TSS). TSST-1 is a bacterial SAG secreted by *Staphylococcus aureus* are in the pyrogenic toxin class of SAGs (McCormick). It is also classified as a Superantigen a class of bacterial or viral proteins that aberrantly alter immune system function through simultaneous interaction with lateral surfaces of MHC class II molecules on APCs, and with particular variable regions of the $\alpha/\beta$ TCR (V$\beta$) (11). In order to determine the function of TSST-1 in TSS analyzing the structure will be one step in identifying the role of TSST-1. This structure then provides the information to look at what TSST-1 effects in terms of binding to other complexes, and following the effects of this to determine how it affects the immune response.
Applications of Fluorescence Spectroscopy in Monitoring Biochemical Transitions

Nicholas S. Briese
Research Advisor: Henry Jakubowski
Chemistry
St. John’s University/College of Saint Benedict

Abstract

Fluorescence spectroscopy is a powerful tool for probing the structure and conformation of biological molecules. The purpose of this project was to refine methods to be used to study biomolecules in an undergraduate laboratory setting using fluorescence spectroscopy. Because fluorescence spectroscopy is not as widely understood as other techniques, the focus was on finding simple procedures with a high probability of experimental success. Procedures were developed for monitoring protein denaturation, formation of micelles of single-chain amphiphiles, and oligonucleotide melting. Native tryptophan fluorescence was used to monitor protein denaturation. An external fluorophore, 1-anilinonaphthalene-8-sulfonic acid, was used to monitor micelle formation. Oligonucleotide melting was measured by monitoring fluorescence from two fluorophores, fluorescein and rhodamine, that were covalently attached to DNA strands. These procedures were incorporated into introductory biochemistry laboratory projects. Future work remains in further refining techniques to accurately monitor the melting of oligonucleotides.
Effects of Weight Cycling on Body Composition and Resting Metabolic Rate of Collegiate Wrestlers

Kelly Denne and Brian Gasser
Research Advisor: Amy Olson
Nutrition
St. John’s University/College of Saint Benedict

Abstract

Eleven collegiate wrestlers were studied to analyze the effects of rapid weight loss on body composition, hydration status and resting metabolic (RMR). Overall measurements were taken before, during and after the season and acute changes during one weight loss cycle. RMRs decreased slightly from 2095 to 1979 kcals (insignificant) from pre- to peak season. Average body weights decreased by ~11 lbs, fat mass decreased by ~10 lbs. and lean mass by ~3 lbs. from pre- to peak season. During the acute [one week] weight loss cycle, average daily caloric intakes decreased from 1868 to 385 and body weights decreased by 8 pounds, whereas RMR’s increased from 1970 to 2144 kcals. Changes in fat mass and lean body mass were insignificant; urine osmolality data [804 mOsm on Monday increasing to 998 mOsm on Friday] suggests the weight loss during an acute weight loss cycle is accomplished primarily from loss of body water.
The Photodegradation of Ciprofloxacin and Possible Bacterial Resistance to the Resulting Compounds

Ann M. Foede
Research Advisor: Michael Ross
Chemistry
St. John’s University/College of Saint Benedict

Abstract

The purpose of this paper is to explore the factors that inhibit or increase the photodegradation of ciprofloxacin, identification of the photodegradation products, and whether the photodegradation products retained antibiotic activity or not. Many different factors in the photodegradation of ciprofloxacin have been studied including pH, buffer type, and concentration of ciprofloxacin. When identifying the photodegradation products a method of separation was created using high performance liquid chromatography (HPLC). This HPLC method was then used to separate the two photodegradation products, compound I and compound II. Spectroscopic data, including HPLC, infrared (IR), mass spectrometry (MS), and especially nuclear magnetic resonance (NMR), was used to determine the structures. Further study was done on the possible bacterial resistance to the photodegradation products. The results of those studies show that ciprofloxacin loses its antibiotic activity when it photodegradates, and if a person is exposed to daylight long enough this could cause a noticeable decrease in its effectiveness while that person is taking the medication.
Fuel Cell Technology

Aaron Getchell
Library Research Advisor: Mike Ross
Chemistry
College of St. Benedict/Saint Johns University

