The McNair Journal is the official journal of the Ronald E. McNair Scholars Post-Baccalaureate Achievement Program at the University of Nevada, Reno. The program is designed to provide research opportunities and other related academic experiences that promote the acquisition of the doctoral degree (Ph.D.) for first generation, low-income and underrepresented college juniors and seniors. The McNair program is federally funded at $231,000 per year. The program was created by Congress in an effort to increase the number of underrepresented persons pursuing teaching, research and administrative careers in higher education.

Acknowledgments

A very special thank you to the University of Nevada, Reno Graduate School for their generous & invaluable support of the McNair Scholars Program! We are also thankful for faculty and administrators on the UNR campus who supported this program. Faculty mentors fill the most important role in guiding scholars to success.

For eligibility requirements and information on the application process, please visit our website at www.unr.edu/stsv/saos/mcnair or stop by the TRiO Office located in Suite 101 of the Thompson Building.
“Whether or not you reach your goals in life depends entirely on how well you prepare for them and how badly you want them.”

-Ronald E. McNair, Ph.D.

Table of Contents

Foreword, Background and Program Overview ........................................ iii

Amy Carl Influence of beaver impoundments on stream health .................. 1

Alex Farkas The influence of electrical charge on the mechanical properties of metals . 2

La Kesha Farmer Release of Soluble Nucleotidases by the Sympathetic Nerves of the Rabbit vas Deferens: Modulation by the Sodium Orthovanadate .................... 3

Nalleli Herrera Safety Implications and Driver’s Understanding of Special Time-of-Day Protected/Permitted Left-Turn Signal Display in Las Vegas ......................... 4

David Hillis Seismic Modeling of Bridge Components with Conventional and Innovative Design ................................................................. 5

Conrad Kiyoshi The role of the protein chaperone calnexin in the secretory pathway of Caenorhabditis elegans: an RNAi approach ........................................... 6

Mebrat Mebrahtu Netrin Regulates Longitudinal Axon Guidance .................. 7

Mark Rincon Evaluating Water Usage and Water Rights in the Kings River Valley, Nevada using Geographic Information Systems ........................................ 8

Leticia Rodríguez Evolving Origins of Crassulacean Acid Metabolism in Tropical Orchids 9

Ashley Rolfe The Influence of Olfactory Cues on the Seed-Harvesting Behavior of Merriam’s Kangaroo Rats (Dipodomys merriami) ........................................... 10

Patricia Piedad-Segura Political Implications When Chemical Warfare is Used or Threatened to be used for Nonwarfare Purposes ......................................... 11

Gene Wong Synthesis and Characterization of Novel Phosphines PTA-Li & PTA-PPh₂ .... 12

Foreword:

It is my great pleasure to introduce the second edition of the University of Nevada, Reno McNair Scholars Journal. Our program is named for astronaut and Challenger crew member Ronald E. McNair who exemplifies the potential of underrepresented students to reach the highest rungs on the ladder of academic achievement. The purpose of our McNair program is to assist undergraduate students from backgrounds that are traditionally underrepresented in graduate school to prepare for the pursuit of a doctoral degree. The foundation of the program is based on the services provided by our academic mentors who guide scholars through the development, execution, and presentation of a substantive research project. The research papers published in this second edition of the McNair Scholars Journal are the product of the strong collaborative relationships between our scholars and their academic mentors. Our McNair Scholars are preparing to become part of a highly educated generation that will contribute to a prosperous future for our country; they will also serve as role models and mentors for those who follow in their footsteps. I would like to acknowledge the scholars whose papers were selected for publication and offer my most sincere thanks to our academic faculty who have given so generously of their time and talent to mentor our scholars. I am happy to report that our program was selected for an additional five year funding cycle beginning in October of 2008. Congratulations to all who have contributed to the success of our scholars and our program.

