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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 and invaluable support of the McNair Scholars Program! We are also thankful for faculty and administrators on the UNR campus who support this program. Faculty mentors fill the most important role in guiding scholars to success.
Foreword:

Rita Escher, Director of Academic &
Opportunity Support Services

It is my great pleasure to introduce the fourth 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 fourth 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
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The Full Version of the Research Journal Can be Found on CD at the Back of This Publication and at:

http://www.unr.edu/mcnair/mcnair-publications
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 seventh 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:

“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.

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.

In addition to receiving a $2,800 research stipend during the summer institute, scholars also benefit from waived application fees at many graduate schools. GRE fee waivers are also available to McNair Scholars. 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.

Eligibility:
Students are eligible for the McNair program if they have completed at least 30 credits, but not more than 92 credits and have a cumulative grade point average of at least 2.9. Students must also meet the federal criteria for selection: neither parent has a bachelor’s degree and the student demonstrates financial need OR the student is a member of a group that is traditionally underrepresented in graduate school: African American, Native American, Hawaiian / Pacific Islander, or Hispanic/Latino. Students must be U.S. citizens or eligible non-citizens (eligible for U.S. federal aid).

Application Process:
Applications are available on the McNair web site: www.unr.edu/mcnair or from the TRiO Office located in Suite 200 of the Thompson Building.
McNair Scholars Abstracts

2010-2011
Jose was born in Estelí, Nicaragua. He’s proud to say that his parents immigrated to the United States with the hopes of providing a better life for him and his brother. Without their love and support, he feels he would not be in the position to pursue his educational aspirations. They will always have his eternal gratitude! At the University of Nevada, Reno Jose was on the Dean’s List from spring 2007 to spring 2010 and was a member of Psi Chi (the Psychology National Honor Society). He presented his work at the Ronald E. McNair Post-Baccalaureate Achievement Program Research Symposium, at the University of California at Berkeley in 2009 and attended the Association for Contextual Behavioral Science World Conference VIII in Reno, NV during the summer of 2010. Jose was accepted into Suffolk University located in Boston, Massachusetts where he will pursue his PhD in psychology starting in the fall of 2011.

ABSTRACT

This study sought to investigate whether or not college students who scored in the “study-aholics” range practice experiential avoidance. Experiential avoidance can be defined as a tendency to try to escape or avoid private psychological experiences (e.g. thoughts, emotions, memories) even when doing so is futile or interferes with valued actions (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Experiential avoidance often works in the short term to reduce some discomfort, but can have long-term negative effects when over-extended and applied inflexibly. This is a process that is believed to be involved in some types of workaholism, and the authors hypothesize that experiential avoidance may also be a factor in study-aholism. In other words, do students who study a higher amount than most see school as a haven from any psychological distress that might haunt them? If so, are there any negative consequences, particularly in terms of the individual’s own mental health and damage to valued personal relationships? The present study recruited 198 college students through the SONA subject pool system in psychology. These students completed various anonymous questionnaires measuring demographics, tendency towards study-aholism, different motivations to valuing study, social adjustment, relationship quality and satisfaction, and mental health. Results showed that students scoring higher on study-aholism also scored higher on experiential avoidance and a series of negative indicators for mental health and that experiential avoidance is a key factor in explaining the relationship between study-aholism and depression, for example. These findings are discussed in terms of implications for college students’ well-being.
Lina Castano

Mentor: Dr. John Cushman

Major: Biochemistry and Molecular Biology

Research Topic: Protein Expression Analysis in the Resurrection Plant, *Selaginella lepidophylla*

Lina Castano was born in Santiago de Cali, a Colombian city with a population of four million. In 2004, for her undergraduate education, she entered the University of Valle, to work on a degree in biology with an emphasis in genetics. In 2008, she entered the BS/MS program in biochemistry and molecular biology at the University of Nevada, Reno. Her undergraduate senior thesis research at UNR was titled “Proteomic study in the resurrection plant, *Selaginella lepidophylla*” under the direction of Dr. John Cushman. Currently (in 2011), Lina is studying for her PhD at Pennsylvania State University where she is doing active research in a laboratory environment. She has decided to research plant responses to abscisic acid in guard cells because she sees this scientific inquiry as exciting and challenging.