Abstract

In today’s society the need for a commercially available fuel cell is becoming more prevalent each day with the continual rise of gasoline prices. The roles of these fuel cells are becoming more widespread each year with advancements in technology. Some of the fuel cells that researchers are very interested in are: Hydrogen, Ethanol and Alkaline fuel cells. These three fuel cells have the possibility of becoming commercially available if the cost of production and the cost of use can be dropped. A fuel cell is an electrochemical cell in which the energy of a reaction between a fuel, such as liquid hydrogen, and an oxidant, such as liquid oxygen, is converted directly and continuously into electrical energy. This paper will examine the use of these fuel cells, the way they work and the advantages/disadvantages of these fuel cells.
Determination of Partial Molal Volume of Lysine Monohydrochloride

Devon B. Hammel  
Research Advisor: Richard M. White  
St. John's University/College of St. Benedict

Abstract

The purpose of this research was to determine the partial molal volume of Lysine Monohydrochloride. The mass of solutions of Lysine Monohydrochloride of different molalities was found for a given temperature, using a 25 mL pycnometer and sand/water bath. Graphical analysis was done using MathCAD to compile these measurements and determine the partial molal volume for Lysine Monohydrochloride. This procedure was repeated several times in order to obtain reproducible results. A preliminary set of experiments was done to determine the partial molar volume of Sodium Chloride using pycnometers of 10, 25, and 50 mL. This was done to determine which pycnometer was the most accurate and should be used for the second part of this research. Additional tests will show the potential dependence of the partial molal volume of Lysine Monohydrochloride on pH.
Identification of a New KEL Polymorphism: Implications for Genotyping Red Blood Cell Js\textsuperscript{a} and Js\textsuperscript{b} Antigens

Brian J. Hansen  
Research Advisor: Michael Reagan  
Biochemistry  
College of St. Benedict/St. John's University

Abstract

The purpose of this research was to genotype people from different ethnic groups to confirm the presence of an undocumented allele coding for Js\textsuperscript{a}/Js\textsuperscript{b} red blood cell antigens. According to literature, the Js\textsuperscript{a} phenotype is expressed in about 20% of African-Americans, but almost 0% in Caucasians. Leukocyte DNA was isolated from African-Americans, Caucasians, and Chinese blood donors for the study. The KEL gene was amplified around exon 17 in a polymerase chain reaction (PCR) and sequenced using the dideoxy chain termination method. Expected genotypes for Js\textsuperscript{a} and Js\textsuperscript{b} were sequenced, along with three new genotypes incorporating the new allele. These new genotypes occurred exclusively in African-Americans, and contained a single nucleotide polymorphisms characteristic of the opposite Js antigen expressed. As a result of this new allele, special care must be taken when genotyping Js\textsuperscript{a}/Js\textsuperscript{b} in donor blood to find compatible units for patients. This is particularly important for African-Americans receiving frequent blood transfusions for sickle-cell anemia.
Using Adenovirus to Study Neuronal Degeneration and Regeneration Associated with Cisplatin

Steven Henle
Research Advisor: Kate Graham and Anthony Windebank
Chemistry
St. John’s University / College of St. Benedict / Mayo Clinic School of Medicine

Abstract

This project is focused on the creation of two viruses which will be helpful to study neuronal degeneration and regeneration related to cisplatin, and could potentially have value therapeutically. One virus will express a 44 amino acid peptide from pigment epithelium derived factor (PEDF). PEDF 44mer has been shown to function as a neurotrophic factor; however it lacks the anti-angiogenic properties associated with the full protein, and could potentially be helpful in treating neuronal death caused by cisplatin treatment and/or surgery. The other virus will express γ-glutamylcysteine synthetase (ECS) from Brassica Juncea which catalyzes the rate determining step in glutathione synthesis and should localize to the mitochondria. Glutathione binds and removes cisplatin from cells. By overproducing it in the mitochondria it should protect mtDNA and allow further study into the mechanisms behind dorsal root ganglion death caused by cisplatin. The creation of the viral vectors consisted of cloning the genes of interest and then inserting them into shuttle plasmid which could then be inserted into the whole virus genome through a recombination event. Both viral vectors were created to be used initially as scientific probes in a variety of experiments both in vivo and in vitro.

