

# NDSU EXPLORE

UNDERGRADUATE EXCELLENCE IN RESEARCH AND SCHOLARLY ACTIVITY 2016

# WELCOME MESSAGE



Kelly A. Rusch, Ph.D., P.E.  
Vice President for Research and Creative Activity



NDSU students at the National Conference on Undergraduate Research in April 2016. Left to right: Lauren Singelmann, Cooper Bierscheid, Typhanie Schafer, John Wells, Torie Jones, Luke Koran, Mariom Carvajal.

To students, staff, faculty and our neighbors in the community,

Welcome to the third annual NDSU EXPLORE event, an opportunity to recognize and celebrate the exemplary research and creative activity of our university's student body. Undergraduates from all disciplines are presenting current or recently completed projects showcasing the diversity of research interests and creative processes at North Dakota State University.

This event has continued to grow each year in student participation, thanks to the dedicated mentorship of NDSU's distinguished faculty and researchers. Results from a spring 2016 survey on Student Experiences in the Research University showed that NDSU students involved in undergraduate research and scholarly activity reported a higher degree of satisfaction with their overall academic experience and connectedness with faculty. These connections and opportunities result in development of critical thinking and problem-solving skills, and allow students to contribute new knowledge and ideas to their respective disciplines.

This past year NDSU EXPLORE supported the participation of seven NDSU students in the April 2017 National Conference on Undergraduate Research at the University of North Carolina-Asheville. This is an annual conference dedicated to promoting undergraduate research, scholarship and creative activity in all fields of study. More than 4,000 undergraduate students from across the U.S. participated, and we were proud to have some of our NDSU EXPLORE participants present.

Our undergraduate students are doing remarkable scholarly work. Thank you for attending our students' presentations and supporting their endeavors. We hope you enjoy exploring a part of the student learning experience at NDSU.

# THANK YOU

Thank you to the following NDSU EXPLORE Committee members for helping make this event possible.

**NDSU EXPLORE Committee:**

**College of Agriculture, Food Systems, and Natural Resources**  
Harlene Hatterman-Valenti \_\_\_\_\_ Plant Sciences

**College of Arts, Humanities and Social Sciences**  
Michael Christenson \_\_\_\_\_ Architecture and Landscape Architecture

**College of Business**  
Rajani Ganesh Pillai \_\_\_\_ Management and Marketing

**College of Engineering**  
Achintya Bezbaruah \_\_\_\_\_ Civil and Environmental Engineering

**College of Health Professions**  
Amanda Brooks \_\_\_\_\_ Pharmaceutical Sciences  
Rebecca Brynjulson \_\_\_\_\_ Pharmacy Practice

**College of Human Development and Education**  
Gregory Sanders \_\_\_\_\_ Deans Office

**College of Science and Mathematics**  
Katie Reindl \_\_\_\_\_ Biological Sciences

**NDSU Libraries**  
Robert Correll \_\_\_\_\_ Sciences Librarian  
Nicole Juve \_\_\_\_\_ Agricultural Science Librarian  
Jenny Gasto \_\_\_\_\_ Resource Acquisition, Management and Discovery / Architecture and Visual Arts Librarian

**NDSU TRIO/McNair**  
Anna Sheppard

**Research and Creative Activity**  
Sheri Anderson, Kay Sizer, and Cassie Johnson \_ Research Development Office

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# SCHEDULE

All events will be held on the second floor of the Memorial Union

**7:30-9 a.m.**  
President's Breakfast  
**Great Room**

Featuring a panel of undergraduate researchers and their faculty mentors:

Daniel Ewert, Ph.D. – Electrical and Computer Engineering  
Lauren Singelmann – Electrical and Computer Engineering

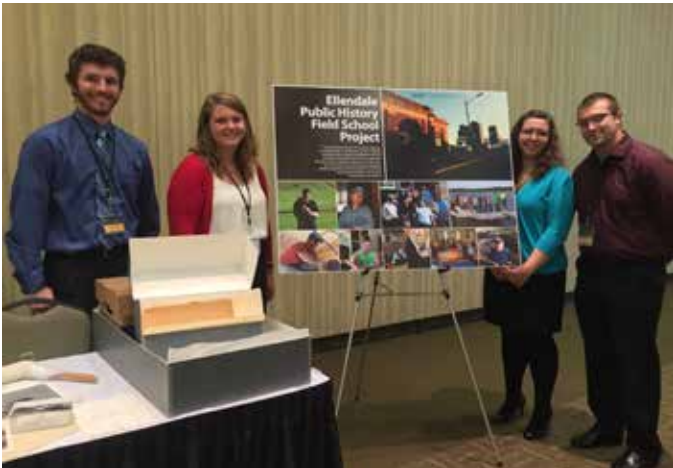
Harlene Hatterman-Valenti, Ph.D. – Plant Sciences  
Austin Espe – Microbiological Sciences

Amanda Brooks, Ph.D. – Pharmaceutical Sciences  
Jacob Shreffler – Animal Sciences

**9-11 a.m.**  
Student Presentations – Morning Session  
Oral Presentations – **Badlands and Mandan Rooms**  
Poster Session – **Plains Room**

**11:15 a.m.-12:45 p.m.**  
Luncheon for Student Presenters and Mentors  
**Great Room**

**1-3 p.m.**  
Student Presentations – Afternoon Session  
Oral Presentations – **Badlands and Mandan Rooms**  
Poster Session – **Plains Room**



# ORAL PRESENTATION SCHEDULE:

**MORNING SESSION ONE** 9-11 a.m. – **Badlands Room**

**Jared M. Melville**  
Salvation or Damnation: The Explanation, Applications, and Serious Implications of CRISPR-Cas9 Genetic Engineering

**Constance Economos, Paige Alexander and Alison Paul**  
Effective Communication Strategies in Nonprofit Organizations

**Alex Anderson**  
Effects of Luteinizing Hormone (LH) on In Vitro Lipid Droplets (LD) Expression in Luteal Cells in Non-Pregnant Sheep Fed Different Diets

**Lauren Singelmann, Ellen Swartz and Jerika Cleveland**  
RF Exposure on Primary Cell Lines

**Duncan Hannestad**  
Media Coverage of Third Party Presidential Candidates

**MORNING SESSION TWO** 9-11 a.m. – **Mandan Room**

**Todd Tingelstad**  
The Leading Women in Edgar Rice Burroughs' Fiction: A Close Look at Dejah Thoris of "A Princess of Mars" and Jane from "Tarzan of the Apes"

