



NDSU EXPLORE

UNDERGRADUATE EXCELLENCE IN RESEARCH AND SCHOLARLY ACTIVITY 2014

WELCOME MESSAGE



Kelly A. Rusch, Ph.D., P.E.

***Vice President for
Research and Creative Activity
North Dakota State University***

To Students, Staff, Faculty and our neighbors in the Community,

Welcome to NDSU's Inaugural NDSU EXPLORE event being held to recognize and celebrate the exemplary research and creative activity of our university's undergraduate student body. The exchange of ideas and creation of new knowledge that happens within the lab, design studio, music hall and outdoor environment are hallmarks that drive innovation and sustain our communities. The opportunity for students to engage in thought provoking and cutting-edge research and creative activities outside of the formal classroom results in graduates that are highly sought after by local, regional and national companies, organizations and graduate schools.

We are excited to showcase the talent of NDSU's undergraduates in a venue that allows you to fully engage and interact with a diverse student population, representing a vast cross-section of disciplines offered at the university. We hope you enjoy being part of the student learning experience at NDSU.

Regards,

A handwritten signature in blue ink, appearing to read 'K. Rusch'.

CONTENTS

Schedule 3

Guest Speaker 4

Oral Presentation Schedule 5

Oral Presentation Abstracts 6

Poster Presentation Schedule 13

Poster Presentation Abstracts 15

Notes 28

SCHEDULE

8:00am-9:00am

Registration and Presentation Set up

Memorial Union, Great Plains Ballroom

9:00am-9:15am

Welcome Remarks – Beth Ingram, NDSU Provost

Memorial Union, Great Room

9:15am-10:00am

Why Undergraduate Research?

Benefits and Value for Students, Faculty and Institutions

Memorial Union, Great Room

Guest Speaker: Susan J. Larson, Professor, Concordia College

Larson is the director of Undergraduate Research, Scholarship and National Fellowships and oversees the Credo Honors program at Concordia College in Moorhead, Minnesota. She is a professor of psychology who also serves as a councilor on the Council on Undergraduate Research, which promotes high-quality student-faculty collaborative research and scholarship.

10:00am-11:30am

Student Presentations – Morning Session

Oral Presentations • Memorial Union, Meadow and Lark Rooms

Poster Presentations • Memorial Union, Plains Room

11:45am-1:00pm

Recognition Luncheon for Student Presenters and Advisors

Memorial Union, Great Room

1:30pm-3:00pm

Student Presentations – Afternoon Session

Oral Presentations • Memorial Union, Meadow Room

Poster Presentations • Memorial Union, Plains Room

GUEST SPEAKER



Susan J. Larson, Ph.D.

Concordia College

*Director of Undergraduate Research
and Student Scholarship*

Director of the Credo Honors Program

Professor of Psychology

Dr. Susan Larson (BA, Univ. of Manitoba; PhD, McMaster University) is a Professor in the Psychology Department at Concordia College in Moorhead, MN. She also serves as the director of Undergraduate Research, Scholarship and National Fellowships and the director of the Credo Honors program at Concordia.

Larson serves as councilor on the Council on Undergraduate Research, whose mission is to "to support and promote high quality student-faculty collaborative research and scholarship" and she served on CUR's executive board for four years. With colleagues from CUR, she co-authored CUR's Characteristics of Excellence in Undergraduate Research, published in April 2012.

Larson engages students in undergraduate research through course-embedded research experiences in her *Research Methods* and *Learning and Behavior* course. She also supervises students in her laboratory on research projects that include the investigation of behavioral and cognitive changes associated with immune system activation and analysis of variables affecting motor learning. In the fall of 2008, Larson was the recipient of the Ole and Lucy Flaot Distinguished Scholarship award at Concordia College.

ORAL PRESENTATIONS

MORNING SESSION ONE

10:00am-11:30am • Memorial Union, Meadow Room

Mariom Carvajal

*What color is the bug? Ontogenic coloration changes in *Ditomotarsus hyadesi* (Insecta: Heteroptera: Acanthosomatidae)*

Mary Hedrick

Effect of surface stoichiometry and passivating ligands on optical spectra of quantum dots

Tyler Ringstad

Creating a sense of self(ie)

Troy Wright, Michael Winther, and Yue Xu

Calculation of life cycle cost of nanoscale zero-valent iron

MORNING SESSION TWO

10:00am-11:30am • Memorial Union, Lark Room

Elizabeth Leke

Endothelial nitric oxide synthase protein (eNOS) expression in ovarian follicles: Effects of diet and arginine (Arg)

Tyler Toepke-Floyd

Emission reduction using an activated carbon supplement

Elisabeth Fricker

Forensics: not just CSI

Chris Larson

Global NDSU: How students at NDSU work and learn in a global world

AFTERNOON SESSION

1:30pm-3:00pm • Memorial Union, Meadow Room

Cody Ritt

Optimization of aqueous phosphate removal using modified biopolymer beads

Garett Slater

Nutritional variation affects larval growth in honeybees

Samantha Day and Malorie Midtaune

A content analysis of sex roles: A journal of research, 1975-2014

Nicole Snyder

Growth and immune system function in juvenile Franklin's Gulls

Houda Abdelrahman

Extended hypoxia in the alfalfa leaf-cutting bee increases adult survival but causes sub-lethal effects

Extended hypoxia in the alfalfa leaf-cutting bee increases adult survival but causes sub-lethal effects

Houda Abdelrahman

Biological Sciences

Title. Extended hypoxia in the alfalfa leaf-cutting bee increases adult survival but causes sub-lethal effects

Authors. H. Abdelrahman, J.P. Rinehart, G.D. Yocum, K.J. Greenlee, B.R. Helm, W.P. Kemp, C.H. Schulz, J.H. Bowsher

Abstract. Many insects are tolerant of hypoxic conditions, but survival may come at a cost to long-term health. The alfalfa leaf-cutting bee, *Megachile rotundata*, develops in brood cells inside natural cavities, and may be exposed to hypoxic conditions for extended periods of time. Whether *M. rotundata* is tolerant of hypoxia, and whether exposure results in sub-lethal effects, has never been investigated. Overwintering *M. rotundata* prepupae were exposed to 10%, 13%, 17%, 21% and 24% O₂ for 11 months. Under hypoxia, adult emergence rates did not decrease over the 11 months of the experiment. In contrast, bees reared in normoxia had decreased emergence rates by 8 months, and were dead by 11 months. Upon emergence, five indicators of quality — emergence weight, body size, feeding activity, flight performance, and adult longevity, — were measured to determine whether adult bees that survived past hypoxic exposure were competent pollinators. *M. rotundata* prepupae are tolerant of hypoxic conditions and have higher survival rates in hypoxia, than in normoxia. *M. rotundata* prepupae exposed to extended hypoxic conditions had similar emergence weight, head width, and cross-thorax distance compared to bees reared in standard 21% oxygen. Despite no significant morphological differences, hypoxia-exposed bees had lower feeding rates and shorter adult lifespans. Hypoxia may play a role in post-diapause physiology of *M. rotundata*, with prepupae showing better survival under hypoxic conditions. Extended exposure to hypoxia, while not fatal, causes sub-lethal effects in feeding rates and longevity in the adults, indicating that hypoxia tolerance comes at a cost.