This is currently still an ongoing project in the Windebank lab.
Site Directed Mutagenesis of two Tryptophan residues in Human Adipocyte Acid Phosphatase-β (HAAP-β)

Claire Hoolihan
Research Advisor: Henry V. Jakubowski
Biochemistry
St. John’s University/College of Saint Benedict

Abstract

Protein phosphatases are an important group of enzymes that cleave phosphate groups from proteins that contain a phosphates esterified to serine, threonine, or tyrosine residues. Phosphatases are important for cell signaling and signal transduction. An external signal can be spread from the cell membrane to the nucleus via phosphorylation by kinases which eventually phosphorylate transcription factors that induce gene transcription and protein synthesis. The purpose of this project was to use site-directed mutagenesis to create two single tryptophan-containing mutants of human adipocyte acid phosphatase-β, which cleaves phosphates from adipocyte lipid binding protein (ALBP) with its P-loop structure motif. In one mutant, tryptophan 39 would be changed to a phenylalanine (W39F) while in the other, tryptophan 49 would be changed to phenylalanine (W49F). Because the tryptophan side chain fluoresces, removing one would let researchers detect structural changes surrounding that residue. By using fluorescence spectroscopy, the active site of the molecule could be explored. This could hopefully give insight to cell signaling and how phosphatases work. Site-directed mutagenesis was done using Stratagene’s Quikchange II Site Directed mutagenesis method. Mutated DNA was purified by a QIAGEN 500 column and sequenced. The data showed that the mutant W49F was made. This data included positive controls for the transfected cells, and a large number of colonies on the plates, along with a positive analysis of the sequencing. Further work will focus on the production of mutants containing W39F, C12S (another active site residue), and a double mutant containing both W39F and W49F.
Chemical Genomic Profiling

Katherine C. Jermihov
Research Advisor: Kate J. Graham
Chemistry
St. John’s University/College of Saint Benedict

Abstract

The concept of genomic profiling is useful in research methods today because it could potentially assign use and mechanisms to small molecules that would otherwise be unnoticed. Small changes and mutations in genomic expression can lead to large changes functionally for a protein or enzyme, and therefore a whole network of biological systems and molecules. The advantage of chemical mutagenesis in single base pair mutations is the ability to for them to be readily identified through DNA sequencing. Transcriptional regulatory proteins tested for binding analysis and network interactions revealed significant data for regulators bound at promoter region of yeast cells in yeast extract, peptone and dextrose. Research through the use of binary adjacency matrix systems, single gene deletions were consequences of different kinesin deletions to pairwise small molecule pertubations. Measuring the amount of luciferase a cell synthesized, compounds that activate reporter genes were found. One compound increased expression in 5 genes including ZRT1 (a zinc transporter), and FET3 (multicopper iron oxidase required for ion transport). The compounds that were found promoted metal homeostasis and increased gene expression. Often, Cu$^{2+}$ alone activated the reporter gene. Single metal protein interactions can reveal new roles for metal ions. Through the use of chemical mutagenesis, MS, PCR, DNA fingerprinting, quantitative phenotype analysis and DNA chip technology, uses of small molecules in single mutations can prove to be beneficial both pharmaceutically as well as biologically.

Katie Jermihov
11:00 a.m.
Room: ASC 104
The Biomechanical and Metabolic Effects of Obesity on the Development and Progression of Osteoarthritis

Kaley Kosak
Research Advisor: Linda Shepherd
Nutrition
St. John’s University/College of Saint Benedict

Abstract

Osteoarthritis (OA) afflicts approximately 20 million people and is most prevalent in adults 65 years and older. Obesity is a significant risk factor for OA. Biomechanical strain places excess weight on joints, especially in the lower extremities. Metabolic factors (leptin and C-reactive protein) are elevated in obesity and may contribute to OA. Both biomechanical and metabolic factors contribute to the dose-response relationship between OA and obesity. Weight loss and muscle strengthening are an effective method for decreasing OA risk. As the population ages and obesity rates rise, improvements in OA risk are imperative to the health of this generation.
Selective Growth of Organic Semiconductors on
Aromatic Self-Assembled Monolayers