**Gabriel Michael Hideo Branco**  
A Pursuit of Happiness in NCAA Division III Athletics

**McKenzi Shelton**  
Accumulation of Lipid Droplets (LD) in the Corpora Lutea of Pregnant Cows

**Amber Winter**  
Investigation on the Determinants of Travelers' Intention to Visit a Destination and Destination Brand Loyalty

**Rio Bergh**  
Pain Visible and Invisible: Empathy's Impact on the Soldier's Experience in Tim O'Brien's "The Things They Carried"

**Lindsey Miller**  
Affluence and Memory

**AFTERNOON SESSION ONE** 1-3 p.m. – **Badlands Room**

**Olivia Vaadeland, Olivia Vogt and Mara Zinda**  
The International Journal of Strategic Communication: Uncovering Its Contents

**Elizabeth Jensen**  
Comparing Behavioral Syndromes in Intercaste Honey Bees

**Alexander J. Becklund**  
Priceless Experience, Expensive Methodology: Looking Into the Full Dimensions of Health-Care through Ethnographic Praxis

**Mackenzie Matousek**  
Foreign Newspaper Coverage of the United States Presidential Election

**AFTERNOON SESSION TWO** 1-3 p.m. – **Mandan Room**

**Brian Jordan**  
Innovative Strategic Health Communication: Challenges of Infectious Diseases in a Global Sphere

**Leanne Oakes and Abigail Ford**  
Measurements of Acromiohumeral Distance with the Application of Kinesio® Tape at 30, 60, 90 and 120 Degrees of Glenohumeral Abduction

**Samantha Hamernick**  
Home Language Literacy and Refugee Resettlement: A Case Study

**Suzie Marin**  
The Origin of Strategic Communication in the Military





POSTER PRESENTATION SCHEDULE

**MORNING SESSION    9-11 a.m. – Plains Room**

**Skylar Anderson-Buckingham**  
Does Testosterone Influence the Time a Male Songbird Joins the Dawn Chorus?

**Jenna Backes**  
Super Bowl Commercials: The Nature of their Content

**Logan Berg**  
Comparison of Biomass Production from Two Native Plant Varieties Adapted to Wet Conditions

**Thomas Blommel**  
Lattice Gas Model with Monte Carlo Collision Operator

**Kenneth Bolte**  
Mechanical Behavior of Material Combinations Implemented in Total Ankle Prostheses

**Noa Brezinka**  
Production of Lignin Based Carbon Fibers Using the Gel Spinning Process

**Deni Danielson and Christian Roise**  
Osteoinfiltration Team

**Lacey Dickerman**  
Melatonin & Receptor Signaling: Investigating Roles in Chicken Embryo Development

**Brendon Disrud**  
Molecular Dynamics of Laser Assisted Decomposition of Unstable Molecules at the Surface of Carbon Nanotubes

**Reed Erickson, Korgen Halver, Lydia Gregersen and Felicia Marquez**  
Effect of Ambient Conditions on the Elastic Modulus of Pig Bone

**Emily Fassbender**  
Micronutrient Zinc Fortification in Spinach using Zinc Nanoparticle in Soil Media

**Matthew Henry and Molly Hess**  
Super Bowl Ads: A Longitudinal Analysis of Gender Portrayals

**Peter Henson**  
Residual Strength of Composite Laminates after Impact and Its Effect on Flight Attitude

**Kelly Howard, Maxwell Carlson and Jacob Huesman**  
Dynamic Biological Systems

**Kally Kvidera**  
Influence of Hypoxia on Longevity and Antioxidant Expression in the Alfalfa Leafcutting Bee

**Mackenzie Matousek**  
Strategic Communication Education Development

**Alex Rischette**  
Germination Success of *Ratibida pinnata* Outside Its Native Range

**Jonas M. Sahouani**  
Highly Functional Methacrylated Bio-based Resin System for UV Curable Coatings

**Megan Schwalbe**  
Using Course Artifacts to Improve Teaching and Learning in Science General Education

**Halley Score, Jonathan Carlson and Sam Karschnia**  
Alternative Prosthetic Arm Attachment

**Vijay Shah**  
Structure and Stability of Silicon Nanoparticle Dispersions

**Patrick Simpson**  
Melt Processing Polyacrylonitrile/Lignin-Based Carbon Fiber

**Marissa Spear**  
Shifts in Flowering Phenology at Bluestem Prairie

**Janessa Veach**  
Solid Waste in Community Detention Basins: Where Does It Come From?

**Prajakta Warang**  
Angiopoietins (ANGPT) mRNA Expression in Ovine Corpora Lutea (CL): Effects of Diet and Arginine

**Braden Weight**  
Structure and Stability of Charged Colloid-Nanoparticle Mixtures

**Nathan Welberg**  
Potential Biomass Growth in Fargo

**Samantha White**  
The Attributes of the Best 50 Super Bowl Commercials

**Heather Yelle**  
Iron Cross-linked Alginate Beads for Removing Phosphate from Wastewater and Storm Runoff and Their Reuse



**AFTERNOON SESSION    1-3 p.m. – Plains Room**

**Kayleigh C. Alme**  
OSL Evaluation of Dune-Sourced Sand Lenses From Gilligan Lake, Michigan, USA

**Sara Bjorlin**  
Integrating New American Populations through Community Gardening

**Briana Breemeersch**  
Turning the Promise of Spider Silk Drug Delivery into Reality: A First Step

**Jaden Carlson**  
Identifying *Moraxella bovis* and *Moraxella bovoculi* in Infectious Bovine Keratoconjunctivitis (IBK) case submissions to the North Dakota State University Veterinary Diagnostic Laboratory (ND-VDL)

**Jacob Droel**  
Developing a New Co-culture Model of Chronic Osteomyelitis

**Austin Espe**  
The Effects of Biostimulants on Cucurbit Emergence and Yield

**Joseph Fehrenbach**  
Remanufacturing of 3D Printer Filament

**Aaron W. Green**  
Using Applied Geomorphology to Induce Meandering in an Urban Drainage Way

**Hailey Greenwalt**  
Abnormal Stream Restoration

**Matthew Henry and Molly Hess**  
Mass Media Coverage of the 2016 United States Presidential Election

**Allie Hobbs, Makenzie Schmidt and Haley Olson**  
A Comparative Analysis of U.S. and Foreign Media Coverage of Major Presidential Summits