ABSTRACT

Understanding the mechanisms used by plants to survive stressful environmental conditions, such as water deficits due to drought is vital to the development of genetic engineering strategies to improve or retain agricultural productivity in the face of increasing environmental insults, changes in rainfall patterns and global warming. Desiccation tolerance is a rare adaptive response of resurrection plants to exist in environments with intermittent drought by entering into a state of metabolic inactivity, wherein vegetative structures are preserved under air-dried conditions. Upon rewatering, these plants resume their metabolic activities and repair any damage that occurred while in the dry state. The mechanistic basis of desiccation tolerance can be better understood by studying it using integrative functional genomics approaches including transcriptomics, proteomics, and metabolomics. In this study, protein expression patterns within fully hydrated and desiccated tissues of *Selaginella lepidophylla* were investigated using a gel-based proteomics approach. A phenol-based protein extraction protocol was optimized for *S. lepidophylla* tissues by including a series of washing steps with methanol, acetone and ether in order to remove membrane lipids and polyphenolics. Protein expression profiles were then compared using two-dimensional difference polyacrylamide gel electrophoresis (2D-DIGE). The 2D-DIGE analysis revealed that 130 proteins that were differentially expressed with 107 proteins showing increased abundance and 23 showing decreased abundance in the dry state compared with the hydrated state. Late embryogenesis abundant and heat shock proteins and reactive oxygen scavenging enzymes were overrepresented in the dried state.
Joseph was born in Reno and graduated from the University of Nevada, Reno in May of 2011 with a bachelor’s degree in electrical engineering and minors in mathematics and business administration. While at UNR, Joseph was a member of IEEE (Institute of Electrical and Electronics Engineers) as well as being the Publications Master from 2009 to 2010. He also received 1st place in the 2011 IEEE Region 6 Design Competition. He presented original research at the 2010 McNair Scholars Research Symposium in Berkeley, California. Additionally he was project manager for several research ventures that arose during his studies on campus. Joseph also contributed to the community by volunteering his time at the 4th of July Boat Races where he helped children ages 13 to 18 design and fabricate wooden, man-propelled racing boats. In addition, he founded and acted as president of The Poi Club.

ABSTRACT

A comprehensive analysis of an optical sensor system using a Lock-In amplifier will be examined, including the complete description of the fundamental principles behind its operation. The discussion on Lock-In amplifiers will help facilitate an understanding as to how it is possible for an optical signal buried in noise to be extracted using the phase sensitive detection of the Lock-In. On the basis of the discussion, a mimicked electromagnetic radiation detection experiment was conducted; with the use of an ultra-sensitive Lock-In Amplifier I was able to detect the transmittance of the sample material (ND filters) down to as low as 0.001% transmittance. Detection intensities at even such low transmittance levels provided relatively high system accuracies of approximately 80.27%. This optical sensor system offers the possibility or providing a simple means of molecular identification and measurement in a cheap, discrete, package. With additional resources such as optical fiber waveguides, the system could have been manipulated to measure the magnitude of physical substances within 25~100 ppb using fluorescence chemistries.
Cassandra Foust

**Mentor:** Dr. Lori A. Bass  
**Major:** Speech Language Pathology & Audiology  
**Research Topic:** Changes in Children’s Narrative Complexity Following Embedded Grammatical Instruction

Cassandra graduated from the University of Nevada, Reno in May of 2010 with her bachelor’s degree in speech pathology and audiology. While at UNR she was, over the course of her academic career, NSSHLA (The National Student Speech Language Hearing Association) UNR chapter president, Environmental Club vice president, a member of the Gerontology Club, and an International Baccalaureate Council representative. She completed a poster presentation at the ASHA (American Speech-Language Hearing Association) Conference in 2009. She also volunteered at Camp Lotsafun, a nonprofit organization serving children and adults with special needs. Cassandra is attending Syracuse University pursuing a master’s degree in speech pathology and will be graduating next spring. She would like to thank her mentor, Dr. Lori Bass, for her guidance and everything she taught her throughout the McNair Scholars Program.