Erica H. Layer
Research Advisor: T. Nicholas Jones
Chemistry
St. John’s University/College of Saint Benedict

Abstract
Solution processing of organic semiconductors offers a simple and inexpensive alternative to conventional processing methods such as vacuum deposition used in the fabrication of devices such as field-effect transistors and organic light emitting diodes. To date, this process is limited by the low solubility of high-performing semiconductors in organic solvents. In this paper, we report the design of highly soluble organic semiconductors that have good performance in field-effect transistor devices. Novel methods to pattern these materials based on selective nucleation at specific surface sites are introduced. A self-assembled monolayer (SAM) of an aromatic thiol was patterned using microcontact printing. Organic crystals selectively grew on aromatic regions by slow-evaporation from a saturated solution of the organic semiconductor. We show that crystal growth from solution can be controlled, which holds promise for directed growth of semiconducting molecules for organic field-effect transistors.
Bituminous and its Chemical Properties

Nicholas E. Levar
Research Advisor: Dr. Richard White
Chemistry
St. John’s University/College of Saint Benedict

Abstract
The paper will discuss the chemical properties of bituminous, and why these properties are important to the life of the bituminous as well as the bituminous’ healing/recovery time. Experiments indicate the strong molecular bonds found in bituminous allow the mixture to take year round punishment from constant vehicle traffic as well as the wide variety of weather conditions. Bituminous is better known as asphalt after it is applied to the road bed. Since bituminous/asphalt is a mixture of different chemical species that can be amorphous and/or crystalline in nature, studies done on asphalt are classified as a Newtonian fluid or as a linear viscoelastic fluid. These fluid classifications help to theoretically explain why the thermodynamic behavior of asphalt is most sensitive to fluctuations in the temperature. The behavior of asphalt can also be modified by the additions of organic polymers and external forces on the asphalt created by the braking and accelerating of motorized vehicles. The paper will explain the chemical make-ups, the thermodynamic behaviors of the asphalt, and the advancements/experiments being conducted today.

Nicholas Levar
10:30 a.m.
Room: ASC 127
What's Out There? Microbiodiversity of St. John's Lakes

Jennifer A. Lien
Research Advisor: Ellen Jensen
Biology
St. John's University/College of Saint Benedict

Abstract

Very little is known about microbiological diversity in fresh water lakes and streams. Few studies have been done on lakes, and none have been done on a watershed. Also, there have been no fresh water studies done over a period of time. On the campus of St. John's University (SJU), a number of studies have examined macroscopic diversity, such as plants and butterflies, but there are no previous studies that have focused on microbes. The purpose of this project was to examine the microbiodiversity in the bodies of water located on the SJU campus. Traditional isolation and identification techniques were used to determine the species richness and diversity, as well as identifying a few of the organisms present. The data collected showed that both species richness and species diversity increased as the summer progressed. Future studies are needed: to confirm if the same pattern of increasing diversity occurs over the course of the summer, to extend the research to include samples gathered throughout the year, and to see if a correlation exists between species richness and diversity and environmental conditions, such as temperature, rainfall, or nutrient content.
Identification of CXCR4 Structural Elements that Regulate Receptor Internalization in a T Cell Receptor Dependent Manner

Andrea Meuleners
Research Advisor: Dr. Ronald Henry
Biochemistry
College of St. Benedict/St. John’s University

Abstract

Stimulation of T lymphocytes with stromal cell-derived factor-1alpha (SDF-1 alpha/CXCL12) results in colocalization of the chemokine receptor, CXCR4, and the T cell receptor (TCR). Internalization of the colocalized complex can initiate prolonged activation of the extracellular signal-regulated kinases (ERK) ERK1 and ERK2, gene transcription, cytokine expression and migration. The molecular mechanisms behind the internalization of the colocalized complex are incompletely characterized. In this study, we show that there are multiple sites in the CXCR4 C-terminus that influence the internalization of the CXCR4/TCR complex in Jurkat and JRT3 T cells. A mutation of amino acids 328 and 329 in the CXCR4 C-terminus, an important beta-arrestin binding site, significantly reduced internalization in Jurkat cells. Deletion mutations in the CXCR4 C-terminus also significantly reduced internalization in Jurkat cells. Basal internalization in Jurkat cells was decreased by an element(s) in amino acids 342-352. Basal internalization was induced by an element(s) in amino acids 334-342. Basal internalization in JRT3 cells was increased by an element in amino acids 322-334. SDF-1alpha induced internalization was similarly regulated by the TCR. Research was supported by the Summer Undergraduate Research Fellowship at Mayo Clinic and Mayo Graduate School.
Effects of PH on the Partitioning of Benzoic Acid Between Water and Heptane – A Gas Chromatographic Analysis