**Benjamin Huber**  
Vasoactive Intestinal Peptide Receptor Deficiency Elevates the Frequency of Antibiotic-Producing Bacteria Found in Mouse Feces

**Joshua Johnson**  
Nitrite as a Substrate Surrogate in Chlorite Dismutase

**Aaron Knudtson, Tim Straus, Christian Eiyndck and Stacy Staab**  
Three Degrees of Freedom Artificial Wrist

**Joshua Krank**  
PGAM5 Isoforms Mediate Divergent Cell Death Reactions in HeLa Cells When Treated with the Chemotherapy Drug Arsenic Trioxide

**Sam Marolt**  
Silicified Stereom

**Rui Miao, Louis Miller and Jiaming Zhao**  
Study and Evaluation of Operating Experiences with Existing Geothermal Heat Pump Systems in North Dakota

**Jenna Murphy**  
Benefits of Integrated Writing Across the Disciplines Pedagogy in a Mid-Level Geomorphology Course

**Sean Nash**  
Transcriptional Regulation During Interrupted Development in Alfalfa Leafcutting Bees, *Megachile rotundata*

**Whitney Ong**  
Oxidation of PbSe Quantum Dots: Insights from First-Principle Calculations

**Alexander C. Reimers**  
Mountain Glacier Retreat Rates During the Last Pleistocene Glaciation in the Western United States

**Levi Schlosser**  
Animal Inside: A Closer Look at Humanity

**Nolan Schwarz**  
Improving Radiation Therapy for Lung Cancer Cells by using Piperlongumine

**Alexandra Sherrard**  
Accuracy of Nutrient Information Provided by Popular Smart Phone Apps and Impact of User Differences

**Jacob Shreffler**  
Validation of the Fitbit Accelerometer for Tracking Behavior of Unweaned Pigs

**Annika Sidhu, Sarah Brawthen and Tessa Keller**  
Media Portrayal: A Case Study of Universities in the Media

**Caleb Stubstad, Kristen Zattera and Carly Deal**  
Reasons Why Abstinent Adolescents Report They Have Not Had Sex

**Chengyao Tang**  
A Parallel Platform for Chip-seq Enrichment Analysis Using MACS Abstracts

**Jonathan Vollmer**  
The Effect of Simulated Hail Damage on Yield for Four Different Varieties of Spring Canola (*Brassica napus*)

**Sierra Walker**  
Vision in Tabanidae



# ABSTRACTS

**Kayleigh C. Alme**  
**K. Lepper**  
**A. Towell**  
**T. Fisher**

OSL Evaluation of Dune-Sourced Sand Lenses From Gilligan Lake, Michigan, USA

The Lake Michigan shore hosts the world’s largest freshwater coastal dune system. The dunes record a history of the dynamic interactions among coastal geologic processes and climatic drivers; however, this record can be difficult to decipher due to its complexity. Past work has shown that small lakes downwind from the dunes may contain eolian sand, thereby providing another archive of dune activity. Gilligan Lake, south of Holland, Michigan, is situated downwind of Green Mountain Dune, one of the largest dunes in western coastal Michigan. Previous lake cores have shown eolian sand laminae and lenses in the deposits of Gilligan Lake. The objectives of this project were to determine if sufficient quartz sand could be extracted from eolian horizons within a core for dating and to make preliminary OSL age evaluations for the samples. Five sand horizons were identified within the core and OSL samples were collected from three horizons. The sand was well sorted in the 150-250 micron range and was primarily quartz. The preliminary OSL results indicate eolian inputs to Gilligan Lake ~2900 years ago and between 3400 and 3600 years ago, which correlates with known periods of sand dune migration in the region and agrees with radiocarbon ages from previous studies. Ultimately, evaluating the record of eolian activity archived in small coastal lakes, like Gilligan Lake, may allow for better resolution of the triggers for dune activation in the Lake Michigan coastal dune system.

**Alex Anderson**  
**J. Thammasiri**  
**V. Khanthusaeng**  
**S. Kaminski**  
**C. Bass**  
**D. Redmer**  
**A. Grazul-Bilska**

Effects of Luteinizing Hormone (LH) on In Vitro Lipid Droplets (LD) Expression in Luteal Cells in Non-Pregnant Sheep Fed Different Diets.

Background: Plane of nutrition has been shown to alter animal reproduction including corpora lutea (CL) functions. Lipid droplets are cellular organelles serving as an energy reservoir as well as mediators of physiological and pathological conditions. The aim of this study was to investigate the effects of LH on LD expression in small and large luteal cells in nutritionally compromised ewes.

Methodologies: Ewes (n=29) were assigned into either maintenance (C, 100% requirements), excess (O; 2xC), or restricted (U; 60% of C) diets. At the early- and mid-luteal phases of the estrous cycle, CL were subjected to enzymatic dispersion in order to obtain cell suspension. Luteal cells were cultured for 24 h in the presence or absence of LH followed by staining with BODIPY, a marker of LD. Images of small and large cells were generated using confocal microscopy followed by analysis of rendered 3D images, and statistical analysis.

Results: During nutritional treatment, C maintained BW, O gained 6±1.2 kg, and U lost 14±1.3 kg. Cell and LD volume, and LD number was greater at the mid than early luteal stage, and was not affected by diet or LH. Proportion of LD in cell cytoplasm was greater at the mid than early luteal phase. Thus, diet or LH did not affect LD accumulation in the CL.

Conclusions: This project brings a contribution to the area of animal nutrition, and results may have some implications for human health demonstrating possible dynamics of LD regulation on selected reproductive functions exclusive of diet.



**Skylar Anderson-Buckingham**

Does Testosterone Influence the Time a Male Songbird Joins the Dawn Chorus?

Testosterone is a hormone that can influence traits and behaviors that enhance reproductive success. Testosterone also influences circadian rhythms in the lab. In songbirds, testosterone directly influences seasonal changes in song production and quality. During the breeding season, male songbirds begin to sing before dawn, a behavior known as the dawn chorus. The time at which a male starts to sing and joins this dawn chorus has been correlated with reproductive success. While it has been shown that testosterone can alter timing of daily (circadian) behaviors, it is unknown if testosterone can influence the time at which a male starts singing in the wild. We tested the hypothesis that an individual’s testosterone level is related with the time at which they join the dawn chorus. To do this, we placed recorders on the nesting boxes of female great tits (songbirds) during their period of fertility to identify the time at which a male joins the dawn chorus. Later, during nestling feeding, we measured the baseline testosterone levels as well as the maximum testosterone levels following an injection of the hormone gonadotropin-releasing hormone (GnRH). Using this data, we then asked if earlier singing males had higher testosterone levels than the males that slept in. We observed substantial repeatability in the time that a male joins the dawn chorus, however there was no significant relationship between the time a male joins the dawn chorus and the measures of testosterone.