-----Afternoon Session: Memorial Union, Meadow Room

What color is the bug? Ontogenic coloration changes in *Ditomotarsus hyadesi* (Insecta: Heteroptera: Acanthosomatidae)

Mariom Carvajal

Entomology

The Hemiptera is a group of insects, commonly called true bugs, which are characterized by having the wings half leathery and half membranous, and by their piercing sucking mouthparts. Many true bugs are considered to be economically important because their feeding may damage crops. *Ditomotarsus hyadesi* is a species of true bug distributed in southern South America which is sometimes intercepted at quarantine facilities by hitching a ride on plants/fruits being brought into the United States. We have observed different color morphs in this species, and we are curious to know if there is a specific reason for the different types of coloration (e.g., Are they different species? Are the different colors correlated with different localities?). Our objective was to determine what causes the different coloration morphs in *D. hyadesi*. In preparation for our research, we collected live specimens and reared them in the laboratory for a year, obtaining biological data, and took notes about the different developmental stages of the species. We discovered that not only are adults of the same species can be different colors, but females can also lay eggs of different colors. It appears that adults are in general green during spring and summer and are more brownish during the fall and winter. We were able to determine that individuals are capable of changing color over time during its life history, and that this coloration change probably helps camouflage the insect; which helps the insect and eggs to avoid predation.

-----Morning Session 1: Memorial Union, Meadow Room

A content analysis of sex roles: A journal of research, 1975-2014

Samantha Day and Malorie Midtaune

Communications

In March 1975 a behavioral science journal with a specifically feminist perspective was first published. "Sex Roles: A Journal of Research," in its official description, declares that it "publishes original research reports and reviews articles that illuminate the underlying processes and consequences of gender role socialization, gendered perceptions and behaviors, and gender stereotypes," (Sex Roles, n.d.). Although many gender journals exist, and many academic journals have been subjected to empirical content analysis to evaluate their performance, there have been few such analyses of gender journals. The problem to be addressed is to determine how academic journals present research on gender by conducting a case study of one journal-Sex Roles: A Journal of Research.

The goal of our project is to examine the contents of Sex Roles: A Journal of Research from first publication in March 1975-August 2014 and discover the nature of content on gender research in academic journals through a case study of Sex Roles: A Journal of Research.

Through a number of content categories, we will analyze the journal to answer the following questions:

1. Who is authoring and completing research on gender roles?
2. What specific topics have been researched? And how frequently do they occur?
3. What research methods have been applied and are prevalent in discussion?
4. How does the nature of the articles reflect the goals of the journal and its purpose?
5. What is the primary gender focus of the contributors in the journal and how does it reflect the feminist perspective of the journal?

-----*Afternoon Session: Memorial Union, Meadow Room*

Forensics: not just CSI

Elisabeth Fricker

History, Philosophy and Religious Studies

This presentation will focus on eliminating the myths and confusion behind the forensics (speech and debate) experience by examining its three educational tenants.

The first is the educational process of creating a speech and the research that goes into preparing for a presentation.

The second is the competitive aspect and learning how to promote yourself and your ideas to an audience.

The third is the pedagogical experience of being judged by an audience of your peers and professors in multiple disciplines-and how being in the forensics marketplace of ideas expands your horizons.

-----*Morning Session 2: Memorial Union, Lark Room*

Effect of surface stoichiometry and passivating ligands on optical spectra of quantum dots

Mary Hedrick

Chemistry and Biochemistry

Harvesting solar energy as a clean and renewable source of energy can be improved by using semiconductor Quantum Dots (QDs). However, photophysics of QDs is extremely sensitive to their surface chemistry. Using density functional theory we study the effect of common passivating ligands, such as carboxylate, phosphine, phosphine oxides, and amine groups, on the electronic and optical properties of CdSe and PbSe QDs. We specifically investigate how ligand attachment to different QD's facets with different stoichiometry affects the QD-ligand interactions and optical response of ligated QDs. The most stable conformations are associated with the ligated QDs having an excess of Cd or Pb ions on the surface. The strength of QD-ligand interactions depends on the polarity of a solvent and the facet of the QD to which the ligand is attached. Full or partial passivation of QD surfaces with the stoichiometry 1:1 by various ligands, eliminates any surface states from the gap of the QDs. Independent on the number of passivating agents, ligands do not introduce any electronic states to the band gap of stoichiometric QDs, but appear deep inside in the valence and conduction bands of QDs. However, absorption spectra of the bare or partially ligated stoichiometric QDs demonstrate the lowest energy transitions with weak intensities, whereas fully passivated QDs have brighter and slightly blue-shifted transitions. Off stoichiometry in QDs with an excess of surface metals interacting with ligands, results in appearing of surface states nearer to the edge of the conduction band and red shifts in absorption spectra.

-----*Morning Session 1: Memorial Union, Meadow Room*

Global NDSU: How students at NDSU work and learn in a global world

Chris Larson

Civil and Environmental Engineering

Working globally promotes new challenges and learning experiences for today's students. The North Dakota State University chapter of Engineers Without Borders (NDSU EWB) is an organization on campus that works globally to improve the lives of underdeveloped communities. NDSU EWB primarily works in a small Guatemalan village called Las Tablitas. Within Guatemala they work closely with both the village and local NGOs to bring crucial infrastructure to the community. Additionally NDSU EWB has represented NDSU at conferences both in the United States and around the global. With the experiences gained from working in a global environment; members of the North Dakota State University chapter of Engineers Without Borders are equipped with a real world skill set that will better suit them to be a part of a global community.

-----*Morning Session 2: Memorial Union, Lark Room*

Endothelial nitric oxide synthase protein (eNOS) expression in ovarian follicles: Effects of diet and arginine (Arg)

Elizabeth Leke

Animal Sciences

The aim of this study was to investigate the role of the NO system in regulation of ovarian function, by determining if Arg supplementation impacts eNOS protein expression in follicles in nutritionally compromised ewes. Ewes (n=95) were randomly assigned into either maintenance (C, 100% requirements), excess (O; 2xC), or restricted (U; 60% of C) diet. At week 8 of nutritional treatment, ewes were treated with saline (~10 mL) or Arg (L-Arg-HCl, 155 µmol Arg/kg of body weight [BW]) 3 times per day (0700, 1400, 2100 h) until ovary collection. eNOS was localized using immunohistochemistry followed by image analysis of ovarian sections. During nutritional treatment, C maintained BW, O gained 6±1.2 kg, and U lost 14±1.3 kg. eNOS was present in blood vessels of thecal layer and other ovarian compartments. eNOS expression in theca layer was greater in U than C and O ewes, and was greater in healthy antral than atretic (regressing) follicles. Arg-treatment did not affect eNOS protein expression. These data show that: 1) eNOS is expressed in blood vessels of the ovary; 2) diet but not Arg affected eNOS expression in blood vessels of theca layer; 3) eNOS expression is greater in blood vessels of thecal layer in healthy antral than atretic follicles. Thus, plane of nutrition may affect follicular function by changing eNOS expression in ovarian blood vessels. The mechanism of regulation of ovarian eNOS expression by diet and remains to be elucidated. Supported by USDA-AFRI grant 2011-67016-30174, and Hatch Projects ND01748 and ND01754 to ATGB and DAR.