Rita Escher, Director
Director of Academic & Opportunity Support Services

Background:
The purpose of the Ronald E. McNair Post-Baccalaureate Program is to encourage undergraduates from backgrounds that have been historically underrepresented in university faculty and research professions to pursue doctoral degrees. The federally funded program is in its fifth year at the University of Nevada, Reno. Dr. Ronald McNair, whose journey to become an astronaut inspires all who seek to achieve ambitious dreams, is a fitting namesake for the program. Although Dr. McNair died in the explosion of the Challenger space craft, his strong message of self determination still resonates with those who strive for excellence.

Program Overview:
The foundation of the McNair Scholars Program is the summer research institute. For seven weeks, scholars engage in research projects closely guided by academic faculty mentors. For many students, the summer institute provides their first experience conducting original research and their first opportunity to work closely with a faculty mentor. The relationship forged between scholar and mentor can be the most significant academic connection that a scholar makes at the university. In addition to conducting research, scholars also take part in GRE preparation workshops during the summer institute. During the academic year, scholars participate in McNair seminars that assist them to complete competitive graduate school applications and provide information related to financing graduate education. Scholars attend national McNair conferences where they present their research and connect with other scholars and faculty from across the country. Scholars receive a $2,800 research stipend, waived application fees, and GRE fee waivers. The greatest benefits, though, are not financial. The McNair program enables scholars to form lasting bonds with fellow scholars and with academic mentors. These relationships allow scholars to see themselves in roles they might not otherwise have considered possible such as professors, researchers, and administrators in institutions of higher education.
Amy Carl

Mentor: Dr. Sudeep Chandra & Chris Jannusch

Major: Wildlife Ecology and Conservation

Research Topic: “Influence of beaver impoundments on stream health”

Amy Carl is a Wildlife Ecology and Conservation major from Woodfords, California. Her research was conducted in the Toiyabe Mountain Range in central Nevada and was done in conjunction with her work experience while she was employed with the Aquatic Ecology and Limnology Lab on campus. Amy worked in the Limnology Lab for one and a half years as a water chemist and was an active member of the Great Basin Invertebrate Team. Her main investigation was the influence of water chemistry on aquatic invertebrate communities. She also worked investigating CO₂ enrichment on Great Basin flora at the Plant Ecology Lab at the University of Nevada, Reno. She graduated with a bachelor's degree in December of 2007 and is currently employed as a biologist and technical writer for an environmental resources consulting firm. Amy presented her research at the 2007 Undergraduate Research Poster Conference held at the University of Nevada, Reno campus.

ABSTRACT

Benthic macroinvertebrate (BMI) communities and water chemistry data were collected at sites above and below two beaver impoundments in Big Creek, in the Toiyabe Mountain Range of central Nevada. The purpose of this research was to characterize the impact of geomorphologic disturbances created by beaver impoundments on stream health. Stream health was assessed by estimating the level of organic pollutants in reaches of Big Creek above and below beaver impoundments using Hilsenhoff’s Family Biotic Index (FBI). Using this index family level invertebrate taxa are assigned tolerance values from 0 to 10 (intolerant to tolerant). Healthy streams are generally comprised of intolerant assemblages of invertebrates. FBI data revealed slightly impaired stream condition downstream of beaver impoundments (at α =0.10). In addition site specific diversity, dominance values, and distribution of functional feeding groups suggests slightly impaired stream health downstream of beaver impoundments. The findings of this research appear to be due to the greater abundance of pollution intolerant species at upstream sites compared to downstream sites rather than the presence of pollution tolerant species downstream of impoundments.
Alex Farkas

**Mentor:** Dr. Timothy Darling  
**Major:** Electrical Engineering  
**Research Topic:** “The influence of electrical charge on the mechanical properties of metals”

Alex Farkas was born in Hawaii, raised in Fairbanks, Alaska and came to the University of Nevada, Reno in the spring of 2005 to pursue his B.S. in Electrical Engineering. He successfully presented his research on the Mechanical Properties of Charged Materials at the 2007 national McNair Conference in Buffalo, New York. Among other accomplishments, Alex has received several scholarships including a departmental award for electrical engineering, the Nevada Spacegrant scholarship, a NSF-EPSCoR grant, and is an officer for the UNR Student Branch of the Institute of Electrical and Electronics Engineers. Alex is working closely with University research professors in the physics department and is also employed on campus at the Nevada Terawatt Facility. Alex will be continuing his research and academic studies in a Master's program upon completion of his bachelor's degree in the spring of 2008. In his spare time Alex enjoys playing the guitar, soccer, and ultimate frisbee.