**Alexander J. Becklund**

Priceless Experience, Expensive Methodology: Looking Into the Full Dimensions of Health-Care through Ethnographic Praxis

The human condition can be measured in various ways, each of which is defined by disparate criteria. Western culture is celebrated foremost for the pioneering and continuous development of health-care systems and practices. The study of Anthropology is similarly varied and therefore, by nature, we see the intersection of Anthropology and Medicine. My exposure to this field of study was one of personal experience as an armchair researcher, an ethnographer, and also as a patient of both Western medicine and Ethnobotany. It is from this vantage point my pursuits into Medical Anthropology began. The oral presentation provided will attempt to regale stories of these experiences in the field, describe the processes and evolution of methodologies, and detail the usefulness of this school of thought and how a developing praxis can bring the ideas of healthcare, represented by six-thousand voices across the world, to a more integrated and complementary understanding of healthcare and the human condition.

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**Logan Berg**

Comparison of Biomass Production  
from Two Native Plant Varieties  
Adapted to Wet Conditions

This project fills the need to investigate the establishment of biomass production in areas such as wetlands. Such wet areas tend to be underutilized by agriculture, but have the potential to provide biomass production for renewable energy such as ethanol along with providing forage and habitat. Two native grass varieties were selected to test if they could provide biomass in a former agricultural field that is subject to wet conditions. The two native species were planted in five randomized replicated plots in two different blocks. We expect to find if there are differences in the biomass produced by the species two years after planting. What we have found is that these native plants tend to do well in depressions in the landscape, with elevation playing a key role in the establishment of the species. Data collected is currently under analysis.

**Rio Bergh**

Pain Visible and Invisible:  
Empathy’s Impact on the  
Soldier’s Experience in  
Tim O’Brien’s “The Things  
They Carried”

The goal for this project is to produce a traditional research paper of 12-15+ pages examining the role of empathy in the experience of war. Specifically, I will use principles from Terror Management Theory within the field of Psychology to analyze the impact of empathy on the experience and memory of traumatic experience, especially within the context of a popular conception of war that does not square with the actual experience of it. I will be analyzing Tim O’Brien’s The Things They Carried since it can be read as a trauma narrative, and deals extensively with memory, expectations versus realities, and the “fractured/fracturing” nature of war. In “Trauma and Literary Theory,” James Berger poses the rhetorical question of why literary and cultural critics should be so interested in trauma, and answers it by characterizing the United States as a culture “obsessed by repetitions of violent disasters” (571). By analyzing the impact of empathy in a traumatic text, this project will feed into the larger conversation of trauma and literature while examining an empathetic aspect of trauma that isn’t centered on morbid fascination.

**Sara Bjorlin**

Integrating New American  
Populations through Community  
Gardening

Community gardening is an exceedingly underdeveloped topic in the field of urban ecology. With little to no research, there are a variety of social factors to be explored that can impact the health of an entire community. With the goal of bringing more attention to the benefits of community gardening, I have teamed up with a local non-profit organization, Growing Together, to understand both the benefits and the obstacles of maintaining a community garden. Their organization works closely with the New American population in the Fargo-Moorhead area. In the past year, I collected data via surveys that will reflect the opinions of New Americans and how community gardening has bettered their quality of life. This research was done in the hope of creating methods to improve recruitment and retention methods that are transferrable to larger urban areas.



**Thomas Blommel**

Lattice Gas Model with Monte  
Carlo Collision Operator

One of the most popular methods of fluid simulation today are Lattice-Boltzmann methods. These methods use a continuous density distribution instead of discrete particles to simulate the movement of fluid over time. They were originally derived from lattice gas methods that use discrete particles. The disadvantage of these lattice gas methods lay in the difficulty of obtaining low viscosities and the low occupation numbers per lattice site inducing the need for significant averaging. Recently, however, there has been an increasing interest in fluctuating Lattice-Boltzmann methods, which is ironic, since one of the goals in the original development of Lattice-Boltzmann methods lay in avoiding fluctuations. The goal of this project is to develop a novel kind of lattice gas method that bridges the gap between Lattice-Boltzmann and lattice gas methods by allowing for an arbitrary (but discrete) occupation number. To do this we introduce an isothermal model in one and two dimensions that utilizes a Monte-Carlo collision operator.

**Kenneth Bolte**

Mechanical Behavior of Material  
Combinations Implemented in  
Total Ankle Prostheses

Total Ankle Replacement (TAR) is a surgical method to treat ankle arthritis using a prosthesis to mimic the function of the ankle. Current ankle prostheses have a 75-80% survival rate ten years after initial surgery which causes many patients to outlive their TAR and requires repeated surgery over time. TAR failures are due to large magnitudes of stresses caused by large forces applied over small contact areas of the prosthesis components during the life of the TAR. These stresses cause increased wear rates of the bearing component. Maximum stresses and the number of cycles the bearing component is subjected to are the main factors determining the lifespan of the TAR. A new design developed by North Dakota State University provides solutions for the previously stated issues facing current TARs. The NDSU design is inverted compared to the typical three component design and incorporates the use of advanced composite material. Preliminary finite element analysis suggests the NDSU design provides more benefits than current in market TARs. Wear testing was done on component material combinations implemented in current TARs with the incorporation of the proposed advanced composite material. Preliminary results suggest that the composite material exhibits better wear rates in TARs versus traditional TAR material combinations, though more testing is needed and is ongoing. Testing and research is currently ongoing to obtain more results. The NDSU TAR addresses issues facing current in market TARs and suggests the NDSU TAR will provide a better quality of life for patients requiring ankle arthroplasty.