Susan M. Moen
Research Advisor: Robert Fulton
Chemistry
St. John’s University/College of Saint Benedict

Abstract
An octanol-water partitioning system is often employed by environmental scientists to determine the partitioning of chemical pollutants in various river waters. This system has many variables and can be quite complex. To study the effects of pH and ionic strength on this type of system, a slightly different scheme was developed using heptane in place of octanol and benzoic acid as the partitioning substance. By studying this simplified system, several characteristics of partitioning can be determined and applied to a more complex system. When benzoic acid, heptane and water are mixed, the benzoic acid partitions itself between the heptane and aqueous layer. By determining the amount of benzoic acid that partitioned into the heptane using gas chromatography and measuring the pH of the aqueous layer, the acid-dissociation constant and partition coefficient were simultaneously determined.
Effects of Beta-Tubulin Knockout Genes on Maize Chilling Tolerance

Martin Morud
Research Advisor: David Mitchell
Biochemistry
St. John's University/College of Saint Benedict

Abstract

Previous research on α and β tubulins show that certain tubulins could play an important role in increased or decreased chilling tolerance in maize (Bokros). The question was whether the knock out of these genes could result in microtubules with greater cold tolerance, thus allowing maize plants to grow in colder temperatures. β tubulins with longer, more acidic carboxyl termini have shown increased sensitivity to chilling so we have attempted to eliminate the gene expression of tub1, tub6, and tub7 using a Mutator transposable element. Analyzing the growth of seedlings in cold growth chambers containing the Mu inserts supplied phenotypic data. Much of my work thus summer has focused on determining the genotype of seedlings that survived treatment at 9°C or 12°C. By comparing phenotypes and genotypes of these plants we can determine the effects these genes have on chilling tolerance. Unforeseen results indicated a shift or deletion of the Mutator transposon from tub1, tub6, and tub7 in summer 2004. The latest task of this ongoing project is to show through Southern Blot technique that tub1: Mu, tub6: Mu, and tub7: Mu are intact and still exist in our Maize genomic DNA. Results are not yet completed, but without this DNA, the project can no longer continue.
The Effects of Dietary Diacylglycerols on Postprandial Lipemia Compared to Triacylglycerols in College Aged Males and Females

Elizabeth Reisdorf
Research Advisor: Amy Olson
Nutrition
St. John’s University/College of Saint Benedict

Abstract

Elevated levels of triglycerides in the blood following a meal [referred to as postprandial lipemia] is associated with an increased risk of cardiovascular disease and metabolic syndrome. Diacylglycerols appear to reduce the postprandial response in older, hyperlipemic, male populations. In this study, twenty one college students (2 male, 19 female) consumed cake with 20g of diacylglycerols (Enova oil) on one occasion and 20g of triacylglycerols (Canola oil) on another. Initial fasting triglycerides were determined and then at 2, 3, and 4 hours post consumption. Our results show no statistically significant difference in serum triglyceride response between the oils. From our understanding, this is the first study of the effect of diacylglycerols on the post consumption serum triglyceride response in college students.
Synthesis and Reactivity of Halo-vinyl Tetrphenylporphyrin Cobalt Complexes

Noah Retka
Laboratory Research Advisors: Mike Ross and Chris Schaller
ACS Chemistry
College of St. Benedict/Saint Johns University