**ABSTRACT**

This experiment will attempt to investigate the effect of free charging a spherical conductor through changes in its natural vibration frequencies. In pulsed power experiments at the Nevada Terawatt Facility, wires achieve a state of high charge over the course of a few nanoseconds. In this timeframe, it is unclear what state transitions the wires undergo, if any. This experiment may shed light on this process. The measurement technique employed in this experiment will be resonant ultrasound spectroscopy (RUS). RUS is capable of detecting minute changes in resonant frequency, which are a function of elastic constants, and influenced by the distance and restorative force between adjacent atoms. As the conductor is charged, its atomic structure will undergo an expansive effect, due to electrostatic forces. This expansion will change the resonant frequencies. Because charges reside at the surface of the conductor, it is expected that Rayleigh waves will be affected more dramatically than normal vibrational modes. The results of this experiment suggest that charging the conductor has an effect on the third order elastic constants of the system. Additionally, distinct differences between the response of the conductor at high frequencies and low frequencies were observed.
La Kesha Y. Farmer

Mentor: Dr. Svetlana Mihaylova-Todorova

Major: Biology

Research Topic: “Release of Soluble Nucleotidases by the Sympathetic Nerves of the Rabbit vas Deferens: Modulation by the Sodium Orthovanadate”

LaKesha Farmer is an ambitious, dedicated, and resourceful student from Reno, Nevada. Some of the extracurricular activities in which LaKesha was involved on campus include the Student Nutrition Association, the Phi Kappa Phi Honor Society, Delta Iota Epsilon and the Golden Key International Honor Society while working at Renown Regional Medical Center. She presented a paper at the 15th Annual California McNair Scholars Symposium in Berkeley, California in the summer of 2007, and she has maintained a 3.97 GPA through her years at UNR.

ABSTRACT

The purpose of this study was to determine whether sodium orthovanadate interferes with the activity or the release of soluble ATPases from the sympathetically innervated rabbit vas deferens. Isolated rabbit vas deferens was maintained under superfusion and the release of soluble enzyme was evoked by the application of electrical field stimulation (EFS). ATPase activity of the collected enzyme samples was tested using etheno-ATP as substrate and the metabolic products of the reaction were quantified by HPLC with fluorescent detection. Our data demonstrate that EFS increases the release of soluble enzyme by five fold. ATP and ADP were metabolized, while AMP was not. Sodium orthovanadate (SOV) at 1mM inhibited the ATPase activity by 14.7±3.7% and the ADPase activity by 8.4±2.7%. On the other hand, when applied to the solution superfusing the rabbit vas deferens SOV (1mM) significantly increased (p<0.0001, ANOVA) the activity of the collected samples suggesting that the release of enzyme was increased. In conclusion, SOV could facilitate the release of soluble ATPases by the sympathetic nerves of the rabbit vas deferens, while slightly inhibiting their enzymatic activity.
Nalleli Herrera

Mentor: Dr. Zong Tian
Major: Civil Engineering
Research Topic: “Safety Implications and Driver’s Understanding of Special Time-of-Day protected/Permitted Left-Turn Signal Display in Las Vegas”

Nalleli Herrera is a Civil Engineering major who came to UNR from Las Vegas, where she attended a vocational high school. A Millennium Scholar, during her first year of college she received an engineering scholarship as well as the Taormina Memorial Civil Engineering Scholarship during the past three years. Nalleli is not merely focused on her schoolwork, however; she also served as Vice President of the Society of Women Engineers, for which she previously held the offices of Treasurer and Historian. Nalleli was also Treasurer for Engineers Without Borders, and has been involved in the Society of Hispanic Engineers and the American Society of Civil Engineers. She presented her research during the summer of 2007 at the 13th Annual McNair Research Conference at the University at Buffalo in New York. In order to attain her dream of working on the next Biosphere project, Nalleli is pursuing a Master’s degree in Civil Engineering at the University of Nevada, Reno.

