Undergraduate Research Summer Poster Session

August 13, 2008
Joe Crowley Student Union, Ballroom B
University of Nevada, Reno

Abstracts

Research sponsors:

NSF EPSCoR
Nevada INBRE
NSF REU in Chemistry
UNR Office of Undergraduate Research

Forward

Exposure to research is a powerful element toward enriching the educational experience of undergraduate students. These abstracts present a summary of the outcome of research conducted by a select number of talented undergraduate students in the summer of 2008. Our undergraduate researchers could not succeed without the unselfish and dedicated guidance from their faculty mentors. The research grants were funded by the National Science Foundation EPSCoR (Experimental Program to Stimulate Competitive Research), the National Institutes of Health funded Nevada INBRE (IDeA Network of Biomedical Research Excellence) program, the NSF-REU program in Chemistry and the UNR General Undergraduate Research Awards.

We hope you will enjoy the poster session and the abstracts. The many hours of enthusiastic work mixed with joy of discovery and, granted, some moments of frustration that are natural occurrences in breaking new grounds are all reflected in the posters and the abstracts. We are certain that the summer research has enriched the educational experience of our undergraduate researchers and hope that this experience has paved the road for a more productive future endeavor for them, be it attending graduate school or joining the work force.

M. Saiid Saiidi, PhD
Director, UNR Office of Undergraduate Research
Director, NSF EPSCoR UROP program

John W. Farley, PhD
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Co-director, NSF EPSCoR UROP program

James Kenyon, PhD
Director, Nevada INBRE

Sean Casey, PhD
Brian Frost, PhD
Co-Directors of the NSF-REU program in Chemistry

Summer 2008 Undergraduate Research Programs

Students participating in the following three undergraduate programs funded by external grants are represented in this poster session.

National Science Foundation
Experimental Program to Stimulate Competitive Research

In August 2005 the National Science Foundation, through the EPSCoR (Experimental Program to Stimulate Competitive Research) program, funded a $13.5M grant (including $4.5M from the State of Nevada) to improve the research infrastructure in Nevada. The project (award no. 0447416) is directed by Dr. G. Dana. One of the focal areas in this grant is undergraduate research with Drs. M. Saiidi and J. Farley as the area leaders. Through this project approximately $1.5M is spent to fund and expand undergraduate research opportunities in NSHE over a three-year period. The grant provides students majoring in math, science, engineering, and education funds to carry out research under the direction of a faculty mentor during the academic year and summer. More details about the project are posted at:
http://www.nsf.gov/awardsearch/showAward.o?AwardNumber=0447416 .

Nevada IDeA Network for
Biomedical Research Excellence

The Nevada INBRE is supported by grant number P20 RR-016464 from the National Center for Research Resources (NCRR) of the National Institutes of Health. The goals of this 5-year project are to develop research infrastructure and resources across the state of Nevada. In addition to supporting Undergraduate Research Opportunities, the INBRE supports a Pipeline Program to bring recent high school graduates into biomedical programs at UNR and UNLV, research core facilities at UNR, UNLV, and the Nevada Cancer Institute, as well as faculty research projects at these institutions. Information about these programs and other INBRE activities can be found at our website http://www.unr.edu/inbre/.

The Research Experiences for Undergraduates (REU) site in the Department of Chemistry at the University of Nevada, Reno is supported by the National Science Foundation for the summers of 2006-2008. This program places special emphasis on participants from small four-year colleges having no graduate degree program. A primary goal of the program is to educate students who otherwise have little to no exposure to graduate degree programs about the excitement and advantages of pursuing an advanced degree in chemistry. Each summer, eight to ten students selected primarily from the Western region of the United States join students from the University of Nevada for a ten-week research experience in one of 12 available research groups spanning the areas of inorganic, organic, physical, and theoretical chemistry. The summer programs are capped-off by an Undergraduate Research Symposium which will include oral presentations from regional faculty at four-year institutions and a poster session by the REU participants.

Abstracts are listed in alphabetical order by student researcher.

Poster 1

Determining Location of Manse-DH Receptors of *Manduca sexta in* Lipid Rafts

Myung Baek, Biochemistry, UNR
Mentor: Dr. David Schooley
Program: Nevada INBRE

Abstract: A diuretic hormone (DH) controls water balance in insect. The insect has distinct mechanism to control water balance from human. In 2000, the Schooley lab published the structure of a different type of DH in adult female malaria mosquito, *Anopheles gambiae*. In this study, only CRF-like DH, Anoga-$DH_{31,}$ selects excretion of sodium ion, whereas calcitonin-like DH, Anoga-$DH_{44,}$ stimulates non-selective excretion of sodium ion. In *Manduca sexta*, two CRF-like DH, Manse-DH_{30} and 41 has been identified. In *Bombyx mori*, one calcitonin-like DH has been identified which is highly similar to Manse-$DH_{31.}$ Both the CRF-like DH and calcitonin-like DH release cAMP. It seems likely that one of the receptors is located in different portions of the plasma membrane. This experiment, through isolating basolateral membrane, investigated location of Manse-DH receptors of *Manduca sexta* in lipid raft, which is believed in the basolateral membrane. There are two ways to isolate the basolateral membrane which are Percoll gradient and sucrose gradient. To separate mitochondrial membrane and basolateral membrane to have optimal analysis of the basolateral membrane by proteomics, the Percoll gradient was performed. From differential centrifugation, the 15 k x g pellet has the least amount of protein, high activity of succinate dehydrogenase, and high amount of basolateral membranes according to a dot blot and succinate dehydrogenase activity. After the Percoll gradient, the 15 k x g pellet had high activity of succinate dehydrogenase and high amount of basolateral membranes which indicate presence of both mitochondrial membranes and basolateral membranes. Due to these facts, the basolateral membranes and mitochondrial membrane were not separated by the Percoll gradient. In the future, data obtained from the sucrose gradient will be used to be analyzed by proteomics.
Supported by NIH Grant Number P20 RR-01646412.