-----*Morning Session 2: Memorial Union, Lark Room*

Creating a sense of self(ie)

Tyler Ringstad

English

The digital age brings innumerable mediations of identity, and selfies are an especially salient manifestation. Recently termed “word of the year” by the Oxford English Dictionary, selfies construct human identities in ways uniquely and inherently posthuman. Drawing from the work of N. Katherine Hayles, David Wills, and others, this paper will argue that both the drive for and creation of selfies develop from posthuman concepts of the human. In concert with new media theory, particularly Bolter and Grusin’s Remediation: Understanding New Media, the proliferation, publishing, and interpretation of these selfies are also integral to understanding the creation of their meaning. In its end, this paper will hope to provide salient, real-world manifestations of the extremely and necessarily abstract concepts of posthumanism.

-----*Morning Session 1: Memorial Union, Meadow Room*

Optimization of aqueous phosphate removal using modified biopolymer beads

Cody Ritt

Civil and Environmental Engineering

Cody Ritt, Mohammad E. Hossain, Achintya N. Bezbaruah

Aqueous phosphate removal was successfully achieved with novel iron cross-linked alginate (FCA) beads. All experiments were conducted with bead batches of 0.12 g (dry weight). About 94% removal of phosphate was achieved in 6 h from solutions having an initial phosphate concentration of 5 mg PO₄³⁻-P/L. With 50 mg PO₄³⁻-P/L, the beads were found to remove only about 41% in 6 h, but they achieved 89% phosphate removal in 96 h. Isotherm studies with the dry FCA beads found the adsorption capacity to be 69.9 mg PO₄³⁻-P/g of beads. The beads were also effective in removal of 40 – 140 µg PO₄³⁻-P/L, implying that the beads can be used for the remediation of eutrophic lakes. No or minimal interference from coexisting ions and natural organic matter was found. Production of beads was optimized through a series of trial and error experiments. The successful sorption of aqueous phosphate by FCA beads coinciding with effective production is expected to have enormous implications for nutrient removal from contaminated waters, including eutrophic lakes and wastewater.

-----Afternoon Session: Memorial Union, Meadow Room

Nutritional variation affects larval growth in honeybees

Garett Slater

Biological Sciences

Nutrition heavily influences the physiology of developing organisms. In social insects, larval nutrition regulates profound phenotypic differences such as caste determination, as well as subtle differences in metabolism and health. Worker honeybees provision brood with a secretion from their mandibular and hypopharyngeal glands, which is called jelly. The nutritional content of these glandular secretions is a result of external factors such as forage and internal factors such as worker behavior, resulting in jellies that vary significantly in protein, sugar and water content. Systematic manipulations of larval diet in vivo will determine to what extent variation in Royal Jelly content affects within caste and between caste development. We manipulated a standard artificial diet for in vitro rearing and measured the phenotypic effects. The factorial design use nine diets that varied in the amount of sugar and royal jelly. We reared 24 larvae per diet and measured larval growth and length of each developmental stage. These results have implications for honeybee growth when foraging sources are limited or under monoculture cultivation.

-----Afternoon Session: Memorial Union, Meadow Room

Growth and immune system function in juvenile Franklin's Gulls

Nicole Snyder

Biological Sciences

How offspring respond to variation in reproductive timing is not well studied. Evolutionary theory predicts, and empirical evidence indicates, investments in offspring decline across the reproductive season. Thus, offspring produced later in the season may need to compensate to survive to breeding age. Franklin's gull (*Leucophaeus pipixcan*) eggs laid later in the season are smaller and produce structurally smaller hatchlings than eggs laid early in the season. In a laboratory study with ad libitum feeding, chicks from late season eggs exhibited faster growth rates than chicks from early season eggs, yet their asymptotic masses did not differ. We hypothesized late season chicks compensate for their later hatching date at the cost of immune system development, ability to repair DNA damage, and ability to withstand a short-term diet restriction. We artificially incubated early and late season gull eggs, randomly assigned hatchlings to diet restriction or control group, measured chicks daily until age 40 days. At age 20 days, we evaluated immune system function with a PHA challenge to the patagium. We evaluated DNA damage during maximum growth age 10-40 days with single cell gel electrophoresis (comet assay). We found no differences among groups in patagial swelling, but late season chicks had thinner initial patagia. The comet assay indicated more fragmented DNA in cells of late season and diet-restricted chicks than early season or control-diet chicks. Our findings suggest late season offspring can compensate for low parental investments without compromising immune function, but may incur costs that inhibit tissue repair or self-maintenance.

-----*Afternoon Session: Memorial Union, Meadow Room*

Emission reduction using an activated carbon supplement

Tyler Toepke-Floyd

Mechanical Engineering

The purpose of this project was to reduce the emissions from an engine using activated carbon (AC) as a supplemental filter while a catalytic converter is warming up. This experiment measured the nitric oxide (NO) and nitrogen dioxide (NO₂) emissions of a diesel engine at two different RPM's and two torque levels for two different types of AC. Additionally, this experiment explored how the amount of AC used changed emissions.

The apparatus included: catalytic converter, filtration chamber, thermocouples, gas sampler, and two forms of AC. After a control run was done, other runs had various combinations of AC, RPM's, and torque loads. The catalytic converter was cooled back down to room temperature after each run. Levels of NO and NO₂, and temperatures were collected at certain times.

After completing the three trials of the experiment, I found my hypothesis was partly correct: activated carbon was effective as a filter for reducing emissions of an engine during a catalytic converter's warm-up phase; however, because Fibrous Activated Carbon (FAC) degraded at high temperatures, Granular Activated Carbon (GAC) proved to be the most effective by reducing the NO_x by an average of -14.3% over all RPM and torque levels.

My hypothesis was also correct that more mass of GAC would be more effective. The 100 g of GAC more than doubled the reduction of NO_x during a catalytic converter's warm-up phase than 19 g of GAC by reducing the emissions by an average of -27.8% at a constant RPM and torque.

-----*Morning Session 2: Memorial Union, Lark Room*

Calculation of life cycle cost of nanoscale zero-valent iron

Troy Wright, Michael Winther, and Yue Xu

Civil and Environmental Engineering

Nanoscale zero-valent iron (NZVI) particles are extensively used for groundwater remediation. They have been field tested and accepted as an efficient way to remove contaminants from groundwater including chlorinated compounds, inorganics, metalloids, and heavy metals. The life-cycle assessment (LCA) of NZVI is important to understand the impacts of the nanoparticles on the environment. In this study we have calculated the life-cycle cost of 1 gram NZVI and related it to groundwater remediation.