ABSTRACT
A comprehensive assessment of the special time-of-day protected/permitted left-turn control display being used in Las Vegas was performed considering drivers’ understanding and safety implications. Driver understanding was assessed through an in class survey and safety implications that may be presented by the display were assessed through the collection of onsite traffic data and crash data. The study results indicate that the time-of-day display being used in Las Vegas is well understood by drivers. Also, there was inconclusive data to indicate that the safety implications presented by the Las Vegas display are cause for concerns.
David G, Hillis, Senior

Mentor: Dr. Saiid Saiidi

Major: Civil and Environmental Engineering

Research Topic: “Seismic Modeling of Bridge Components with Conventional and Innovative Design”

David Hillis is the third McNair scholar at the University of Nevada, Reno to enroll in a Ph.D. program and is currently pursuing his doctorate in Civil Engineering. His previous research experience includes involvement in numerous graduate students’ research projects and in FRP restrainers. He is the recipient of many honors and awards including Engineering Student of the Year in 2005, Outstanding Officer of Phi Theta Kappa Honors Society, and was on the Dean’s list every semester in college. David presented his research at the Undergraduate Research Poster Conference held at the University of Nevada, Reno campus in 2007 and attended the 14th Annual California McNair Scholars Symposium at the University of California at Berkeley in 2006.

ABSTRACT

The placement of Shape Memory Alloy (SMA) bars in the plastic hinge region has been shown to reduce residual displacement in reinforced concrete (RC) columns under cyclic loading (O'Brian, 2006) and has been observed under large scale dynamic testing (Wang, 2005). Using the computer modeling program Open System for Earthquake Engineering Simulation (OpenSees) various models were created to simulate a large scale RC columns under dynamic loading. The first specimen was to simulate a conventional construction column, using standard rebar for longitudinal reinforcement. The second model simulates the longitudinal reinforcement being replaced with SMA. This poster presents the analytical approach, typical model results, and discusses the implications of the use of innovative materials.
Conrad Kiyoshi

**Mentor:** Dr. Patricia Berninsone

**Major:** Cell & Molecular Biology

**Research Topic:** “The role of the protein chaperone calnexin in the secretory pathway of *Caenorhabditis elegans:* an RNAi approach.”

Conrad Kiyoshi is a Cell and Molecular Biology major with an immense interest in cancer development. He came to the University of Nevada, Reno after completing high school in the Northern Marianas Islands of the western Pacific Ocean. While at UNR Conrad was involved in many academic clubs and honor societies as well as a volunteer with the pediatric intensive and critical care units at Renown Regional Medical Center. He also worked in a lab on campus studying *C. elegans*, a model organism for understanding how cellular processes of glycosylation affect neural development and protein trafficking, which could possibly be applied to understanding various disorders. His goal is to one day work as a medical scientist and further contribute knowledge to cancer research and to also contribute to communities in which members are unable to afford healthcare. Conrad presented his research at the 13th Annual McNair Research Conference at the University at Buffalo in New York in 2007.