**Gabriel Michael Hideo  
Branco  
B. Strand  
B. Bormann**

A Pursuit of Happiness in NCAA  
Division III Athletics

This investigation used the survey method to analyze NCAA Division III institutions’ intercollegiate student-athletes’ (n=42) perceptions on what external factors their respective university provides that makes them the happiest. Five questions were asked to gauge the perception of the student-athletes: What university they attended, what conference was their university affiliated with, what year of school were they currently, and what sport did they participate in at their respective university. The participants were then asked to rank the external factors listed from 1 to 14 (1 being the best and 14 being the least) which factors made them the most and least happy: Facilities, Equipment, Academic support, Playing time, Tradition/culture (winning), Housing, Nutrition, Pipeline to professional sports, Recreational facilities, Team sponsorships, Cost of attendance, Cost of tuition, Conference affiliation, and Being in their major of choice. The study showed that at this particular NCAA Division III student-athletes believe being allowed to participate in their major of choice brings them the most happiness. Subgroups showed however that freshman, sophomores, and student-athletes in less intensive academic majors placed less emphasis on academics than juniors, seniors, and academic intensive majors in relation to their happiness.

**Briana Breemeersch  
K. Money  
P. Mulinti  
A. Brooks  
B. Brooks**

Turning the Promise of Spider  
Silk Drug Delivery into Reality:  
A First Step

As a composite structural protein with a balance of flexibility and strength, the ability to harness and manipulate major ampullate silk from the golden orb-weaving spider *Nephila clavipes* has long been sought after for a variety of healthcare and other applications, specifically as a drug delivery vessel. Manipulating the genetic sequence of the silk protein can add protease sensitive sites allowing for the creation of a physiologically responsive drug delivery system. Unfortunately, for spider silk to be useable for any application, it must first be solubized and processed. In this work, a variety of solvents with different characteristics (i.e., acids, bases, chaotropics, salts, chelators, etc.) were used to dissolve natural major ampullate silk. Major ampullate silk was forcibly obtained from *Nephila clavipes* and dissolved in various solvents. Protein saturation in each solvent was determined by spectroscopy. It was found that chaotropic agents, such as HFIP and urea, were the most successful in dissolving the silk. Interestingly, heating and stirring were also included to assess alterations in solubility. Solvents that require the use of heat and stirring included mostly detergents, such as SDS, and alcohols, such as ethanol and methanol. These results are promising and future efforts are under way to characterize the secondary and tertiary structure of the protein in different solvents and to find the optimal solvent for downstream processing to produce a spider silk based delivery formulation.



**Noa Brezinka  
P. Simpson  
C. Ulven**

Production of Lignin Based  
Carbon Fibers Using the Gel  
Spinning Process

Carbon fiber provides many advantageous physical properties to material based industries, but the high cost of this product is cause for low demand. As a way to reduce costs, the carbon fiber that is produced in this experiment will contain various combinations of poly-acrylonitrile and lignin. These compounded fibers were produced using the gel spinning process. This method was selected due to poly-acrylonitrile’s similar melting and degradation temperatures, which makes fiber production challenging, along with the process’s ability to provide enhanced strength to the compounded fiber. In this experiment, the gel solution includes different concentrations of water, dimethyl-sulfoxide, lignin, and poly-acrylonitrile. Once the compounded fibers are treated and stretched, the fiber surface was observed until a favorable fiber surface and cross sectional fiber shape were advantageous. After desired fiber quality was obtained, the compounded fibers experienced a heat treatment which produced a carbon fiber made up of both lignin and poly-acrylonitrile. This investigation created a bio-based fiber that could potentially help move carbon fiber to a greener and more cost-effective material.

**Jaden Carlson**

Identifying *Moraxella bovis* and  
*Moraxella bovoculi* in Infectious  
Bovine Keratoconjunctivitis (IBK)  
case submissions to the North  
Dakota State University Veterinary  
Diagnostic Laboratory (ND-VDL)

IBK infections, commonly known as Pinkeye, have significantly increased the number of bovine cases throughout North Dakota and the Midwest in the past few years. These *Moraxella* spp. infections cause painful ocular disease with significant morbidity and mortality in the beef and dairy industries. For this research project, eye swabs submitted to the ND-VDL will be processed for bacterial isolation and further sequenced to genotype the species and strains associated with IBK. Polymerase chain reaction (PCR), more specifically the 16s ribosomal DNA sequencing, will also be used for speciation of *Moraxella* spp. These findings will help with the discovery of the etiology of IBK and further development of a reliable vaccine.

**Deni Danielson  
Christian Roise**

Osteoinfiltration Team

The goal of the Bison MicroVenture group is to design and test a new type of ceramic dental implant that is hydrophilic, antimicrobial, porous, adheres to bone, and allows for quicker healing time than the current method of titanium implants. The osteoinfiltration team is focused on inferring information about the ideal ways that osteoblasts, or bone-building cells, will integrate into these pores of a sample from both a biological and engineering perspective. We began by using a three-dimensional printer to create square-shaped samples with six channels in each, all with different elements of a given variable, such as channel size dimensions, surface roughness, and angle. We then exposed these samples to MC3T3 mouse osteoblast cells and imaged them under various microscopic techniques to infer information about the way the cells integrated into the channels, and which variables were more favorable. Our first run of tests did not lead to any conclusive results because of high variability in the data. We have modified our experiment and intend to eliminate certain sources of error that were present previously in order to generate more significant and accurate data. These channels are intended to simulate the pores of a ceramic dental implant on a larger scale. As data is collected we will be able to apply this knowledge to the overall implant design to replicate the conditions for osteoinfiltration that were found to be most favorable.



**Lacey Dickerman**

Melatonin & Receptor Signaling:  
Investigating Roles in Chicken  
Embryo Development

Maternal investments in eggs affect offspring growth and development, but the mechanisms are not always clear. Melatonin is a hormone with wide ranging effects on phenotypes. In order to understand melatonin’s role in development, we conducted two experiments: 1) We dosed eggs with melatonin to understand effects of variation in yolk-derived melatonin on development; 2) We administered agonists and antagonists of melatonin receptors to evaluate role in early development. We hypothesize embryos possess a minimum and maximum concentration threshold for which effects can be measured. Our results suggest maternal melatonin may influence embryonic developmental trajectories, and ultimately affect offspring survival and fitness.

**Brendon Disrud**

Molecular Dynamics of Laser  
Assisted Decomposition of  
Unstable Molecules at the Surface  
of Carbon Nanotubes

Photo-induced fragmentation is simulated for dinitromethane (CH2(NO2)2) on the surface of a (4,0) carbon nanotube. These simulations were carried out using density functional theory (DFT) with Perdue Burke Ernzerhof (PBE) functional in Vienna Ab-initio Simulation Package (VASP) software. Different fragmentations were caused by unique charge transfer excitations. We test a hypothesis that the presence of a CNT substrate can facilitate chemical reactions, such as photo-degradation of molecules, related to optically-controlled explosions. This model demonstrates a potential for photo-induced charge transfer between adsorbate and substrate, which can lead to unique fragmentations for different charge transfers.