Poster 2

Assessing Fish Stocking Efficiencies on the Truckee River

Jason Barnes, Natural Resources & Environmental Science, UNR
Mentor: Dr. Sudeep Chandra
Program: NSF EPSCoR

Abstract: Hatchery reared trout are stocked into the Truckee River to meet prescribed management objectives related to angler demand. While stocked fish can prevent the depletion of wild trout populations by providing a buffer, they also compete for finite resources within their environment. Angler interviews are performed by wildlife management agencies in an effort to evaluate the success of a stocking program, but budget and time constraints limit the extent of such data analysis. In this project, twenty-five years of stocking records were coupled with angler interview data and analyzed in conjunction with other variables to explore the relationship between trout stocking and angler success. The results of this study attempt to provide an empirical basis for future stocking practices.

Poster 3

Visualizing Energy Flow in *Scapharca* dimeric Hemoglobin (HbI)

Benjamin Borgo, San Francisco State University (CA)
Mentors: Dr. David Leitner and Dr. Johnson Agbo
Program: Chemistry REU

Abstract: Understanding the manner in which energy flows within proteins is essential to a wide variety of applications in the fields of biology, chemistry and biophysics. Utilizing the CHARMM simulation program, we studied the flow of vibrational energy in each of the globules of Scapharca dimeric hemoglobin (HbI) alone as well as the two globule structures. The structure of HbI is a conglomorate of two identical myoglobin-like structures. The A and F helices form the interface between the two globules, and HbI cooperatively binds oxygen to its two equivalent binding sites. Cooperative binding of multimeric proteins is one of the primary concerns in molecular biology. This process has been found to depend on the cooperative motions of specific protein residues and water molecules at the interface between the two globules. The rate and pathway which the energy flows within and between the globules directly affects structural changes and the cooperative binding mechanism. Both fast and slow diffusion processes have been shown to occur in myglobin-like proteins. We identify and compare the dominant energy pathways for the fast processes (first 5 picoseconds) in monomeric globules and in the dimeric configuration and present them visually with the program Visual Molecular Dynamics (VMD).

Poster 4

Hyperoxia and Oxidative Stress during Exercise

Chris Carlson, Biochemistry, UNR
Mentors: Dr. Jeff Angermann and Dr. Mihalis Panagiotidis
Program: Nevada INBRE

Abstract: High intensity exercise under elevated fractional inspired oxygen ('hyperoxia') has repeatedly been shown to increase exercise capacity and improve sustained aerobic power in competitive athletes. Although intense exercise is known to contribute to cellular oxidative stress by increasing rates of Reactive Oxygen Species (ROS) generation, the effect of hyperoxic training on oxidative stress-generating pathways is not well described. In this study we proposed to investigate the effects of brief hyperoxic training bouts on sensitive, specific markers of oxidative stress in athletes from the Reno-Tahoe area. Subjects perform intense treadmill exercise on two separate occasions under either normoxic (21% O_2) or hyperoxic (60% O_2) conditions. The hyperoxic gas mixture is delivered to the subjects using an experimental device that utilizes the 'Douglas Bag' mixing method. Venous blood and urine samples collected before and after exercise are analyzed for biomarkers of lipid, protein, and nucleic acid oxidation. Preliminary results suggest the ability of hyperoxic gas exposure to generate ROS within a relatively short, intense exercise bout. Furthermore, the study demonstrates the effectiveness of utilizing unique and sensitive biomarkers for differentiation of ROS generated during exercise under normoxic and hyperoxic conditions. Supported by NIH Grant Number P20 RR-01646412.

Poster 5

Nanosecond-pulsed Electromanipulation of Exocytosis in Chromaffin Cells – Assessment of Adverse Effects

Marc Cerruti, Biochemistry, UNR
Mentor: Dr. Gale Craviso
Program: NSF EPSCoR

Abstract: Studies exploring the effects of nanosecond (nsec) duration, high electric field signals on biological systems form the basis for a new area of research that has the potential for the development of novel research tools and clinical strategies. Using electrically excitable adrenal chomaffin cells as a model system, I have been examining the effect of nanosecond electric pulses of high electric field intensity (5 MV/m) on the release of the catecholamines (CA) norepinephrine (NE) and epinephrine (EPI) from these cells. Pulses were delivered using a cuvette pulser supplied by researchers at the University of Southern California. For experiments, aggregates of chromaffin cells were dissociated into single cell suspensions and 50,000 cells were dispensed into standard electroporation cuvettes. CA release was quantified using high performance liquid chromatography coupled with electrochemical detection.

Dimethylphenylpiperazinium (DMPP), a selective nicotinic receptor agonist used as a positive control for stimulating CA secretion, released on average 4% of NE cellular stores and 2% of EPI cellular stores (n=11) at 5 μM. An average of 9% of NE cellular stores and 5% of EPI cellular stores (n=5) was released in response to 20 μM DMPP. Applying a single 6 nsec pulse to chromaffin cells was found to release slightly less NE and EPI than that elicited by 5 μM DMPP. The dye YO-PRO-1, which enters damaged or dead cells causing them to fluoresce, indicated that nanopulse stimulation did not cause an immediate decrease in cell viability or plasma membrane integrity. In the future, cells will be placed back into culture after pulsing in order to study any potential adverse long-term effects, such as induction of apoptosis (programmed cell death). Subsequent studies will also determine the maximal number of pulses that can stimulate CA release without causing deleterious effects.