**ABSTRACT**

Across the world's cultures, narratives help express cultural beliefs, show cultural interaction rules, and share familial beliefs across generations (Fiese et al., 1999). They are used throughout various cultures to describe sequenced events and experiences to express meaning and may be fictional, based on real events, or retellings of stories heard previously (Hughes, McGillivray, & Schmidek, 1997). Children’s ability to retell stories or create narratives shows specific skills such as describing plots, understanding and identifying characters, and developing resolutions. These are all factors that assist in promoting academic success in school (Hoggan & Strong, 1994). Upon entry into school, children’s narrative content and production vary across cultures and differences may affect academic success in schools (Heath, 1986). Children from low SES homes and/or from non-mainstream backgrounds often come to school with little to no familiarity with mainstream cultural narrative styles and structures (Dickinson & Tabors, 2001). This paper will report the results of changes in narrative complexity for children from low socioeconomic environments following a grammatical instruction program. Participants' narratives were digitally recorded, transcribed verbatim, and story grammar elements were coded using the narrative macrostructure taxonomies developed by Applebee (1978).
Nicholas Hockensmith

Mentor: Dr. Tom Nickles

Major: Mathematics

Research Topic: Is an Iterated Pascal’s Wager a Game Changer?

Nicholas Hockensmith was born in Reno, NV. Even though Nick grew up in a single parent household, he was privileged to have grandparents who helped raise him while his mother worked. Nick graduated from Wooster High School in 2005 and decided to attend the University of Nevada, Reno. He spent six years as an undergraduate at Nevada where he majored in mathematics. During his junior and senior years, Nick became a TRiO Scholar and a McNair Scholar, where he broke out of his quiet shell meeting new people and making lifelong connections. During the summer of 2010, Nick participated at the Berkeley McNair Scholars Symposium, presenting on a modified version of Pascal’s Wager. He graduated in 2011 with his bachelor’s degree in mathematics and a minor in economics. In the fall of 2011, Nick will enroll at the University of Oregon, pursuing graduate study in economics.

ABSTRACT

Is it rational to wager in the belief that God exists? This is a centuries old question made famous by the seventeenth-century French mathematician and philosophical thinker Blaise Pascal. Pascal’s Wager originated from Pascal’s Pensées where he argues why it is rational to wager in the belief that God exists. Rationality is defined as an agent who maximizes their expected utility. The essence of Pascal’s argument revolves around assigning an infinite utility to the event of wagering in the belief that God exists and where God does, in fact, exist; as long as the probability that God exists is greater than zero, wagering in the belief that God exists yields an infinite expected utility. I propose a new version of Pascal's Wager: an Iterated Pascal's Wager (IPW). Pascal's Wager will be divided into two parts: the iterations (or repeated wagers) played in life and a final payoff in death. The IPW consists of solely finite utilities while Pascal’s infinite utility is allocated during the payoff in death. Two cases arise in the IPW. The first is an indefinite IPW and the second is a finite IPW. In either case, the argument is made that a person who chooses to wager in the belief that God exists would no longer be playing a rational strategy.
Samantha Lee

**Mentor:** Dr. David K. Shintani,

**Major:** Biotechnology

**Research Topic:** Overexpression of the inositol hexakisphosphate biosynthetic pathway in duckweeds as a method for aqueous phosphate extraction

Samantha was born in Reno, NV and attended the University of Nevada, Reno as an undergraduate. Even as an undergrad, Samantha was able to attend several research conferences and competitions; they include, the Biotechnology Symposium at UNR in both 2010 (poster presentation) and 2011 (oral presentation), The California McNair Scholars Symposium at UC Berkeley, and the 2010 iGEM Jamboree at the Massachusetts Institute of Technology where she earned the silver medal with her Nevada team. She was a Finlay McDonald Scholarship Recipient and has participated in several clubs and organizations while at UNR including the American Medical Student Association (National and UNR Chapter member), the Biochemistry and Biology Club, and Alpha Epsilon Delta - a Pre-Medical Honor Society (National and UNR Chapter member).

**ABSTRACT**

There has been an increase in the concentration of phosphates in the environment in recent years; much of it has been shown to be anthropogenic. An excessive amount of phosphates in the environment has been shown to have detrimental effects on aquatic life. Because of these harmful effects, there has been a growing need for new, rapid, and cost effective ways to facilitate remediation of these phosphate compounds. The proposed method is to take advantage of the inositol hexakisphosphate biosynthetic pathway in plants. Inositol hexakisphosphate is the primary phosphate energy storage molecule for many plants species. Five *Arabidopsis thaliana* genes pertaining to inositol hexakisphosphate biosynthesis, transport, and storage were selected to be in cloned into the floating freshwater plants, duckweeds. MultiSite Gateway® technology (Invitrogen™) was the chosen cloning method because of its ability to transfer up to three genes using a single construct. Successful isolation of four of the five genes has been achieved and they have been inserted into plasmids as entry clones. Creation of expression clones is well under way for their transformation into the duckweeds.
Nazrul Mojumder