**Jacob Droel  
E. Olig  
A. Brooks**

Developing a New Co-culture  
Model of Chronic Osteomyelitis

Both acute and chronic osteomyelitis, a deep bone infection predominantly attributed to *S. aureus* bacteria, pose a significant and costly complication in traumatic orthopedic injury and surgery. Although difficult to treat, there are clinical antibiotic treatment regimens for acute osteomyelitis that often prove effective. However, chronic osteomyelitis is a much more difficult complication as the pathogenic bacteria infiltrate host bone cells and remain dormant. This emerging problem poses a significant issue in drug delivery, necessitating the development of a better in vitro model of chronic osteomyelitis. Currently, visualizing the interaction of *Staphylococcus aureus* and osteoblasts is often infeasible or unreliable, but it is necessary to help solve this problem. This work presents the first experimental steps to develop a co-culture model that will allow the visualization of *Staphylococcus aureus* and osteoblasts. Using an ATCC strain of *Staphylococcus aureus* containing a fluorescent plasmid transposon, *S. aureus* can be localized in osteoblasts, which can subsequently be counter stained using a fluorescent tagged antibody. If successful, this protocol will provide a new tool to either develop a new drug to prevent bacterial infiltration or develop a delivery strategy to kill osteoblast ingested bacteria, ultimately pushing forward treatments in the fight against chronic osteomyelitis.



**Constance Economos  
Paige Alexander  
Alison Paul**

Effective Communication Strategies  
in Nonprofit Organizations

More than 1.5 million nonprofit organizations in the United States serve society by fulfilling their missions. Effective communication strategies and resource utilization are necessary for nonprofit organizations to reach and engage their publics, address their missions, and not only survive, but succeed and grow. Although some research exists on communication in nonprofit organizations, there are still many unanswered questions. This project was designed to use mixed methods research and case study illustrations to determine the uses of traditional and new social media methods by some of the biggest NPOs in the US today.

Using qualitative case studies and content from publications as well as quantitative surveys and communication audit methods, data was collected from participating members of the North Dakota Association of Nonprofit Organizations (NDANO) and the websites of six national NPOs.

Although not all the data from the mixed methods research has been analyzed yet, strong indications show that many NPOs seem to favor new social media. The survey will show how nonprofit organizations use communication, both traditional and new media, effectively, and highlight what factors impact implementation such as finances or lack of trained staff.

The findings portray great significance for the NPO’s uses of mass and new social media to achieve their missions and address societal problems. For the NPOs to contribute significantly, they must employ effective and efficient strategic communication. The results of this research indicate the areas of greatest attention to achieve this.

**Reed Erickson  
Korgen Halver  
Lydia Gregersen  
Felicia Marquez**

Effect of Ambient Conditions on  
the Elastic Modulus of Pig Bone

There are currently companies seeking to develop synthetic materials that mimic the mechanical properties of bone. The data that is currently available for these properties were collected from cadavers that had been subjected to a variety of storage conditions. This is problematic as some of the methods used to preserve the cadavers are known to alter the mechanical properties of bone. The purpose of this study is to evaluate the effects of different storage conditions on the mechanical properties of pig bones. Samples from pig bones will undergo compression testing after having been subjected to various storage conditions for a specified quantity of time. For this experiment the Elastic Modulus of samples stored at room temperature and freezing conditions will be tested and compared to a control group. It has been hypothesized that both the duration of time before testing and the storage conditions will affect the mechanical properties, in this case Elastic Modulus, of the bone. The results from this test will be useful in two areas: they will provide a base line for comparison of future test results and they will provide some initial insight into the larger question of how specific storage conditions affect the mechanical properties of bone.

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**Austin Espe**

The Effects of Biostimulants on Cucurbit Emergence and Yield

The purpose of this experiment was to determine the effectiveness of four different types of biostimulants, Megafol, NutrAsyst, KickStand PGR, and Hydra-Hume, on Cucurbit time of emergence and yield. Our experiment used three replications of six varieties of Cucurbits, cucumber, summer squash, cantaloupe, watermelon, winter squash, and pumpkin, with two different types per variety. The types of Cucurbit included: Spacemaster, Sumnter, Black Beauty, Early Prolific Straightneck, Imperial 45, Vienna, Sugar Baby, Crimson Sweet, Butternut, Buttercup, Jack O’ Lantern, and Pie. Preliminary data suggests that biostimulants impact both Cucurbit time of emergence and overall yield, however, further data collection must be performed and assessed to determine the significance of these results.

**Emily Fassbender  
A. Bezbaruah**

Micronutrient Zinc Fortification in Spinach using Zinc Nanoparticle in Soil Media

The purpose of this study was to investigate how zinc oxide nanoparticles (ZnO Nano) affect plants in a soil media. While most studies have focused on the phytotoxicity in plants treated with nanomaterials, very few have studied how the plant nutrient uptake is affected in the presence of ZnO Nano. Further, multiple studies have been done hydroponically, but a soil media was used to explore the effects in a more widely used agricultural media. Spinach was grown until maturity and leaf samples were analyzed via ICP-OES analysis. Controls were run with ZnO Bulk particles and ZnSO4. ANOVA analysis revealed there were significant differences in zinc and other nutrient uptake by plants subjected to different doses of ZnO Nano and between different treatments (ZnO Nano, ZnO Bulk, and ZnSO4). The observed changes in nutrient uptake by plants in the presence of nanoparticles may have great ramification on global food and nutrient security.

**Joseph Fehrenbach**

Remanufacturing of 3D Printer Filament

The goal of this research was to recycle 3-D printing material waste into usable 3D printing filament. Waste from 3D printing comes from excess material being used for supports or rafts, and from unsuccessfully printed parts. To accomplish this goal the machinery and processes were developed to recycle waste from the common 3D printing material PLA (polylactic acid), a bio based polymer. A two-stage mechanical shredder was built in order to reduce the size of 3D printing waste into ¼ inch diameter pieces. Some recycled material was then compounded with virgin PLA in order to compare mechanical properties vs. non compounded material. A machine was then designed and built in order to draw filament of a desired diameter from an extruder. The desired diameters chosen for the production of the filament were 1.75mm and 2.85mm, as these diameters are compatible with most bench top 3D printers. The mechanical properties of the recycled filament were tested and compared to commercially available PLA filament, as well the compounded mixture of recycled and commercial filament. The final outcome of the project is to reduce the waste created from 3D printing as well as create a lower cost 3D printer filament.