Poster 6

Synthesis towards [4] Circulene

Matthew Chin, Providence College (RI)
Mentor: Dr. Benjamin T. King
Program: Chemistry REU

Abstract: Circulenes are closed rings consisting of benzene molecules. Such compounds are interesting because of their unique structural, spectral, and optical attributes. Since [5] circulene or corannulene is the basis of the buckminsterfullerene molecule C60 it would be interesting to see what properties other circulenes may possess including the possible formation of cylindrical fullerenes also known as nanotubes. The main goal is to reach the primary synthetic target of [4] circulene and investigate its properties. The synthetic route includes four steps which are the dimerization of starting material 1,4-naphthoquinone, the addition via an organolithium compound, the elimination of hydroxyl groups, and finally the trimerization of the previous compound with another alkyne. As compounds are synthesized along the way their properties are investigated using 1H and 13C NMR, IR, and mass spectroscopy.

Poster 7

Phenyl and Pyridine Substituted N-Heterocyclic Carbenes used as Ligands for Gold and Silver Complexes

David Chow, Western Washington University (WA)
Mentor: Dr. Vince Catalano
Program: Chemistry REU

Abstract: Metal complexes with d10 electronic configurations often exhibit luminescence properties. In d10 metal complexes, there can be metal-metal interactions. If the complex is exposed to UV light, electrons in the metal-metal bond will be excited to a higher energy orbital. Once the complex relaxes back to ground state, energy will be emitted as fluorescence. Complexes fluoresce at various wavelengths depending on the bond length of the metal-metal interaction.

Ligands can be used to build multimetallic assemblies which hold the metal atoms at various distances apart. Our lab is interested in N-heterocyclic carbene (NHC) ligands. Once the ligand is synthesized, it can then be converted to the gold complex. These NHC ligands can be used to bond to metals (in our case, silver and gold), holding the metal atoms various distances apart, with different complexes fluorescing at different wavelengths.

In different solvents, the distance between the metal atoms in metal-ligand complexes will vary; changing its luminescence. Ultimately, the goal of our lab is to create chemical sensors derived from the NHC-metal complexes. For instance, if a metal complex will fluoresce at a certain wavelength when exposed to a certain chemical, it can be used to create a sensor to detect the presence of that chemical.

Poster 8

Synthesis, Characterization, and Coordination of a Novel Series of Amino-Phosphine Ligands

Kelly Eads, Bradley University (IL)
Mentors: Dr. Brian Frost and Dr. Donald Krogstad
Program: Chemistry REU

Abstract: Bifunctional P,N ligands are extremely important for a variety of catalytic reactions; however, very few water-soluble P,N systems are known. Therefore, a new study has been undertaken to prepare a selection of amino-phosphines from the water-soluble ligand 1,3,5-triaza-7-phosphadamantane (PTA). Previous research has shown that aldehydes and ketones have been successfully inserted into the lithiated form of PTA (1,3,5-triaza-7-phosphadamantan-6-yllthium). Consequently, in an attempt to prepare new P,N ligands, PTALi was reacted with N-(4-Methoxybenzylidene)-aniline and N-Benzylidene-aniline. These ligands were characterized using ^{1}H and ^{31}P NMR spectroscopy. The ligands were found to be soluble in a wide variety of organic solvents and water. Coordination chemistry of these ligands will also be described.

Poster 9

Identifying Expression Patterns of Chromatin Insulator Components Su(Hw) and CP190 in *Drosophila* Embryos

Elizabeth Harris, Biotechnology, UNR
Mentor: Dr. Chi-Yun Pai
Program: Nevada INBRE

Abstract: Chromatin insulators have an important role in organizing chromatin in the nucleus and regulating the expression of genes. When positioned between the enhancer and promoter of a gene, chromatin insulators act as a boundary to reduce or stop the transcription of that gene. The *gypsy* insulator in *Drosophila* is a protein complex with several subunits, including Su(Hw) and CP190, that are essential for its function. The proteins bind to *gypsy* specific DNA sequences, or retrotransposons, and link two distant sequences together to form loops of chromatin. The genes in these loops are tightly compacted and inactivated.

In the first stages of embryogenesis, the two initial nuclei undergo 14 meiotic divisions before becoming individual cells with a single nucleus. Production of essential proteins begins sometime during the first four stages. The purpose of this research is to observe the expression of Su(Hw) and CP190 and their relationship to each other in *Drosophila* embryos. Green and red fluorescent proteins (GFP and RFP) are used as reporters for the expression of Su(Hw) and CP190, respectively. This allowed us to observe the proteins in the embryos without staining or using antibodies. Two fly lines were created to produce fusion proteins of the fluorescent protein and the protein of interest (Su(Hw) GFP and CP190 RFP). The fly lines were also crossed in to have embryos that expressed both CP190 RFP and Su(Hw) GFP. The information gained from this project will be useful in further research projects by showing how these chromatin insulator components act in normal *Drosophila* embryos. Supported by NIH Grant Number P20 RR-01646412.