Abstract

Perchloroethylene (PCE) and trichloroethylene (TCE) are carcinogenic pollutants commonly found in groundwater. Vitamin B$_{12}$, a cobalt containing macrocycle, has been found to effectively dechlorinate PCE and TCE to ethylene, a benign product. Under similar reaction conditions, a water-soluble cobalt porphyrin has been found to also catalytically dechlorinate these pollutants. This research project has focused on cobalt porphyrin complexes as potential catalytic cycle intermediates in the dechlorination process. Different halo-vinyl complexes of tetrphenylporphyrin cobalt were prepared and studied to compare stability and reactivity differences. Specifically, this project focuses on the preparation, characterization, and reactivity of the (trans-2-bromovinyl)(tetrphenylporphyrin) cobalt.
Development of a Robust System for PCR Labeling Probes for Northern Blots to Determine the Effect of Ethylation on Transcriptional Recovery in the Yeast S Cerevisiae

Danielle T Vlazny
Research Advisor: Dr. Michael Reagan
Biology
St. John’s University/College of Saint Benedict

Abstract

Genes repeatedly suffer DNA damage throughout their lifetime. Without proper repair and recovery, transcription in damaged DNA may be permanently altered or cease altogether. In this experiment S. cerevisiae cells were exposed to ethylation and the transcriptional recovery of the GAL10 gene observed. Transcription of this gene is induced by the sugar galactose. We measured mRNA levels after subjecting the cells to the ethylating agent ethyl methanesulfonate (EMS) and then exposing the cells to galactose to induce transcription of the GAL10 gene. We used chemiluminescence after gel electrophoresis separation to detect the GAL10 transcripts. The intensities detected were compared between the same time samples in the treated and untreated cells.
Partial Synthesis of 3’-Deoxy-3’-Fluororibonucleosides

Kara VonderHaar
Research Advisor: Dr. Edward McIntee
Chemistry
College of Saint Benedict/St. John’s University

Abstract

The purpose of this project was to synthesize 3’-deoxy-3’-fluororibonucleosides and examine their anti-cancer and/or anti-viral activities. The multi-step synthesis was only partially completed, as described here with the preparation of 1,2-di-O-acetyl-3,5-di-O-benzoyl-D-xylofuranose from D-xylose. Multiple pathways for synthesis of this product were attempted, and the best one is reported here. In the first protection step, 3,5-di-O-isopropylidene-α-D-xylofuranose (1) was synthesized from D-xylose (83%), which was then selectively de-protected to give 1,2-O-isopropylidene-α-D-xylofuranose (2) (69%). The hydroxyl groups at positions 3 and 5 in this product were then protected by esterification with benzoyl chloride to give 3,5-di-O-benzoyl-α-D-xylofuranose-1,2-O-isopropylidene (3) (71%). This third product in the synthesis was then purified via silica gel column chromatography and both de-protected and acetylated to produce 1,2-di-O-acetyl-3,5-di-O-benzoyl-D-xylofuranose (4) (67%). The project thus far suggests promises in synthesizing the final 3’-deoxy-3’-fluororibonucleosides, and the best pathway to produce (4) has been determined. Ongoing work on the multi-step synthesis will indicate if any of the final products possess anti-viral and/or anti-cancer activities.
Counterfeit Drugs: Chemistry under Disguise

Catherine F. Weber
Research Advisor: Edward McIntee
Chemistry
College of Saint Benedict/ Saint John’s University

Abstract

In recent years, the consumer confidence in marketed drugs has declined. Even though, this is a very well regulated area, counterfeit drugs have found their way into the market. An examination of counterfeit drugs, generic drugs as an anti-counterpart and technological efforts being made to combat the trafficking of counterfeit drugs is the target of this paper. Three known counterfeit drugs—Tamiflu (oseltamivir), Procrit (epoetin alfa), and Lipitor (atorvastatin calcium)—will be presented. The physical properties, analytical analysis, mechanism of action, and risks of counterfeit product associated with one or more of these drugs will be examined. The line between generic and counterfeit drugs will be examined by the standards and regulations including equivalence analyses associated with the manufacturing process. Ranitidine, a generic substitute of Zantac, was the target of this examination. A brief reference to radio-frequency identification (RFID) and NIR spectroscopy, techniques being developed to combat counterfeit drugs, conclude the examination. To maintain and take back the well-regulated, advanced drug supply enjoyed today, joint efforts from consumer groups, pharmacies, wholesalers, drug manufacturers, technology specialists, regulatory agencies, and international government must continue.

Catherine Weber
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