-----*Morning Session 1: Memorial Union, Meadow Room*

POSTER PRESENTATIONS

MORNING SESSION

10:00am-11:30am • Memorial Union, Plains Room

Elizabeth Rowinski

Correcting historical inaccuracies of settlement-era log cabins at Western Minnesota Steam Threshers Reunion

Jacob Larson and Mike Mann

Cellulation

Jacob Parrow

Effects of radio frequency on Lambda DNA

Jane Loueng

Relation of two brief health literacy tools to correct prescription understanding

Kaitlin Lindsey and Kendra Kibble

Evaluation of basil extracts on colon cancer cell growth

Kouevi Kodjovi

*Influence of the 5 gene stress survival islet on salt-induced nisin resistance of *Listeria monocytogenes**

Kristine Wentworth, Robbie Darling, Austin Foss, Diedrich Harms, Ally Hatcher, Amy McDonald, and Tommy Schmidt

#Warsh

Levi Lystrom

*First principle calculations of optical properties of platinum(II) diimine complexes:
effect of the N-Methylnaphthalimide substitutes*

Mariana Lopez Jaimez and Wutt Mhone Soe

Developing an open source electronic chessboard

Wei Kang Lim

Polymer crowding and shape distributions in polymer-nanoparticle mixtures

Andrew Dalman, Felicia Marquez, and Justin Paulson

Artificial bone

Hayley Horntvedt, Megan Toso, Emma Kramlich

Corporate social responsibility communication research: A review and research agenda

Joseph Starbuck

Red River Civic Plaza

David Breitbach

Dominance status and exploratory behavior in a wild population of black-capped chickadees

POSTER PRESENTATIONS

AFTERNOON SESSION

1:30pm-3:00pm • Memorial Union, Plains Room

Allison Goldenstein

Epidemiology of Moraxella bovis in North Dakota

Austin Schmidt

Blood flow restricted exercise increases muscle swelling and indicators of fatigue to the same extent as low-intensity exercise

Nathan Esboldt

Robots for relief

Clare Geinert, Chelsea Brown, Ali Wu, Austin Koenig, Kami Sim, and Lexi Zawatz

Seven-Eleven project

Elaine Cristina Ferreira

Primer design using 16s rDNA sequences for dust microflora determination

Jackie Wrage

Do aphids survive better on ZnO-nanoparticle treated wheat plants?

Jordan Brummond, Cole Rehovsky, and Jaci Conroy

Bison Microventure Antimicrobial Group: Producing an antimicrobial dental implant

Kelsy Hewitt

Costuming The Little Shop of Horrors

Krystal Dawn Kalliokoski

Renewable resource derived starting materials for polymer synthesis

Lucas Budzien and Neil Worms

Ion-exchange chromatography

Ben Olson

Compression exercise at low-to-moderate cuff pressures does not alter the metabolic or perceptual response to resistance exercise

Sanjivni Sinha

A case study to see the effect of nanoscale zero-valent iron on plant growth promoting rhizobacteria (PGPR) Pseudomonas fluorescens

Sydney Boschert

Fabrication of fine pitch copper pillars utilized in die bonding

Vanessa O'Gara, Eric Haverluk, Mitch Muske, Kaleb Hutchens

SNOWMENATOR

Alexander Spacek

HIF frequencies and functions in small cell lung cancer

Fabrication of fine pitch copper pillars utilized in die bonding

Sydney Boschert

Center for Nanoscale Science and Engineering

Fine pitch copper pillars have an advantage over traditional solder bumps in that they have a higher reliability and better thermal performance; they also give the advantage of a smaller pitch between the pillars as during reflow they will not slump like solder would¹. With these advantages in mind and in order to keep up with the ever-driving market demand of creating smaller electronic devices; fine pitch copper pillars with a solder cap are being explored. In this research, fine pitch copper pillars were electroplated in a copper plating solution to form 60 micron pillars capped with a 10 micron solder cap.

-----*Afternoon Session: Memorial Union, Plains Room*

Dominance status and exploratory behavior in a wild population of black-capped chickadees

David Breitbach

Biological Sciences

In some species of birds, dominance status has been shown to have a large impact on fitness by affecting mating success, resource allocation, and survival. Additionally, individuals have been shown to differ in how they react to a novel situation and how they gather information about their surroundings. I studied a non-breeding population of black capped chickadees to understand how variation in social ranking within a linear dominance hierarchy correlated to exploratory behavior and response to the introduction of a novel object in a natural population, and to assess the effectiveness and quality of recording exploratory behavior in a natural rather than a laboratory environment. I predicted that subordinate chickadees would locate newly introduced feeders, with or without novel objects present, faster than dominant chickadees as a result of their lower social status in a dominance hierarchy. While there was no considerable correlation between individual arrival order, total number of arrivals, and initial arrival with dominance rank, the total number of arrivals at the temporary feeding stations housing no novel object did slightly correlate with dominance score. I believe that increasing the number of dyadic interactions in addition to expanding the range of the population sample size and having prior knowledge of each individual's sex would greatly help discern whether individual variation in behavioral traits is correlated with dominance status in winter hierarchies of black capped chickadees.

-----*Morning Session: Memorial Union, Plains Room*

Bison Microventure Antimicrobial Group: Producing an antimicrobial dental implant

Jordan Brummond, Cole Rehovsky, and Jaci Conroy

Microbiology/Industrial and Manufacturing Engineering

Infection is one of the leading causes of rejection amongst dental implant recipients. Infection leads to pain, inflammation, and bone loss, which complicates future surgeries. The ultimate goal of the Bison Microventure is to create a porous ceramic dental implant with antimicrobial properties. Over the existence of the Bison Microventure, this group has been trying to find a material with antimicrobial properties that is not cytotoxic to mouse osteoblast cells. Once a material is found, it will then be incorporated into a dental implant in the most convenient and effective way possible. The past year, two materials have been considered, nano-particle silver and betulin, a derivative of birch bark. One of them has shown that it is not the direction the group wants to go in, while the other is currently being researched.

-----*Afternoon Session: Memorial Union, Plains Room*

Ion-exchange chromatography

Lucas Budzien and Neil Worms

Mechanical Engineering

Chromatography is a multibillion dollar market utilized by pharmaceutical, biotechnology, food & beverage and water analysis industries. The product currently being developed should be able to accommodate all of the previously mentioned market players. The process for Ion-Exchange Chromatography is what is being focused on at the present time because of the available resources. The product being proposed will automate the current manual manufacturing method for creating Ion-Exchange Columns. Ion-Exchange Columns are made up of 4 generic parts. First is the syringe which holds everything in place. The second part are micropores filters used solely to hold the third element in place. The third and most critical segment are the Ion-Exchange beads. The beads are what essentially create the Ion-Exchange Column. The other components are just place holders. Lastly is a buffer solution which stabilizes the beads during the manufacturing/combination of the different elements to create the column. There have been two previous iterations of the product but neither of which would be suitable for selling as a commercial product. The next step in the process is to refine the process and product components. This is help create a more commercial and user friendly product that should be able to cover a wide range of the market. The refinement steps along with create a version 3.0 prototype will be completed by the end of the 2014-2015 school year.