Poster 10

Identifying Proteins Interacting with Best-3 in Mouse Heart

Steeven John, Biochemistry, UNR
Mentor: Dr. Fiona C. Britton
Program: Nevada INBRE

Abstract: Bestrophins are a family of chloride ion channels that are regulated by intracellular calcium ion concentrations. In mice there are three known Bestrophin genes that code for ion channels, Best -1, -2, -3. Bestrophins may play a significant role in regulating the electrical activity in the heart. Previous studies have shown that the Best-3 expressed chloride ion currents are generally similar to native cardiac chloride currents, but differ in voltage sensitivity and time dependence. This suggests that Best-3 is potentially regulated by other proteins. Therefore, this project will investigate what proteins form a complex with the cardiac Best-3 channels. The yeast-2-hybrid technique with a GAL4 reporter was used to test the interaction between Best-3, the “bait”, and mouse heart cDNA library, the “prey”. The cDNA library was created from total RNA isolated from the mouse heart and cloned in to the “Prey” vector. Best-3, which had been cloned previously in our lab, was sublconed in to the “bait” vector. Once the bait vector was transformed into the Y187 yeast strain (MATa) and the prey vector in to the A109 strain (MAT-), they were mated. The Diploid colonies were grown on nutrient selective plates with X-Gal. When a protein complex was formed between the Best-3 and “prey” protein, the reporter gene, X-GAL, was expressed allowing for easy identification of positive protein interactions on the plate. The plasmids were then isolated and sequenced. Supported by NIH Grant Number P20 RR-01646412.

Poster 11

Protein Glycosylation Status of *C. elegants* Mutants with Abnormal Lectin Reactivity

Anna Johnson, Biochemistry, UNR
Mentor: Dr. Patricia Berninsone
Program: Nevada INBRE

Abstract: Glycoproteins, a class of proteins modified by addition of carbohydrate residues, are estimated to comprise 50% of eukaryotic proteomes. Secreted and extracellular proteins are glycosylated during their trafficking through the Endoplasmic Reticulum and Golgi apparatus. Glycosylation gives rise to an astonishing diversity of molecules, which are essential to normal development of an organism by mediating such critical processes as cell growth, immune defense, inflammation, fertilization and parasitic infection. It is therefore not surprising that many severe human diseases arise from defective glycosylation pathways. In the research project I used the nematode Caenorhabditis elegans as a model organism. Most basic molecular mechanisms implicated in development, including glycosylation pathways, are conserved between worms and humans. The research focused on a group of surface mutations (srf) that have been previously shown to abnormally bind a lectin called wheat germ agglutinin. Lectins react with specific carbohydrates, yet the glycoprotein(s) affected in the srf mutants remain unknown. During the Summer I developed and tested a protocol for an efficient worm fractionation into different protein fractions: soluble, membrane and cuticle. To portrait the glycoprotein composition of the fractions and test the efficiency of the fractionation, the proteins of each fraction were separated by SDS-PAGE and labeled with a collection of lectins (Wheat Germ Agglutinin, Peanut Agglutinin, Helix pomatia Agglutinin and Concanavalin A) and an antibody against Phosphorylcholine. To identify glycoprotein differences between wild type animals and srf-3 mutants, I am analyzing these fractions by 2-D gel based lectin blots. These experiments constitute a platform for glycoprotein identification in a genetically tractable organism for further investigation of the role glycoproteins play in developmental and physiological processes. Supported by NIH Grant Number P20 RR-01646412.

Poster 12

Seasonal Changes in Phytoplankton Fatty Acid (FA) Composition of Walker Lake, NV

Chase Korsmo, Biology, UNR
Mentor: Dr. Sudeep Chandra
Program: NSF EPSCoR

Abstract: Currently no research has been conducted on the food quality from a FA (fatty acid) perspective on western terminal lakes. Walker Lake is a terminal nitrogen-limited lake located in western Nevada and is one of only eight large saline lakes in the world (Beutel 2001). The lakes predominant phytoplankton species is blue-green algae *Noduria spumigena*. Currently young of the year fish acquire HUFA's by eating zooplankton, which receive their FA from phytoplankton. Fisherman from the lake eat the fish from the lake. Understanding the dynamics of HUFA concentrations in the bottom of the food web (phytoplankton and zooplankton) in different seasons will be critical for understanding the nutritional status of the fish in the lake. The objective of this study is to examine how concentrations of FA change over the four seasons as well as with depth.

Poster 13

Expression of Truncated Andes Virus G1, G2, Nucleocapsid Proteins in Mammalian Cells

Peggy Ann Lugo, Biochemistry, UNR
Mentor: Dr. Stephen St. Jeor, Dr. Kelly S. Colletti, Dan Boudreaux
Program: Nevada INBRE

Abstract: Andes virus is a type of Hantavirus commonly found in South America that is responsible for Hantavirus Pulmonary Syndrome (HPS) that results in a 25-30% fatality rate. There are no vaccines and few treatments for HPS. Hantaviruses contain three negative sense RNA segments: S (small), M (medium), and L(large). The S segment encodes the nucleocapsid (N); the M segment encodes the G1 and G2 glycoproteins; and the L segment encodes the viral polymerase. Previous research has shown that G1 and G2 glycoproteins interact although the exact location of this interaction has yet to be determined. It is speculated that Nucleocapsid interacts with G1 glycoprotein and the viral polymerase. In this experiment, full length and truncated portions of the proteins were cloned and uniquely tagged. They were then expressed in order to identify locations of protein-protein interactions through a co-immunoprecipitation assay. Currently, we have successfully cloned the N-terminal end of G2, the C-terminal end of G1, and the N-terminal and middle portion of nucleocapsid. In addition, we have successfully detected expression of the N-terminal portion of the nucleocapsid using Western Blotting. Future work will involve cloning the remaining truncated proteins and their full-length counterparts. Determination of protein interactions will help in understanding the critical assembly processes required for functional virion replication. Ultimately, this will aid in the design of drugs that can inhibit viral infections thus leading to more effective treatments for HPS.