Mentor: Dr. Alan Fuchs

Major: Chemical Engineering

Research Topic: Maquettes modeling of Nickel Superoxide Dimutase (NiSOD)

Nazrul Mojumder has led a successful career at the University of Nevada, Reno. From his freshman year on he has served as an Honors Ambassador, been on the College of Engineering Dean’s list, been an active member of the Circle K Club and the International Club, and was co-captain of an intramural soccer team. In his sophomore year, he participated in the Council for Opportunity in Education – International Leadership Conference in Liverpool, England. He also was selected to take part in The Scholar-Ship experience; along with 200 students from around the world he went on a semester long voyage to eleven countries carrying out clinical studies, studying intercultural issues, and offering community services. During his senior year, he was a Rotary International Ambassadorial Scholar to Morocco. He has been a Wells Fargo Scholar and part of the MESA Program where he devoted time to tutoring high school and middle school children. He was a member (as well as treasurer and vice president) of the Muslim Student Association and the Delta Epsilon Iota Academic Honor Society. He received the Certificate for Outstanding Poster Presentation at the 2010 Annual Biomedical Research Conference for Minority Students in Charlotte, NC, and he presented his work at the 18th Annual McNair Scholars Research Conference at U.C. Berkeley.

ABSTRACT

The Senior Chemical Engineering design class was assigned with the challenge of modeling the purification process of humanized anti-VEGFa monoclonal antibody fragments, specifically the protein Ranibizumab commercially produced by Genentech under the product name Lucentis. Lucentis is used for treatment of the age related wet form of macular degeneration in the eye, a common form of blindness. Vascular Endothelial Growth Factor A (VEGF-A) becomes immobilized by the Lucentis. It binds to VEGF and isoforms, changing the conformation of VEGF-A. In order for angiogenesis to occur VEGF-A must constantly bind to receptors on the surface of the blood vessels. Figure 1 shows the mechanism of VEGF-A binding to Lucentis MAB-F. Since it is a monoclonal antibody fragment (MAB-F) it must be purified differently than normal proteins. Affinity chromatography isn’t used because it is very expensive. Instead the following order of operations (Figure 2) was the basis for our experimental work as well as theoretical scale up.
Dylan Rahe

Mentor: Patricia Berninsone

Major: Biology

Research Topic: The Elusive Caenorhabditis elegans Surface Coat: A Proteomic Approach

Dylan was born in Reno, NV but soon moved to Minden, NV, where he grew up. He graduated with distinction in biology from UNR in 2010, after having received scholarships / awards from UNR and being part of the NSF EPSCoR Climate Change Program. He’s the second oldest of four boys in his family, several of whom have also attended or are still attending The University of Nevada, Reno (another brother will be attending a school in Boston next year). As part of the McNair Scholars Program, Dylan presented his work at the McNair Scholars Conference in Berkeley, CA (and through the NSF EPSCoR Program). Dylan now attends Columbia University in the biological sciences department, where he is pursuing research regarding the role of chromatin in cellular reprogramming and differentiation in Oliver Hobert's laboratory. He recently participated in a program with the Harlem Center for Education, which invites scientist speakers to talk about their research / experience with kids in inner-city schools, and he says he plans on continuing this wonderful experience. He also volunteers at the McNair office in Columbia, offering tutoring for math / science scholars.