-----*Afternoon Session: Memorial Union, Plains Room*

Artificial bone

Andrew Dalman, Felicia Marquez, and Justin Paulson

Manufacturing Engineering

Originally developed as part of a dental implant research project, the artificial bone innovation exists to develop a material & manufacturing process in order to produce & commercialize a product with mechanical and physical properties as similar to human bone as possible.

The artificial bone will share the same shape and material strength as real human bone, allowing it to react in the same manner as the bone for a given stress placed upon it. By allowing practitioners to work on a sample that will fracture in the same way and under the same circumstances as a human bone, our innovation provides the capability to gather usable data without requiring a human trial.

Areas of application for artificial bone include surgical training and R&D, implant testing and development, bone/fracture mechanics research, and safety testing. Another notable area of application is surgical preparation- a bone can be replicated to match a patient's bone and a surgery undertaken on it, allowing a surgeon to gain valuable knowledge about the procedure before any invasive action is undertaken.

Artificial bone makes it simpler and less expensive to test procedures and implantable devices- because the innovation does not include any biological components, there are no ethical or administrative barriers to research performed using it. Because it is a nonliving, manufactured (vs. grown) product, it does not decay or present a biological hazard like 'real' body parts do.

-----*Morning Session: Memorial Union, Plains Room*

Robots for relief

Nathan Esboldt

Mechanical Engineering

The task is to design and develop a scaled down prototype capable of delivering aid to places affected by natural disasters. The device is required to traverse a variety of terrains including sand, water and other obstacles while safely transporting food, water, medical supplies and other relief materials. In order to provide a lasting solution the device will focus on low power consumption and will be powered by rechargeable batteries. Our prototype will compete in a regional competition hosted by ASME. The competition will consist of an obstacle course that the competing devices will have to traverse.

-----*Afternoon Session: Memorial Union, Plains Room*

Primer design using 16s rDNA sequences for dust microflora determination

Elaine Cristina Ferreira

Veterinary and Microbiological Sciences

Primer design using 16s rDNA sequences for dust microflora determination

Elaine C. Ferreira^{1,2}, Shelley M. Horne², Birgit M. Pruess²

¹Department of Engineering, Rio Grande do Sul State University, Brazil

²Department of Veterinary and Microbiological Sciences, North Dakota State University

It is known that dust is replete of microorganisms, and due to the increasing of dust in the Bakken oil fields road the determination of the microflora on it has become a focus of interest. This study aims to design PCR primers using 16S rDNA sequences to identify 14 bacterial species that are commonly associated with dust, these being either pathogens or biorremediators. For bacteria with multiple copies of 16S rDNA operons, the sequences retrieved from Genbank database were first aligned (Clustal Omega – ClustalW) among themselves; the sequence with maximum copy number in each bacteria was then chosen to represent that bacterium. For the reason that each bacterial species (e. g. E. coli) can have more than one variety (e.g. O157:H7, CFT073), alignments between the varieties of the same species were made. Then, a final alignment was made with the 14 bacterial species showing the conserved regions among the 14 bacteria analyzed and the nine well characterized hypervariable regions (V1-V9). The conserved regions will allow us to design a primer pair to be used as positive control to detect all tested microbes, and the variable regions to design one primer pair for each microbe for specific determination. For confirmation, we will also design primers using sequences of species specific virulence factors (e.g. shiga toxin for E. coli).

-----*Afternoon Session: Memorial Union, Plains Room*

Seven-Eleven project

Clare Geinert, Chelsea Brown, Ali Wu, Austin Koenig, Kami Sim, and Lexi Zawatzke

Theatre Arts

One set. Seven days. Seven eleven-minute plays.

Usually a show starts with a script, but this time newfangled theatre company started with the set. On September 8, 2014, seven student playwrights were shown a set and asked to write eleven-minute scripts in seven days. Each script was assigned to a student director, who had eleven days to cast and rehearse the scripts. On September 26-27, audiences were invited to attend a unusual performance experience: seven unique shows all inspired by the same set, entirely student written, directed, designed, and produced.

Founded in 2008, newfangled theatre company strives to challenge and enlighten students and audiences by presenting bold, engaging works of theatre. Each newfangled production is entirely student-directed, designed, and produced. The company is a branch of Theatre NDSU under Little Country Theatre Productions, and combines that institution's commitment to theatrical excellence with the daring, "newfangled" vision of the next generation of theatre artists.

-----*Afternoon Session: Memorial Union, Plains Room*

Epidemiology of *Moraxella bovis* in North Dakota

Allison Goldenstein

Veterinary and Microbiological Sciences

Moraxella bovis is a gram-negative, aerobic bacterium that causes bovine keratoconjunctivitis, an eye disease similar to pink eye in cattle. To research the genetic diversity of this bacterium, I used samples taken from the North Dakota Veterinary Diagnostic Laboratory. I then constructed the epidemiology of the *Moraxella bovis* bacterium while discerning the geographic locations of the samples. I selected isolates to be genotyped using Polymerase Chain Reaction testing and determined the species of each individual isolate; all bovis samples were run under Pulsed-field Gel Electrophoresis to observe the genetic composition of the entire chromosome.

-----*Afternoon Session: Memorial Union, Plains Room*

Costuming The Little Shop of Horrors

Kelsy Hewitt

Theatre Arts

Kelsy Hewitt is a senior in the BFA Theatre Design and Technology program with an emphasis in Costume Design. This fall she completed her capstone project designing costumes for LCT's production of *The Little Shop of Horrors*. From beginning to end this process involved a heavy amount of early 1960's period research, allowing the scene to completely be set. This project began with a thorough script analysis and scene breakdown that allowed the design team for the show to be clearer about what was to be seen on stage. Renderings and fabric choices were then made to get a clearer picture of the design before the show was cast where then clothing was built, pulled, or shopped. The process continued through rehearsals and finally into dress rehearsal and performances that completed the design process. This project involved a heavy amount of research, problem solving, period knowledge, budgeting, script analysis.

-----*Afternoon Session: Memorial Union, Plains Room*

Corporate social responsibility communication research: A review and research agenda

Hayley Horntvedt, Megan Toso, and Emma Kramlich

Communication

In 2011, major companies gave, on average, \$21.02 million to charitable organizations (Corporate giving standard, 2012). In addition, 89% of Americans think that businesses, governments, and NGOs should collaborate to solve pressing social and environmental issues (Cone, 2008). To this end, corporate social responsibility (CSR) communication seeks to enhance an organization's reputation, stakeholder assessments of legitimacy, and financial performance. To achieve these goals, CSR often involves managing relationships with nonprofit organizations.