Poster 14

Preparation of PTCDI-Based and NTCDI-Based Amines and Thiols

Colleen McHugh, Chemistry, University of Dallas (TX)
Mentor: Dr. Sean Casey
Program: Chemistry REU

Abstract: Perylene-3,4,9,10-tetracarboxylic dianhydride (PTCDA) and naphthylene-1,4,5,8-tetracarboxylic dianhydride (NTCDA) are of interest in the field of organic electronics, and are utilized in conjunction with organic light emitting diodes. The goal of this research was to functionalize linker groups to serve as a covalent bridge between the perylene and naphthalene cores to semi-conductor substrates and small metal clusters. These linker groups include ethylene diamine, allylamine, cysteamine, p-phenylene diamine, and 4-amino thiophenol. The first three linker groups provide short aliphatic chains terminating in amine, alkene, and thiol groups, respectively; the last two provide molecules with aryl spacers terminating in amine and thiol groups, respectively. In order to obtain these molecules with functional linker groups, condensation reactions were completed with PTCDA or NTCDA and primary amines to yield perylene-3,4,9,10-tetracarboxylic diimides (PTCDI) or naphthalene-1,4,5,8-tetracarboxylic diimides (NTCDI). Changing the size of the core changes the visible absorption and emission ranges, while changing the terminating group allows for different linking chemistry to be explored for reactions with metal clusters and/or semiconductor surfaces. Molecules with aliphatic spacers are expected to have different electronic interactions with the metal clusters and/or surfaces than molecules with aryl spacers. The synthesis and characterization of these molecules will be further described, in addition to the interaction of several of these molecules with small silver clusters.

Poster 15

The Formation of 2-Cyclopentenone Through Gold Catalysis via 1-3 Rearrangement

Kaitlyn Miller, Seattle Pacific University (WA)
Mentor: Dr. Liming Zhang
Program: Chemistry REU

Abstract: In the realm of organic chemistry, cyclopentenones often serve as an important building block in the formation of natural compounds. However, these molecules can be somewhat difficult to synthesize. The use of gold as a catalyst in their formation has been a recent highlight in research, and has so far yielded positive results.

Via gold catalysis, efficient and mild methods for the preparation of 2-cyclopentenones with substitution on the double bond have been developed. However, these methods can not access cyclopentenones without substitions on the double bond. There is much need for preparing this type of cyclopentenone under mild reaction conditions as they can be found in a range of natural products. My research this summer has been focused on synthesizing a 2-cyclopentenone which has no substitution on the double bond using gold catalysis. By using various starting alkynols synthesized from propargyl alcohols, I have been using different gold catalysts, combined with molybdenum and vanadium catalysts, to generate a new cyclopentenone via a 1,3-rearrangement of the alcohol portion of the alkynol. Once the rearrangement has occurred, the gold catalyst can then activate the triple bond and cause a cyclization of the molecule. If successful, this will open up a whole new area of study and will allow expedient access to various cyclopentenone-containing natural products.

Poster 16

Photoisomerization of (E/Z)-2-X-9-(2,2,2)-triphenylethylidenefluorene

Clay Mishler, Manchester College (IN)
Mentor: Joseph Cline
Program: Chemistry REU

Abstract: As part of the research group under Dr. Joseph Cline, the main focus this summer was the photoisomerization of (E/Z)-2-X-9-(2,2,2)-triphenylethylidenefluorene, where the "X" stands for various substituents. This molecule has been affectionately dubbed the "motor molecule". Isomerization occurs around the ethylenic double bond, and as the molecule is sterically coordinated, rotation happens in one direction, causing behavior similar to a stepper motor.

The main focus of the research this summer was to observe the effects of various substituents on the efficiency of the photoisomerization. These substituents, which were connected to the bibenzofulvene portion of the molecule were: CN, I, NO_2, NH_2, pyrrole, and *t*-butyl. Particular substituent groups appear to photoisomerize better than others.

Another major area of study was the effect of different wavelengths of light on the various substituted motor molecules. The light was delivered by a dye laser pumped by a Nd: YAG laser. The effects of the irradiation were observed through HPLC (High Performance Liquid Chromotography), UV-Vis spectroscopy, and fluorimetry.

Additionally, specially designed computer programs were used to fit the data and determine quantum yields associated with irradiation experiments. Molecular modeling was also used in an attempt to determine why photoisomerization occurs with some substituents but not others.

Poster 17

Long Term Impact of Participation in a Middle School Girls Math and Technology Program

Stephanie Murphy, Educational Specialties, UNR
Mentor: Dr. Lynda Wiest
Program: NSF EPSCoR

Abstract: The Northern Nevada Girls Math & Technology Camp held annually at the University of Nevada, Reno is a five-day residential program designed to address underrepresentation of women in STEM (science, technology, engineering, and mathematics) fields by providing a single-sex, out-of-school intervention program for middle school girls. The camp aims to support and encourage girls in mathematics and technology at a critical juncture by improving content knowledge, attitudes, and career awareness, in addition to providing networking with other girls and female staff members. Previous studies (e.g., Wiest, 2004) investigated the impact of this summer camp on girls' attitudes and perceived abilities at camp entrance, exit, and several months later. Through individual, semi-structured interviews with girls who participated in the program four to five years earlier, this study investigated the long-term impact of this summer program on girls' attitudes, perceived abilities, and future career choices, as well as a retrospective evaluation of the camp's strengths and weaknesses, in order to attempt to identify key issues, barriers, and supports that shape and influence personal mathematics/technology-related decisions. Data were analyzed using HyperResearch qualitative research software by repeatedly reviewing data and assigning participant comments to conceptual categories further analyzed for broader themes. Data were examined as a whole, by racial/ethnic and socioeconomic subgroups, and by number of years of participation in the program.