ABSTRACT

Nematodes, more commonly known as roundworms, are an incredibly diverse phylum, with more than 80,000 known species, of which over 18% are known to be parasitic in plants and animals. Parasitic nematodes are the causative agents of widespread and devastating plant and animal diseases, resulting in an estimated 5% global crop loss (root-knot nematodes, genus Meloidogyne) and the infection of more than 1.3 million humans worldwide (hookworms, genera Necator and Ancylostoma). The ability of these parasites to exist in the hostile host environment is dependent on their ability to trick or evade the host immune system. It has been proposed that the outermost layer of these organisms, known as the surface coat, plays a significant role in the process of immune system evasion. Hypothesized to consist of a thin layer of excreted/secreted products (ESP), this layer has been little studied due to its dynamic nature. One free-living species of nematode, Caenorhabditis elegans, has been studied extensively since the mid-1970’s, providing a rich collection of information regarding the biology of this and other related nematodes. Despite this, little is known about its surface coat. C. elegans is related to a number of plant and animal parasitic nematodes; by studying the ESP of C. elegans, insight can be gained into both the constitutive nature of the surface coat, as well as the biochemical pathways important in its production and expression. This research project explores an approach to isolate the ESP, which allows a proteomic analysis of its components. The strategy developed will also enable an unbiased proteomic analysis of the ESP from mutants with abnormal surface morphology. Among these, analysis of srf-3 mutants is currently underway.
Zane Ricks

Mentor: Dr. Yantao Shen

Major: Mechanical Engineering


Zane was born in Reno, NV. He graduated from the University of Nevada, Reno with High Distinction, earning a bachelor's degree in mechanical engineering in the fall of 2010. He is a member of the Tau Beta Pi Engineering Honors Society. Zane presented his work at the 2010 McNair Symposium at the University of California, Berkeley. He also recently coauthored a paper on dropwise condensation on hydrophobic surfaces for submission to a SMASIS (Smart Materials Adaptive Structures and Intelligent Systems) conference. During his time at UNR, he served as a tutor at Sepulveda Elementary and enjoyed the hobbies of weight lifting and art. Zane will be attending Vanderbilt University to pursue a degree in biomedical engineering in the fall of 2011.

ABSTRACT

The purpose of this research is to design a 3-D highly sensitive micro-force sensor, which is capable of ultimately interfacing with a haptic device to offer real-time force feedback to the user involved in tasks such as bio-manipulation. The sensor itself uses a highly sensitive polyvinylidene fluoride (PVDF) film to measure forces. In the current design iteration, four strips of the PVDF film are serially interconnected using rapid prototyped fastening devices, which allow for three decoupled force measurements in the x, y, and z directions. Two types of circuits, one charge amplifier and one voltage amplifier, are compared for use in effectively processing the sensor signals. Static and dynamic tests of the sensor materials are performed, in addition to assessments of the effects of the pyroelectric properties of the material. Several force-guided bio-manipulation tasks will be further implemented using this developed 3D micro-force sensor.
Miranda Smith

Mentor: Dr. Melanie P. Duckworth

Major: Psychology and Sociology

Research Topic: Examination of Risk Factors for Migraine Headache in a College Student Population

Miranda is a local who was raised in the Reno area. She attended North Valleys High School and was the valedictorian of her class in 2007. She recently graduated summa cum laude from the University of Nevada, Reno after dual majoring in psychology and sociology with a minor in creative writing. While at the University, she participated in the Honor’s Program and was on the Liberal Art’s Dean’s list from 2008 to 2010. She was the secretary for Psi Chi (Psychology National Honor Society), was a member of Phi Kappa Phi Honor Society, the Golden Key Club, and the Sociology Club. She received the Psychology Department Dean’s Award for Research in 2011. Miranda’s work on “The Impact of Fear of Pain, Social Support and Pain Acceptance on College Students’ Quality of Life” was presented at the 2010 McNair Symposium at the University of California, Berkeley. Additionally, Miranda worked as a Writing Center tutor and participated in intramural soccer. In her free time, she coached and refereed for the American Youth Soccer Organization, overseeing children from six to fifteen years old.

ABSTRACT

Some data indicate that migraine headaches significantly affect the college student population. The purpose of this study is to examine risk factors across four categories of variables: sociodemographic variables (age, gender, ethnicity, socioeconomic status, and family history), personality variables (neuroticism), lifestyle factors (blood pressure, exercise, smoking, and substance abuse) and stress responding (recent stressful life events, daily hassles and psychological distress (anxiety and depression)). These variables were examined in 131 migraine and non-migraine experiencing college students at the University of Nevada, Reno. Measures used included Sociodemographic and Medical Information Sheet, Zuckerman-Kuhlman Personality Questionnaire, the Survey of Recent Life Experiences and the Symptom Checklist-90-Revised. The findings indicate that more college students with high blood pressure, anxiety and depression have migraine headaches than college students without migraines, suggesting that high blood pressure, anxiety and depression are risk factors that are associated with migraine headaches.