The CSR literature is vast and encompasses many academic disciplines although it tends to be concentrated within the business and communication fields of study. Our review organizes the literature into three broad domains: macro, meso, and micro. Within these domains, we identify the literature that guides current conceptualizations of CSR. Our review concludes by identifying gaps in the literature and offering a set of propositions for future research.

-----*Morning Session: Memorial Union, Plains Room*

Developing an open source electronic chessboard

Mariana Lopez Jaimez and Wutt Mhone Soe

Electrical and Computer Engineering

Nowadays, technology allows chess players around the world to use a vast amount of gadgets and computer applications to keep on learning and playing chess. However, among the current options for an electronic chessboard in the market, there is a notable absence of an affordable, flexible, and open-source alternative that would allow a chess player to customize her own experience. This project consists on building an electronic chessboard using Light Dependent Resistors (LDR) to monitor and keep track of the movement of the chess pieces throughout a game of chess. The open-source platform Raspberry Pi and the programming language C++ are used to develop the software to validate a player's move and a Graphical User Interface will indicate the current status of the game.

-----*Morning Session: Memorial Union, Plains Room*

Renewable resource derived starting materials for polymer synthesis

Krystal Dawn Kalliokoski

Chemistry

Approximately 96% of the organic chemicals used today are derived from nonrenewable fossil fuels. With the oil supply diminishing and emissions from burning fossil fuels polluting the environment, it becomes imperative to discover alternative solutions to produce these necessary chemicals. One viable option is to utilize biomass, a renewable carbon-neutral resource, as a chemical feedstock. Our group's research is focused on the development of novel methods for the conversion of renewable resources to feedstock chemicals for use in polymer synthesis. In particular, we are investigating methodologies for the synthesis of terephthalic acid and analogs from 2,5-furandicarboxylic acid and 5-hydroxymethylfurfural. In this project, furan diacids which contain differing chain lengths, 2,5-furandicarboxylic acid, 5-carboxy-2-furanacrylic acid, and 2,5-furandipropionic acid were synthesized.

-----*Afternoon Session: Memorial Union, Plains Room*

Influence of the 5 gene stress survival islet on salt-induced nisin resistance of *Listeria monocytogenes*

Kouevi Kodjovi

Microbiology

The foodborne pathogen *Listeria monocytogenes* is capable of growing at refrigeration temperatures, which makes it a significant safety concern on ready to eat foods. Natural antimicrobials such as nisin can be used to control this pathogen in foods. It is important to understand how components of a food could impact resistance of *L. monocytogenes* to the antimicrobial. Prior work has shown that *L. monocytogenes* has increased resistance to nisin at 7°C when it is first exposed to NaCl. Besides environmental stressors, the presence of specific genomic islands such as the stress survival islet (SSI-1, lmo0444-lmo0448) can confer increased nisin resistance. As SSI-1 is variable among *L. monocytogenes* strains, we wanted to determine if the presence of SSI-1 was associated with increased salt-induced nisin resistance. The presence or absence of SSI-1 was determined using a multiplex PCR assay for 48 strains of *L. monocytogenes* from lineage I and lineage II. Multi-locus sequence typing was used to classify these strains as members of clonal complexes. We found that the distribution of SSI-1 is clonal. Salt-induced nisin resistance was measured by first exposing strains grown at 7°C to BHI+6% NaCl, followed by exposure to 2mg/mL Nisaplin for 24h at 7°C. Strains from clonal complex 7 (SSI-1 positive) had greater survival in nisin when first exposed to salt stress compared to strains from clonal complex 11 (SSI-1 negative). These data suggest that inducible nisin resistance in *L. monocytogenes* can be influenced both by environmental conditions as well as the genetic composition of the strain.

-----*Morning Session: Memorial Union, Plains Room*

Cellulation

Jacob Larson and Mike Mann

Manufacturing Engineering

Cellulation is a system to more accurately represent the cell growth conditions found in the body (in-vivo) in a laboratory (in-vitro) setting. It was hypothesized the current method of testing cell growth was not ideal and many areas of improvement could be made. Currently, cell tests occur in a 6 well plastic plate which is a stagnant environment. Simulated bio-fluid, essentially the blood in a human body and cells are placed into the 6 well plate which is placed inside an incubator kept at 37 degrees Celsius. Waste produced by the cells is not removed and slowly fills up the well until it is replaced by the tester. This system procedure requires large amounts of effort to check growth conditions and cannot be run for long periods of time.

To improve the current method a system was created to replicate the fluid flow through a human capillary under human growth conditions. A pump to flow a regulated amount of simulated bio-fluid was fabricated and feeds into growth chambers where tests occur. The third version currently in development will occur in a self-contained incubator which provides a sterile, 37 degree Celsius environment.

Future testing of mice osteoblasts and human breast cancer cells will occur to further test the validity of the hypothesis. Plans to test drugs in the device is also underway. Not only does the device offer promise of better cell growth testing but also speeding up the pre-clinical testing of vital drugs.

-----*Morning Session: Memorial Union, Plains Room*

Polymer crowding and shape distributions in polymer-nanoparticle mixtures

Wei Kang Lim

Physics

Macromolecular crowding can influence polymer shapes, which is important for understanding the thermodynamic stability of polymer solutions and the structure and function of biopolymers (proteins, RNA, DNA) under confinement. We explore the influence of nanoparticle crowding on polymer shapes via Monte Carlo simulations and free-volume theory of a coarse-grained model of polymer-nanoparticle mixtures. Exploiting the geometry of random walks, we model polymer coils as effective penetrable ellipsoids, whose shapes fluctuate according to the probability distributions of the eigenvalues of the gyration tensor. Accounting for the entropic cost of a nanoparticle penetrating a larger polymer coil, we compute the crowding-induced shift in the shape distributions, radius of gyration, and asphericity of ideal polymers in a theta solvent. With increased nanoparticle crowding, we find that polymers become more compact (smaller, more spherical), in agreement with predictions of free-volume theory. Our approach can be easily extended to nonideal polymers in good solvents and used to model conformations of biopolymers in crowded environments.

-----*Morning Session: Memorial Union, Plains Room*

Evaluation of basil extracts on colon cancer cell growth

Kaitlin Lindsey and Kendra Kibble

Biological Sciences

Colon cancer is a leading cause of cancer mortality and is the third most commonly diagnosed cancer among both men and women in the United States today. Botanicals, such as basil, consist of several bioactive components that show chemopreventive effects against many tumor types including colon cancer. The antitumor potential of a botanical can vary significantly depending on the species, the accession, growing conditions, and several other factors. The purpose of this study is to compare the effects of different basil extracts on the growth of colon cancer cells. Five different accessions of basil (four from *Ocimum tenuiflorum* and one from *Ocimum basilicum*) will be compared for their antitumor effects in two colon cancer cell lines, HCT116 and HT-29. The tumor cell lines will be treated with 0-100 μ l of basil extract for 24 and 48 hours and the effects on colon cancer cell numbers will be evaluated using the trypan blue and clonogenic survival assays. Should significant growth-inhibitory effects be observed for any of the basil extracts, further studies to identify the potential mechanisms will be performed. This study aims to determine which basil extracts have the greatest therapeutic potential for colon cancer cells and to identify potential molecular mechanisms associated with the basil extracts.