Poster 18

Investigating Viscoelastic Properties of a Mucus Simulant for Biomedical Application

Simon Pinsky, Biology, UNR
Mentor: Dr. Alan Fuchs
Program: Nevada INBRE

Abstract: In the human airway and lung a thin layer of mucus normally coats the tissues, this mucus is generally forced upward by cilia in the airway and is then swallowed to prevent airway blockage. In sick patients, especially those with cystic fibrosis, and chronic obstructive pulmonary disease (COPD) this layer of mucus becomes very thick and viscous making it much more difficult to clear, and can have a significant effect on airway flow resistance. The clearance problems are directly related to the material properties of the mucus, specifically, the viscosity and elasticity.

Our research focused on the development of a mucus simulant that would achieve the optimal viscosity and elasticity to facilitate the greatest displacement in airway clearance.

Previously we synthesized simulants using bean gum, a long-chain galactomannan biopolymer, and sodium tetraborate ($Na_2B_4O_7$) which served to cross link the locust bean gum creating a viscoelastic gel. Now we have expanded our research into other long-chain biopolymers like xanthan, guar, and acacia gums all of which are structurally similar to locust bean gum. Simulants using various concentrations and combinations of each gum were synthesized and tested on a rheometer for viscous and elastic moduli. Simulants were also tested on a rigid lung airway model to measure displacement with 1 second air bursts to simulate a cough.

Poster 19

Behavior and Testing of Small Scale Columns Under Combined Action Loading

Tiffany Reichert, Civil and Environmental Engineering, UNR
Mentor: Dr. David Sanders
Program: NSF EPSCoR

Abstract: Bridge columns are subject to movement in multiple dimensions during a seismic event, but research on the effect of these movements has previously only been performed in uni-axial directions. Industry design practices neglect combined action loading effects predominantly due to a lack of experimental data available. Previous studies performed bi-directionally utilized slow testing. When dynamic testing was utilized, columns were typically tested uni-axially. By performing bi-directional testing on columns, it can be determined how full interactions from multiple directions impact the performance of bridge columns. Under an existing research project, a bi-directional mass rig (BMR) has been designed by University of Nevada, Reno (UNR) doctoral student Juan Arias. This mass rig is capable of testing columns of approximately 16 inches in diameter. The objective of this study is to verify the large-scale test setup and basic loading protocol with small scale bridge columns by using a small scale BMR.

Poster 20

Properties of Pacemaker Activity and Neural Innervation of the Murine Female Reproductive Tract

Melissa A. Rivera, Biochemistry, UNR
Mentor: Dr. Sean M. Ward and Rose Ellen Dixon
Program: Nevada INBRE

Abstract: Oviducts are smooth muscle lined tubes which connect the ovaries to the uterus. The smooth muscle of oviducts display spontaneous coordinated contractile activity, which along with cilia beating and epithelial secretions aid in the propulsion of the ova from the ovary to the site of fertilization at the ampullary-isthmic junction (AIJ). Following fertilization, smooth muscle contractions and epithelial secretions are also thought to be entirely responsible for the transport of the fertilized egg from the AIJ along the relatively unciliated isthmic portion of the oviduct to the uterus. The coordinated contractile activity of oviductal smooth muscle is therefore vital for normal fertility however, as yet, it is not understood how these contractions direct ova movement along the oviduct, how female hormones modulate this contractile activity or how nerves that innervate the ova regulate the contractile activity at different regions along the duct.

The aims of the present study were to examine (i) the spontaneous mechanical activity at different regions along the oviduct; (ii) examine how the female hormones 17β-estradiol and progesterone modulate contractile activity and (iii) how stimulation of nerves within the oviduct wall modulate smooth muscle excitability.

The present study demonstrates that there is (i) a gradient in spontaneous mechanical activity along the oviduct from the ampulla to the isthmus regions and this activity (ii) is modified by the exogenous application of female hormones. (iii) Simulation of nerve endings within the oviduct wall using electrical field stimulation causes the release of an inhibitory neurotransmitter that inhibits oviduct contractile activity. The identity of the inhibitory neurotransmitter is currently under investigation.

The findings of this study reveal that the spontaneous contractile activity that is involved in egg movement is highly coordinated and is modulated by hormonal and neuronal influences. The identity of the neurotransmitter involved in inhibition of mechanical activity and likely egg movement could prove significant in several clinical disorders that lead to infertility and ectopic pregnancy. Supported by NIH Grant Number P20 RR-01646412.

Poster 21

Characterizing the effect of sucrose on actin-myosin interaction

Karolina Siwinska, Biochemistry/Nutritional Science, UNR
Mentor: Dr. Josh Baker
Program: NSF EPSCoR

Abstract: Fine control of muscle force is central to the normal function, adaptation, and development of most musculoskeletal and organ systems. Muscle force is generated through the cyclic adenosine triphosphate (ATP) hydrolysis reaction between actin and myosin molecules. In this reaction, force is thought to be generated in the weak-to-strong binding phosphate release step. Steps of the reaction can be modulated by varying conditions and chemical exposures to ultimately alter muscle contraction. Previous studies have demonstrated that viscous solutes, such as sucrose, can be used to slow actin sliding velocity in in vitro motility assays. The mechanism for the inhibitory effect of sucrose on actin-myosin interaction remains unclear, however. Possible explanations include sucrose affects actin-myosin interaction by imparting a viscous load or by altering the activity of water in the actin-binding cleft of myosin. In this project, sedimentation binding assays were used to study how viscous solutes affect the weak-to-strong binding transition in the actin-myosin ATPase cycle. Use of the sedimentation binding technique supplements previous data obtained from motility studies. Together, these techniques advance development of a high throughput screen for other conditions causing molecular modification of muscle force, thereby facilitating development of therapies for diseases affecting smooth or skeletal muscle, such as asthma and cardiovascular disease.