**Aaron W. Green**

Using Applied Geomorphology to Induce Meandering in an Urban Drainage Way

The purpose of this project is to assist the city of Fargo in creating an aesthetically pleasing, sustainable, and natural channel form between two drainage culverts in Rabanus Park. Through this research we plan to answer these questions: 1) Can stable channels be designed and created in urban drainage systems using only the power of water and little initial channel manipulation? 2) What in-channel structures and materials would be most effective in catalyzing channel evolution and inducing meandering? 3) Would this method be feasible and effective for similar projects in the future? To achieve this goal and answer these questions, surveying of the initial conditions of the stream channel was completed using a laser level. Three cross sections and one longitudinal profile were taken. This data was then used to determine what the stable channel form of the drainage way would be and designs were created. Next, in-channel designs were created that included two rock-constructed riffles and two riffles with both rock and willow plantings that will hopefully induce channel meandering. After placement of the riffles is complete, monitoring will take place in the form of continual surveying of key cross sections throughout the channel as well as longitudinal profiles to track channel evolution. As the project progresses we hope to gain a better understanding of fluvial geomorphology and contribute to future potential projects concerning rivers, streams, and drainage ways in urban areas such as Fargo, North Dakota.

**Hailey Greenwalt**

Abnormal Stream Restoration

We are currently looking at a stream in a flood basin in South Fargo near the YMCA. When it floods, this stream fills up with water and transports it back to the Red River, however the stream behaves in an abnormal matter pushing our pool and ripple systems with a lot of water (20-30 cubic feet per second), but also small amount of water (10-12 CFS). We are trying to induce natural behaviors, instead of engineering an entirely new stream to hold flood water. This project will be a part of a natural green space that is being created for the city of Fargo. It will be more aesthetically pleasing and useful. In order to measure bank flow, CFS (cubic foot per second) and report how the stream is changing, we used a laser level and recorded the water level per foot, going across 20 feet. We measured three cross sections throughout the stream, once during the fall of 2015 and the fall of 2016. Our methods were consistent, using the same cross sections, 20 feet across and measuring per foot. We could see that just in one year, the stream had deep trenched itself by water carrying large rocks during intense rainfalls. A substantial amount of sediment was moved and bank flow in increased. The willows we planted held the bank together nicely. We are progressively moving forward at a steady pace. We do not have completed data yet, due to needing to still implement plunge pools, adding rocks for a new ripple system and to induce 6-8 ft. meanders within the stream. We are hoping that with these three changes, we see consistent behavior within the stream, being able to hold up to 30-40 Cubic Feet of water per second during times of flood. We also hope to learn why a stream like this can behave in such unpredictable manners. I am learning that inducing natural streams, just might be better than engineering entirely new ones. It allows for natural processes to happen, rather than fighting mother nature. It may take more trial and error, but I think that it will be worth it in the long run.



**Samantha Hamernick**

Home Language Literacy and  
Refugee Resettlement: A Case  
Study

This study examines current and past literacy practices among refugees in Fargo, North Dakota. 500 refugees are resettled annually in Fargo, and literacy is an integral part of this resettlement process and further assimilation into a new community. This research project investigates how the level of literacy and educational background a refugee has coming from their home country affects their resettlement in Fargo. Data collection will involve interviews with two refugees in Fargo. Analysis of the data will look for patterns, define categories, and then apply theory. My research will add to and expand on the existing knowledge of literacy practices and how such practices shape how we navigate a new environment. The expansion of knowledge will occur with my focus on the Fargo, North Dakota community.

**Duncan Hannestad**

Media Coverage of Third Party  
Presidential Candidates

The upcoming presidential election has been one of the most contentious in recent memory. A recent poll in Utah done by Y2 analytics showed Donald Trump and Hilary Clinton tied at 26% each with an independent candidate, Evan McMullin, lurking close behind at 22%. Third party candidates play a significant role in US presidential elections. This research will be focused on how four elite US-based newspapers cover third party candidates and also the role social media plays for third party candidates. Content Analysis will be done on the four selected newspapers, the Chicago Tribune, Los Angeles Times, New York Times and USA Today. A case study will be done on the social media aspect. The research is still early in the process so there are currently minimal results to share. I expect to see coverage of third party candidates in the media to have little impact on the voting population because I do not believe third party candidates’ stances on the issues receive enough attention in the national media. Rather I expect to see social media play a larger factor in reaching the voting population.

**Matthew Henry  
Molly Hess**

Mass Media Coverage  
of the 2016 United States  
Presidential Election

The US Presidential Elections have always been a unique focus point for US and international media. Due to the multiple scandals and aggressive personal tactics and rhetoric from both major party candidates, the 2016 election has received major coverage in both national and international publications. The unique state of this election has created media coverage rivaling anything seen in previous election years, and therefore is especially important to examine. This research aims to assist ongoing research regarding media coverage of US presidential elections, specifically in regards to coverage in prominent newspapers. This study will be completed using content analysis of prominent national and international newspapers, and will focus on said newspapers’ coverage of specific events during the election. We expect that this research will help provide a clearer understanding of newspaper coverage of US presidential elections, and will add to the research that has already been conducted regarding newspaper coverage.



**Matthew Henry  
Molly Hess**

Super Bowl Ads: A Longitudinal  
Analysis of Gender Portrayals

For years, the Super Bowl has been the highlight of not only the football season, but also prime real-estate for advertisers who want to reach millions of consumers. The commercials produced every year are highly anticipated, and are a now a part of American culture, reflecting society and societal norms. Due to the mass reach and influence of Super Bowl Commercials, it is important to examine how they portray stereotypes, specifically in regards to gender, and how they have or have not changed through the years. This examination will be conducted through a content analysis of the top Super Bowl commercials from every year since 1967, and Ad Meter will be used to identify said commercials. Much research has been conducted previously showing how commercials play a strong role in shaping culture and societal norms, but almost none has been done in regards to how these commercials shape public opinion of gender. This research aims to fill this gap, allowing for a better understanding of American culture, and will hopefully lead to less stereotypical portrayals of genders by advertisers.