-----*Morning Session: Memorial Union, Plains Room*

Relation of two brief health literacy tools to correct prescription understanding

Jane Loueng

Pharmacy Practice

Objective: To evaluate two brief literacy prediction tools for relation to understanding of a prescription label and using a drug correctly. We examined an association between scores on the Newest Vital Sign (NVS) or Rapid Estimate of Adult Literacy in Medicine (REALM-R), and the likelihood that patients would interpret a prescription label correctly, calculate day supply, and use an oral syringe correctly.

Methods: Patients who visited Family HealthCare Pharmacy were asked to complete the NVS and REALM-R, and to interpret a prescription medication label. Each patient received a bottle of amoxicillin suspension with one of four prescription labels randomly varied in directions for frequency and amount. Patients were also asked to calculate day supply and demonstrate ability to draw up the required dose in an oral syringe.

Results: A total of 150 patients consented to participate. Only NVS score was associated with ability to fully interpret the label correctly. Neither tool was related to ability to draw up the correct syringe amount, but both had some correlation to success in calculating the day supply provided. The NVS and REALM-R literacy scores had a modest correlation with each other.

Conclusion: The NVS may be useful in predicting prescription label understanding and a patient's ability to do a simple dosage calculation. Neither the NVS nor REALM-R was related to ability to draw an amount from an oral syringe correctly.

-----Morning Session: Memorial Union, Plains Room

First principle calculations of optical properties of platinum(II) diimine complexes: effect of the N-Methylnaphthalimide substitutes

Levi Lystrom

Chemistry

The effect of the aromatic group N-Methylnaphthalimide on optical properties of platinum(II) diimine complexes bearing 7-benzothiazolylfluoren-2-yl motif on the bipyridine and acetylido ligands are theoretically investigated using time-dependent density functional theory (TDDFT) calculations. Substitution of benzothiazolyl groups by N-Methylnaphthalimide in all ligands results in wider and redshifted absorption band with a longer lower-energy shoulder. For all complexes, the lower energy optically weak shoulder of the absorption spectra is dominated by singlet metal-to ligand (MLCT) and singlet Ligand-to-Ligand (LLCT) Charge Transfer character. The first highly intense band originates from $1\pi, \pi^*$ transitions associated with bipyridine ligands. For emission, substitute N-Methylnaphthalimide groups in acetylido ligands result in blue-shifted triplet transitions with dominating $3\pi, \pi^*$ character, while its substitution of benzothiazolyl in fluorene motif have significant contribution from triplet MLCT/LLCT transitions. Our calculated spectra demonstrate good agreement with experimental data validating feasibility of applied computational approaches.

-----Morning Session: Memorial Union, Plains Room

SNOWMENATOR

Vanessa O’Gara, Eric Haverluk, Mitch Muske, Kaleb Hutchens

Mechanical Engineering

The initial idea for this project came from the challenges senior citizens and people with physical disabilities face during the winter months. In order for these people to maintain their independence they need assistance with snow removal. The objective of this project was to design a snow plow that would operate completely autonomously. This would allow disabled persons to remain self-sufficient year round. The presentation defines the teams personal design constraints as well as those required to compete at the 2015 Annual ION Autonomous Snowplow Competition. It highlights major milestones during the design process and how components were selected to be present in the final design. The final design has been completed with CREO software and detailed renderings can be reviewed in the final design section.

-----*Afternoon Session: Memorial Union, Plains Room*

Compression exercise at low-to-moderate cuff pressures does not alter the metabolic or perceptual response to resistance exercise

Ben Olson

Health, Nutrition, and Exercise Sciences

Compression exercise is a novel method of training that elicits rapid muscle mass and strength gains at low-intensities. This may have significant applications in injury rehabilitation and the prevention of age-related loss of muscle mass (sarcopenia). However, little is known about factors contributing to compression exercise prescription. This study determined whether thigh size influenced energy metabolism, heart rate (HR), perceived exertion (RPE), and pain during compression resistance exercise. Fourteen male subjects (age=22±3 yrs, height=178±6 cm, weight=86±12 kg, thigh size=59±4) completed knee extension and flexion resistance exercise (4 sets, 75 total repetitions, 20% of maximum strength, 30 sec rest between sets during two trials: 1) Control; 2) Compression. The compression exercise used a 5cm external cuff around the proximal thigh inflated to 140 mmHg. Whole blood lactate, HR, RPE, and pain via a visual analog scale (VAS) were evaluated pre-exercise, after sets 1, 2, 3, and 4, and 5 min post-exercise. There were no differences ($p>0.05$) in peak lactate (Control= 6.05±1.3 vs. Compression=5.9±0.9 mmol), HR (Control=140±19 vs. Compression=144±13 bts/min), and RPE (Control=5.8±2.8 vs. Compression=6.3±2.4 arbitrary units). Pain tended ($p=0.06$) to be lower in Compression (28±38mm) compared to Control (39±39mm). Individuals with larger thigh circumferences did not have lower lactate or RPE ratings during compression exercise. We conclude that at a pressure of 140 mmHg using a 5cm inflation cuff, thigh size does not increase metabolic or perceptual responses to compression resistance exercise. Future studies with larger samples, greater ranges of thigh sizes, and different cuff pressures need to be examined.

-----*Afternoon Session: Memorial Union, Plains Room*

Effects of radio frequency on Lambda DNA

Jacob Parrow

Electrical and Computer Engineering

This research study will investigate the effects of Radio Frequency on Lambda DNA. The study will consist of a Radio Frequency sweep from 1 GHz to 8 GHz on a 1x TE buffer to pick up characteristics, if any, of the buffer. Next, Lambda DNA will be put into the 1x TE buffer, and we will run the same frequency sweep to determine if the DNA absorbs any specific frequencies. More specifically, we are trying to determine if there are any unique frequencies that will up- or down-regulate the activation state of Lambda DNA. If there are unique frequencies, how can we use these frequencies as a long term advantage regarding health care and other aspects of the body?

-----*Morning Session: Memorial Union, Plains Room*

Correcting historical inaccuracies of settlement-era log cabins at Western Minnesota Steam Threshers Reunion

Elizabeth Rowinski

Natural Resources Management

Previously published historical information about five settlement-era log cabins at the Western Minnesota Steam Threshers Reunion (WMSTR) in Rollag, Minnesota, has sometimes been inaccurate. This research project is being completed to provide future generations with accurate facts and to add to the general history of the settlement of Clay County, Minnesota. Land Patent documents were retrieved from General Land Office records and census reports were used to support the Land Patents. A cross section of a log from the Priewe cabin was collected for dendrochronological (tree-ring) analysis. Official government records have corrected inaccuracies in WMSTR documentation of three of the five cabins. The sample taken from the Priewe cabin did not crossdate with other regional samples. Continued research should focus on the dendrochronology aspect of these buildings. Research should also emphasize determining the eligibility of the buildings for a nomination to the National Register of Historic Places.