**ABSTRACT**

Calnexin is a membrane-bound protein chaperone involved in quality control of glycoproteins. In the nematode *Caenorhabditis elegans*, mutations of calnexin, and its homologue calreticulin, do not seem essential as the organisms and their progeny are viable in unstressed conditions. The goal of this study is to investigate the effects of reducing expression by RNAi feeding of *sel-9*, a p24 gene, which has been implicated in protein trafficking, on calnexin and calreticulin mutants. We found that RNAi against *sel-9* induced different phenotypic effects on the calnexin and calreticulin mutants. This indicates a difference in glycoprotein selection in quality control where the mechanisms in selection are unknown.
Mebrat Mebrahtu graduated with a Bachelor of Science in Biology from the University of Nevada, Reno in the spring of 2007. She comes from a large family of 12 brothers and sisters and is one of only two siblings to come to the United States from Mekelle, Ethiopia. After successfully completing her degree in four years and research for McNair in 2007, Mebrat was accepted into Pharmacy school at Oregon State University. She will receive her Pharm.D. in 2011 and plans to one day earn a Ph.D./M.D. to be able to do more for her family than if she had stayed in Ethiopia. She presented her research in 2007 at the Nevada Undergraduate Research Symposium held at the University of Nevada, Las Vegas.

ABSTRACT

The growth of axons to their target is believed to be guided by the diffusible chemotropic factors produced by target cells. There are two types of axonal growth, longitudinal and commissural. Commissural axons grow towards the midline and cross the midline to connecting the two sides of the Central Nervous System (CNS). Commissural axons have been studied extensively and these studies have led to the discovery of numerous essential guidance cues, and to the understandings of their mechanism at a cellular and molecular level. On the other hand, the second type of axon is the longitudinal axons that grows longitudinally towards the anterior brain or posterior spinal cord, eventually connects areas within the CNS. The majority of long axons projections in the CNS are forms of longitudinal axons. However, when it comes to the guidance mechanism, much less is known about longitudinal axon pathways. One of the most known cues or protein in the field of axon guidance is Netrin. Previous studies revealed Netrin-1 and Netrin-2 have out growth-promoting activity for commissural axons. To investigate the role of Netrin in longitudinal axon guidance we performed chick embryo electroporation and antibody labeling. Our study shows that Netrin is involved in the guidance of the first longitudinal tracts of the brain.
Mark Rincon

Major: Geography

Faculty Mentor: Dr. Kate Berry

Research Topic: “The History of Irrigating the Kings River Valley, Nevada Using Geographic Information Systems”

Mark Rincon is a Geography major originally from Chino Hills, California. During his undergraduate studies Mark worked part-time at the Desert Research Institute as a GIS technician, where he was able to do a lot of research that lead him to pursue his interest in Geographic Information Systems (GIS). Some of Mark’s scholarships and academic accomplishments include the Gignoux Family Mining Memorial Scholarship and the John W. Mackay 2007 Awards Banquet Winner for Best Undergraduate Paper for which he submitted his McNair Research project. Some of his career goals include teaching Geography or working in a non-profit agency that specializes in research development of protection for natural habitat and environmental resources in the United States. Mark will enter a Master’s Degree program in Geography at California State University, Chico in the fall of 2008.

ABSTRACT

The goal of this research project is to evaluate the history and geography of water usage and water rights in the Kings River Valley during the 20th century. The Kings River Valley is located northwest of Winnemucca, Nevada and is primarily in Humboldt County. Before the 1950’s, the Kings River Valley was mainly a sheep and cattle ranching area, though this has changed. More specifically since 1956 ranchers have developed irrigated croplands within the valley. In this project Geographic Information Systems (GIS) is developed to analyze change over time in water usage and water rights. This paper will describe how the GIS is developed through usage of different layers on digital terrain, springs, rivers, wells, water rights and patterns of water use. This paper will conclude with a discussion about approaches using GIS for water management and more specifically suggest further avenues for research within the Kings River Valley.
Leticia Rodríguez

Mentor: Dr. John Cushman

Major: Biochemistry

Research Topic: “Evolutionary Origins of Crassulacean Acid Metabolism in Tropical Orchids”

Leticia Rodríguez is from the rural town of Battle Mountain, Nevada. She graduates with a combined five year Bachelors of Science and Masters of Science in Biotechnology at the University of Nevada, Reno in 2008. After graduation she plans on pursuing a Ph.D. in Pharmaceutics at Oregon State University. She presented her research at the Summer 2007 Undergraduate Research Opportunities Program Poster Session held at the Desert Research Institute in Reno. She also co-presented her research with her mentor at the American Society of Plant Biologists in Chicago, Illinois in July of 2007.