Poster 22

Syntheses, Characterization, and Coordination Chemistry of a new iminophosphine compound

Travis Sunderland, Concordia College (MN)
Mentor: Dr. Brian Frost and Dr. Don Krogstad (Concordia College)
Program: Chemistry REU

Abstract: Water soluble phosphine compounds have received increased attention in recent years because of their role in green chemistry. More specifically bifunctional ligands involving phosphorous and nitrogen atoms are garnering interest because of their ability to create a chelating system with metal complexes. This is beneficial because it can create an open coordination site for catalysis to occur. A new iminophosphine ligand has been created by reacting PTALi with 4-methoxybenzonitrile under nitrogen atmosphere in THF. The resulting compound was isolated and characterized by IR and NMR spectroscopy. The new iminophosphine ligand was then coordinated to a tungsten compound in two different ways. The ligand was first reacted directly with W(CO4) pip2 under nitrogen environment in dichloromethane under refluxing conditions. Two different products were obtained based on the duration of the reflux. The resulting complexes were characterized by IR and NMR spectroscopy, and additionally by X-ray diffraction. Secondly, the new P,N ligand was reacted with W(nbd)(CO4) under nitrogen environment in dichloromethane while refluxing The resulting complex was characterized by IR and NMR spectroscopy. A discussion of these and other results will be presented.

Poster 23

Establishment of a Slow-growing Renal Cell Carcinoma Model in vivo

Nicholas Tschernia, Biochemistry, UNR
Mentor: Dr. William Murphy
Program: NSF EPSCoR

Abstract: Current tumor models are flawed in that, *in vivo*, they progress quickly which may limit the accuracy of conclusions drawn from experimental treatment. Therefore, a tumor line which advances over the long term may allow for the study of treatment in a more relevant model. To examine the potential benefit of a slower growing tumor, we used a renal cell carcinoma which was induced by the mouse carcinogen, streptozotocin. Streptozotocin-induced renal cell carcinoma (SIRCC) can be found in roughly 20 different variations, each with slight differences in the rate of tumor growth and metastasis. Studies have shown these SIRCC cell lines progress, on average, over the course of 60-80 days *in vivo*. We hypothesized that the establishment of a slower growing tumor model would be more relevant to study the efficacy of our immunotherapy models as it allows for examination of therapy during long term growth, more accurately mirroring the growth pattern of many human cancers. Therefore, we tested a dose response for this tumor model. Two different SIRCC lines were injected *in vivo*, each at a similar dose. The lines were found to progress much slower than the currently used model for renal cell carcinomas in our lab, RENCA, as the survival of SIRCC bearing mice was >3 times longer than what is normally observed for RENCA bearing mice. Further *in vitro* analysis may help determine potential differences between the SIRCC lines and RENCA tumor cell line. These results may be able to be used as baseline observations for future experimentation with the SIRCC line in our lab.

Poster 24

Co-expression of *Hevea* Cis-prenyl Transferase II and Rubber Elongation Factor in *Eschericia Coli*

Joseph Evan Villaluz, Biochemistry, UNR
Mentor: Dr. David Shintani
Program: NSF EPSCoR

Abstract: Natural rubber is an important carbon polymer used in everyday materials. Intrinsic properties such as its ability to maintain structural integrity under high temperature and pressure make it ideal to use as a component in synthetics as well as a pure material. Rubber has applications ranging from insulators, medical catheters, to airplane/car tires in addition to other rubber synthetics. These extensive uses of natural rubber have placed a stress on world rubber supplies and have subsequently stimulated interest in alternative methods for its production.

While natural rubber (cis-1,4-polyisoprene) is an important industrial plant commodity, little is known about the enzymatic machinery involved in rubber synthesis. However, several lines of evidence suggest that two proteins, the cis-prenyltransferase (CPT) and the rubber elongation factor (REF), may together be required for rubber biosynthesis. Recent substrate analog photoaffinity labeling studies performed in the Shintani lab have shown that the *Hevea* CPT and REF both interact with rubber biosynthetic precursors and are also in close physical proximity to each other. Based on this and other information, we hypothesize that CPT and REF are both required for rubber biosynthesis. We are therefore in the process of testing our hypothesis by developing a coexpression system involving both CPT and REF in a single *E. coli* strain to determine whether the co-expressing strain is capable of producing rubber.

Poster 25

Analysis of endocrine disrupting compounds in surface water

Jackson Webster, Civil and Environmental Engineering, UNR
Mentor: Dr. Edward Kolodziej
Program: NSF EPSCoR

Abstract: In recent years there has been considerable interest in endocrine disrupting compounds (EDCs) in natural waters. EDC's such as steroid hormones can cause physical and reproductive abnormalities, decreased fecundity, and even population collapse in fish species. Despite their ecological risks, the fate and transport of steroids suspected of endocrine disruption in the environment is unclear. To address this issue, an analytical method capable of quantifying steroids in surface waters at low (ng/L) concentrations is needed. This research project focuses on the process optimization of both the extraction of 17β-trenbolone from surface water and the subsequent derivatization of the compound. The analytical methods are based upon adapting recently discovered analytical methods applied to veterinary tissue analysis to surface water matrices from water for steroid detection at ng/L concentrations. Solid phase extraction of the steroid uses C18 solid phase extraction cartridges followed by Florisil cleanup to reduce matrix interferences. Once the steroid has been isolated the molecule is stabilized by derivatizing with MSTFA-I_2. The stabilization of the trenbolone molecule is critical for preventing fragmentation during GC/MS analysis. The research conducted suggests that MSTFA-I_2 is viable as a derivatization agent, though evidence of isomerization yielding two chromatographic peaks is yet to be reconciled. Once fully validated, samples will be analyzed from surface waters surrounding point and non-point sources of steroids to assess the occurrence, transport and fate of these compounds in aquatic ecosystems.