-----*Morning Session: Memorial Union, Plains Room*

Blood flow restricted exercise increases muscle swelling and indicators of fatigue to the same extent as low-intensity exercise

Austin Schmidt

Health, Nutrition, and Exercise Sciences

Blood flow restriction (BFR) exercise is a relatively new style of exercise that is still being researched to determine proper prescription. BFR utilizes a compressive force applied proximally to a limb in order to restrict venous flow while still allowing arterial flow. BFR is being developed as a potential rehabilitation method given it induces a rapid increase in muscle mass and strength at a low intensity. The main purpose of this study was to explore muscle swelling (via ultrasonography) during and after BFR exercise. A secondary objective was to explore indices of fatigue (contraction velocity, power output, and total work) with BFR exercise. Fourteen subjects (age=22±3 yrs, height=178±6 cm, weight=86±12 kg, thigh size=59±4 cm) were recruited to complete a control exercise session and a BFR exercise session at least two days apart. Both sessions consisted of 4 sets with 75 repetitions (30, 15, 15, 15) and 30 seconds rest between sets. BFR was performed using a 5cm inflation cuff (Hokinson) at 140mmHg. Pre-exercise there were no differences in muscle cross-sectional area (CSA) (control=6.6 ±1.7 vs. BFR=6.8±0.6cm², p=0.73). Five minutes post-exercise muscle CSA increased 12% and 9.5% in control and BFR, respectively with no differences between the two sessions (p=0.80). The indices of fatigue significantly declined from set 1 to set 4 (p<0.05) with no difference between sessions (p>0.05). We conclude at a moderate cuff pressure (140mmHg), BFR exercise does not alter muscle swelling (CSA) or indicators of fatigue to a greater extent than exercise without a cuff.

-----*Afternoon Session: Memorial Union, Plains Room*

A case study to see the effect of nanoscale zero-valent iron on plant growth promoting rhizobacteria (PGPR) *Pseudomonas fluorescens*

Sanjivni Sinha

Civil and Environmental Engineering

Nanoparticles (<100 nm) are currently in use for biomedical, personal care, industrial, and environmental remediation applications. Therefore, assessing their impact on environmentally beneficial microorganisms such as *Pseudomonas fluorescens* is imperative. This plant growth promoting rhizobacteria (PGPR) is able to solubilize insoluble forms of Fe (iron) by producing siderophores when Fe availability is limited. *P. fluorescens* secretes siderophores providing Fe to itself and plants while limiting iron availability to plant pathogens. The aim of this ongoing research is to ascertain whether and how the presence of Nanoscale Zero-Valent Iron (NZVI) affects growth, viability and siderophore production of *P. fluorescens*. The interactions of *P. fluorescens* with NZVI concentrations ranging from 1-5mg/mL are being studied via plate counts and a MTT Cell Viability Assay. Our future research will evaluate the effects of NZVI on siderophore production and iron uptake in *P. fluorescens*. This research is ongoing and supported by National Science Foundation (Grant # CMMI-1125674).

-----*Afternoon Session: Memorial Union, Plains Room*

HIF frequencies and functions in small cell lung cancer

Alexander Spacek

Biological Sciences

The leading cause of death in the United States is lung cancer. Lung cancer is caused by any variety of genetic changes in cells which lead to abnormal cell behavior and increased proliferation and eventual invasive behavior. One such change that often occurs in lung cancer cells is the activation of Hypoxia-induced factors (HIFs). HIFs are transcription factors which allow for the activation of many genes that allow cells to function in low oxygen (hypoxic) environments. There are three different HIFs (HIF1, HIF2, and HIF3), each with their own functions and each composed of an alpha and a beta subunit. HIFs are vital to the survival and progression of cancer cells, as cancer tumors are often densely packed and are inadequately vascularized, resulting in hypoxic conditions. HIFs are also believed to be responsible for increases in cell proliferation rates and other dangerous cancer activity. The purpose of this study is to investigate the role each HIF plays in lung cancer, what stage of cancer each HIF is most prevalent, and to identify possible times to target HIF inhibition.

-----*Afternoon Session: Memorial Union, Plains Room*

Red River Civic Plaza

Joseph Starbuck

Architecture and Landscape Architecture

The City of Fargo, North Dakota, is funding the construction of a new City Hall to replace their current 1960s structure. This proposed development provides the largest city in North Dakota with a tremendous opportunity to design an iconic open space between their Civic Center, Public Library, and their proposed City Hall. My research will focus on the integration of low impact development into the Red River Civic Plaza to manage stormwater by utilizing bioretention, green roofs, porous pavements, and rainwater harvesting to reduce the demand for the current engineered water conveyance systems consisting of gutters, storm sewers, culverts, and detention basins. The Red River Civic Plaza provides the Fargo-Moorhead community with three sets of benefits: economic, environmental and sociological. My research quantifies the volume of stormwater run-off before and after development, the cost effectiveness of low impact development over time as it relates to current engineered water conveyance systems, as well as its environmental and sociological benefits in the landscape. My thesis will conclude opportune locations for integrating low impact development within the Red River Civic Plaza to maintain zero discharge of stormwater from the site and provide the Fargo-Moorhead community with a socially interactive, sustainable public destination.

-----*Morning Session: Memorial Union, Plains Room*

#Warsh

**Kristine Wentworth, Robbie Darling, Austin Foss, Diedrich Harms,
Ally Hatcher, Amy McDonald, and Tommy Schmidt**

Architecture

#Warsh is an innovative design solution for a self-sustaining desert climate community located near Marfa, Texas. It consists of eight residencies under 500 square feet and four community spaces. Each dwelling was uniquely adapted to a specific client, but cohesive in design. They incorporate local, sustainable materials and innovative green design solutions. This project was completed in the spring semester of 2014 in our second year studio class.

-----*Morning Session: Memorial Union, Plains Room*

Do aphids survive better on ZnO-nanoparticle treated wheat plants?

Jackie Wrage

Biological Sciences

The properties of nanoparticles are unique because of their high surface area-to-volume ratio, and the effects that they may have on an ecosystem are poorly understood. Nanoparticles are being increasingly incorporated into many industrial products such as pesticides and the effects they have on entire ecosystems have yet to be studied in depth. This project is part of a larger study looking at how ZnO nanoparticles move through wheat plants and focuses on the trophic transfer of the nanoparticles to aphids. *Triticum aestivum* L. (spring wheat) were planted in vermiculite/hydroponic medium and exposed to either regular ionic Zn or ZnO nanoparticles via the roots. Five wheat aphids were placed on each plant after 31 days and counted after five, seven, eight, and nine days. The aphids were removed from the plants after 11 days and separated as either nymphs or adults based on body size, then weighed. This study is on-going, and the next step is to analyze the Zn concentration in both the wheat and the aphids using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) to determine if the concentrations of Zn in the aphids differ between treatments.

-----*Afternoon Session: Memorial Union, Plains Room*

NOTES