ABSTRACT

Neotropical orchids have adjusted to the environment in order to prevent water loss by evolving a photosynthetic pathway to help cope with the carbon uptake and water loss. This photosynthetic pathway is termed crassulacean acid metabolism (CAM). The metabolic reactions required for CAM in plants are well understood, but the evolution of this pathway remains uncharacterized. This research focuses on the understanding of the evolutionary mechanisms of CAM within neotropical orchids by developing molecular markers for tracing CAM evolution. I focused on the phosphoenolpyruvate carboxylase (PEPC) gene family because it is widely conserved in plants, and specific members of the family are differentially expressed in plants performing CAM. PEPC was used to trace the evolutionary progression from C₃, weak CAM, to strong CAM. Based on stable carbon isotope, night titratable acidity, and leaf thickness measurements, orchid species were identified as either CAM, weak CAM, or C₃. Sequence analysis of DNA obtained from CAM species Oncidium ampiiatum, Oncidium nanum, Oncidium carthagenense, and Rossioglossum insleyi indicated that three different PEPC isoforms were present in each species. Based upon sequence alignments and relative frequency of sampled cDNA clones, isoforms with the highest relative frequencies appeared to be related to other known CAM specific PEPC isoforms present in the National Center for Biotechnology Information (NCBI) database. The other isoforms present in each orchid species were found to have high homology to C₃ PEPC isoforms. A phylogenetic tree of nucleotide sequences resulted in the grouping of two distinct groups one of Ppc1, the CAM specific isoform, and the other Ppc2 and Ppc3. Understanding the molecular mechanism responsible for CAM expression will be important to our understanding of species survival in the face of current global climate change and of arid land area expansion worldwide.
Ashley Rolfe

Mentor: Dr. Stephen Jenkins

Major: Wildlife Ecology & Conservation

Research Topic: “The Influence of Olfactory Cues on the Seed-Harvesting Behavior of Merriam’s Kangaroo Rats (Dipodomys merriami)”

Ashley Rolfe started to pursue her passion of studying different species of animals and animal extinction after coming to the University of Nevada, Reno from St. Helen’s, Oregon. As a Wildlife Ecology and Conservation Biology major, she has always wanted to learn ways in which people can help species extinction. Her dream is to one day work in a job to educate the public on this matter and on the importance of earth’s biodiversity. In the spring of 2007 after receiving the Gilman Scholarship she spent a semester studying in Ghana, West Africa, where she got to see first hand baboons, warthogs, crocodiles and bats, along with experiencing the rich culture and meeting many people. After graduation in spring of 2008, Ashley plans on attending graduate school at Eastern Michigan University to continue studying bats. Her research was presented at the Nevada Undergraduate Research Symposium in 2008.

ABSTRACT

Due to low resource availability and variable weather conditions in desert ecosystems, many organisms alter their foraging behavior to compensate for the decrease in resource abundance. Desert rodents participate in reciprocal pilfering behavior of caches which affects the food availability for and survival of certain individuals. This study investigated the pilfering behavior of Merriam’s kangaroo rats (Dipodomys merriami) as a function of olfactory cues on seeds. Six scenting and six harvesting individuals were paired resulting in 36 replications to test the preference of scented versus unscented seeds when foraging. There was significant evidence of seed preference for eating unscented over scented seeds by D. merriami. However there was no strong evidence of preference by D. merriami when re-caching seeds; even though there was some individual variation in seed preference in response to the scent of different caching individuals.
Patricia Piedad Segura

Mentor: Dr. Leonard Weinberg & Dr. Thomas Bell

Major: Chemistry

Research Topic: “Political Implications When Chemical Warfare is Used or Threatened to be used for Nonwarfare Purposes”