Poster 26

Synthesis and Characterization of Two New NHC's and their respective Au(I) Complexes

Jennifer Weinzettel, College of St. Scholastica (MN)
Mentor: Dr. Vince Catalano
Program: Chemistry REU

Abstract: Metallophillic interactions can occur with several heavy metals, but aurophilicity specifically refers to interaction between gold(I) –gold(I) atoms. It has become apparent that these complexes will form short and weak bonds, which can then be classified by their luminescent properties due to the fact that luminescence can be observed in multinuclear complexes which contain d10 electron configurations.

The Catalano group is exploring N-Heterocyclic Carbene (NHC) ligands and how they support the construction of multimetallic systems. With NHC ligands, the two amino groups aid in the stabilization of the nonbonding electrons on the carbene atom they surround. NHC ligands have a great ability to form strong metal ligand bonds due to their nucleophilic strength and Lewis basicity. Several [Au(NHC)]+ luminescent complexes have been made and characterized already, and an overarching goal is to use their luminescence to report any kind of secondary action. As a result, alterations of different NHC ligands must be compared to explore each one's role in altering the luminescent behaviors.

Herein I report the synthesis and characterization of two ligand precursors which will be used to find their respective Au(I) complex properties: CH3imCH2PyCOOCH3 and CH3im(CH2)2N(PyCOOCH3)2.

Poster 27

An unnatural amino acid based on the tetraphenylporphyrin moiety

Julia Wildt, Taunvsschule Koenigstein (Germany)
Mentor: Dr. Jason Shearer
Program: Chemistry REU

Abstract: The goal of this research is to synthesize unnatural amino acids containing porphyrin derivatives. These will be utilized in synthetic and semi-synthetic proteins to expand their function beyond what would be capable using the 20 natural amino acids. We have chosen porphyrin groups because of their ability to bind metals with a charge of +II or +III which posses catalytic activity, their photochemical properties, and the wealth of well established synthetic routes to prepare unnatural porphyrins. The unnatural amino acid will be based on the the meso-Tetraphenylporphyrin (TPP) motif. TPP is synthesized by refluxing benzaldehyde and pyrrol in propionic acid. The obtained crystals are nitrated at the para-position of one of the phenyl group forming p-nitrophenyl-triphenylporphyrin. This is necessary to enable the reduction of the NO2-group into the NH2-group. The nitration is effected by the reaction with TPP and fuming HNO3 in chloroform. After working up the product and purification by column chromatography, SnCl2 in HCl is used to reduce the NO2-group. To achieve the unnatural amino acid, para-aminophenyl-triphenyl porphyrin will be reacted with the symmetrical anhydride of

N-Fmoc(tBu)-glutamic acid, forming an amide between the NH2 group on the porphyrin and the COOH group of glutamic acid. The ester group will be de-protected by the acidic treatment of the amino-acid with trifluoroacetic acid. This molecule can coordinate a metal ion in its N4-cavity. The first protein this amino-acid will be incorporated into will be a small zinc-finger protein (ZnFP), which can specifically bind DNA. The porphyrin will be used to form singlet O2 upon photoexcitation in aerated aqueous solutions, thus allowing for site-specific DNA cleavage.

Poster 28

Expression of Stilbene Synthase 2 during Grape Berry Development

Senny Wong, Biochemistry, UNR
Mentor: Dr. Grant Cramer
Program: Nevada INBRE

Abstract: Resveratrol is a phytoalexin belonging to the polyphenolic compounds family found in grapes and has been shown to exhibit a wide range of biological effects, such as antioxidant properties, anti-cancer, anti-inflammatory, longevity and many other health benefits. This compound is produced in grapes under microbial infection, ultraviolet radiation, and exposure to ozone. Resveratrol is produced by the enzyme stilbene synthase. The aim of this project is to assess the expression of one of the stilbene synthases (stilbene synthase 2, STS2) present in grapes throughout its development. In addition the effect of water deficit on the STS2 gene expression would be estimated. Two varieties of grapes were tested, a red grape cultivar, Cabernet Sauvignon, and a white grape cultivar, Chardonnay. Berries were harvested every two weeks throughout the berry development. Reverse transcriptase polymerase chain reaction (RT-PCR) was done with total RNA extracted from the berries to quantitate messenger RNA abundance of stilbene synthase 2. Preliminary data indicated that total RNA extracted from grape berries was of good integrity. RT-PCR revealed the presence of a PCR product that exhibited the right size fragment for the samples, which indicated that primers were of good design. A gene encoded for ankyrin, previously used in the lab as a control, produced a strong quantitative signal. Altogether, a measurement of the expression of stilbene synthase 2 gene would allow us to determine which cultivar expresses the highest amount of this enzyme and what level of irrigation would have the best affect on gene expression and to potentially increase the amount of resveratrol in grape berry. Supported by NIH Grant Number P20 RR-01646412.