Patricia Piedad-Segura, originally from Peru, started her formal college classes at the University of Nevada, Reno in 2003 with a dream of finishing college. Her passion has always been in research and analysis and now Patricia has many great dreams she will soon achieve after receiving her dual bachelor’s degree in Chemistry and Political Science in 2008. Some of her many awards include the National Science Foundation (NSF) Award for 2007-2008, the Chase Scholarship and Dean’s List for the College of Human and Community Science. After graduation she plans on pursuing a graduate program in the field of international policy studies to become a specialist in International Science and Technology policy. Her NSF research was presented in the spring of 2008 at the Nevada Undergraduate Research Symposium. She participated in an internship on Spectroscopy Methods in the Chemistry Department of Moscow State University in Russia in the summer of 2007 and presented her McNair Research at the 14th Annual California McNair Scholars Symposium at the University of California at Berkeley in 2006.

ABSTRACT

Due to the increased use of rhetoric involving weapons of mass destruction by those in power, the goals of this research paper is to make clear what constitutes a weapon of mass destruction and to give an idea about the underlying implications when chemical warfare is used for non-military purposes. This study does not only analyze chemical warfare history and what constitutes a chemical weapon, but rather defines what implies a weapon of mass destruction. By analyzing three key cases in which chemical warfare was used illegally by one person, an organization, and a state actor, this study postulates that there has not yet been a terrorist attack with chemical warfare that has produced mass destruction. This includes the attack to Tokyo’s subway by the terrorist organization Aum Shinrikyo in 1995. Instead, this study concludes that there are massive underlying international implications when chemical warfare is used. These are mostly the nation’s leaders’ own political interests. Finally, in an effort to contribute to the nonproliferation of these highly politicized and controversial chemicals, this research paper also proposes a hydrolysis study to collaborate with military chemical warfare disarmament.
Gene W. Wong

**Mentor:** Dr. Brian J. Frost  
**Major:** Professional Chemistry  
**Research Topic:** “Synthesis and Characterization of Novel Phosphines PTA-Li & PTA-PPh₂”

Gene Wong began conducting research in the spring of 2005 with Professor Brian Frost in the Department of Chemistry at the University of Nevada, Reno. His activities as a student included writing undergraduate grant proposals (which were ultimately accepted), participation in the Chemistry Club, acting as an undergraduate representative for the College of Science, and teaching an introductory organic chemistry lab. His research for the McNair Scholars Program demonstrated enormous talent in the field of water soluble phosphines that lead to presentations at professional and undergraduate research symposiums as well as publications in the journal of *Inorganic Chemistry*. Gene graduated with a B.S. in Professional Chemistry in the spring of 2007 and is currently in the doctoral program for Inorganic Chemistry at the University of Wisconsin-Madison.

**ABSTRACT**

The upper rim of 1,3,5-triaza-7-phosphaadamantane (PTA) has been modified for the first time via lithiation of PTA. The addition of n-butyl lithium to PTA resulted in deprotonation of an α-phosphorus methylene and formation of 1,3,5-triaza-7-phosphaadamantane-6-yllithium (PTA-Li). Characterization of PTA-Li was done by reacting with D₂O to form PTA-D and analyzed by multinuclear NMR spectroscopies (³¹P, ¹³C, and ¹H). The first actual upper rim PTA derivative was synthesized by reacting PTA-Li with CIPP₂ resulting in the chiral phosphine, 6-(diphenylphosphino)-1,3,5-triaza-7-phosphaadamantane (PTA-PPh₂). PTA-PPh₂ has been fully characterized in solution by mass spectroscopy and multinuclear NMR spectroscopy, and in the solid state by X-ray crystallography. Unlike PTA, the new bidentate phosphine, PTA-PPh₂ is insoluble in aqueous solutions but the development of PTA-Li can ultimately lead to additional derivatives of PTA.