**Peter Henson**

Residual Strength of Composite  
Laminates after Impact and Its  
Effect on Flight Attitude

Composite laminates are a material that is becoming more and more widely used in aerospace structures. However, these structures are vulnerable to external impacts, including bird strikes and running debris. Thus, the remaining, or residual, strength of these materials is critical for its continuing service. The research goal of this project is to establish a relationship between the external impact energy level and the residual strength of the laminate composites to provide a limiting threshold for vehicles’ continuing service or repair. Researchers who have worked on this topic have shown that there are promising methods currently available to be able to effectively detect and locate damage, non-destructively and in real time; however, not nearly enough research has been performed to relate the damage to the structure’s remaining health. Fiberglass reinforced composites were prepared and subjected to low-velocity and high-velocity impact energy levels at the NDSU Mechanical Engineering Testing Laboratory, using a shock tower and gas gun. Although this material is not considered state-of-the-art compared to carbon fiber reinforced polymers, the methodology is still found to be practical. Barely visible damage was evaluated using an ultrasonic C-Scan device at the NDSU Research Park. Specimens’ areal amount of damage was characterized, using image processing software. A new damage index was defined, showing inverse linearity between impact energy applied and remaining strength of the material. These specimens’ remaining health will be tested against the estimated strength relationship using a universal tensile testing method. Once the relationship is proven to be valid, a flight attitude computational software simulation on an aircraft, with assumed impact damages, will be attempted to be able to measure whether the damage will be sustainable or critical.

**Allie Hobbs**  
**Makenzie Schmidt**  
**Haley Olson**

A Comparative Analysis of U.S.  
and Foreign Media Coverage of  
Major Presidential Summits

Although there is abundant research on presidential activities, including presidential summits, there is little or no research done on how those summits are covered from area to area. By comparing the coverage we can gain a better understanding of the relations between the United States and other areas of the world, and what their constituents find most important. We analyzed the coverage done three days before and three days after a summit from the most popular newspapers in the area, to determine the success or failure of the summit as deemed by the public. We chose our newspapers based on their popularity, proximity, and available translated content. We expect to see differences between the coverage done by the United States and other regions. By examining the similarities and differences between the coverage of summits in newspapers we can get a better understanding of what countries have in common, how the relationship between the areas is valued, and how its peoples feel about the success or lack thereof of the summit.

**Kelly Howard**  
**Maxwell Carlson**  
**Jacob Huesman**

Dynamic Biological Systems

On average, it takes 15 to 20 years to develop a new cancer drug. After going through the entire development process, the average cost is 4 billion dollars. The Dynamic Biological System Version 3.1 (DBS) device is an automated system that may reduce the high cost and long timeframe of drug development. This is done by more accurately replicating the cellular growth conditions found in the human body by flowing a test media across a cell culture. This methodology will more accurately mimic conditions in the human body, since current initial drug testing occurs in a static environment. Using this technique will improve the process of pre-clinical pharmaceutical testing and any situation where cellular experiments are undertaken. An additional potential use of the device is to test an individual patient’s cancer for susceptibility to different drugs.

**Benjamin Huber**

Vasoactive Intestinal Peptide  
Receptor Deficiency Elevates the  
Frequency of Antibiotic-Producing  
Bacteria Found in Mouse Feces

Evidence suggests certain populations of bacteria lining the gut may act as sources for natural antibiotics by preventing the colonization of pathogens. A mammalian neuropeptide highly expressed in the gut, known as vasoactive intestinal peptide (VIP), and its receptors, designated VPAC1 and VPAC2, have been shown to cause significant gut microbiota composition changes when knocked out (KO). Presently, there is a necessity for new antibiotic discovery due to bacteria becoming resistant to currently prescribed antibiotics. We hypothesized that the VIP and its receptor knockout mouse strains would be good candidates for exploring the existence of novel antibiotic-producing bacteria (APB). To this end, fecal material from wild type (WT), heterozygous (HET) and KO strains were plated on nutrient agar, incubated aerobically, and zones of inhibition against *Escherichia coli*, *Staphylococcus epidermidis* and *Staphylococcus aureus* were tested. Our results showed elevated numbers of previously characterized APB from both HET receptor strains, but not from WT or VIP HET strains. We conclude that reduction in VIP receptor signaling in the gut, as opposed to reduction in the VIP ligand, elevates the frequency of aerobic APB. Future studies will also utilize VPAC1 and VPAC2 KO strains to mine for the existence of novel anaerobic APB, many of which have yet to be investigated and therefore represent a potential antibiotic “treasure chest” waiting to be harvested.

**Elizabeth Jensen**

Comparing Behavioral Syndromes  
in Intercaste Honey Bees

In honey bee colonies there are two distinct castes: A single queen bee that is in charge of reproduction, and thousands of worker bees, who are sterile and perform all necessary work to maintain the hive. The notion of personalities in honey bees has been strongly supported, and this has important implications for the colony. Having different behavioral types could increase the colony’s efficiency by making division of labor more specialized, and giving extra plasticity. Honey bees are important pollinators that many living things depend on, so it is important to know as much as possible about these insects. Research was done here at NDSU that revealed a gradient of caste could be achieved by feeding varying amounts of food during development. “Inter castes” are the individuals that have both queen and worker qualities, but we do not know how they behave in a natural hive setting, which is what we intend to test. We will be analyzing the behavioral syndromes of intercaste bees, and determining if they have more queen-like or worker-like behavior. This could give insight into what factors might determine behavioral syndromes in honey bees. There is expected to be a gradient of behavior that correlates with the gradient in size, with no distinct cut off as to where worker behavior ends, and queen behavior starts. If we do in fact see a gradient of all types of behavior, it will support the idea that behavior is influenced by slight differences in body size or caste.

**Joshua Johnson**  
**Z. Geerarts**  
**G. Lukat-Rodgers**  
**K. Rodgers**

Nitrite as a Substrate Surrogate  
in Chlorite Dismutase

Chlorite Dismutase from *Klebsiella pneumoniae* (*KpCld*) is an interesting heme enzyme because of its ability to catalyze the decomposition of chlorite ( $\text{ClO}_2^-$ ) to chloride and oxygen. The purpose of these experiments was to see if nitrite is a surrogate for the substrate,  $\text{ClO}_2^-$ , with *Klebsiella* Chlorite Dismutase in solution. This question was first addressed by determining the thermodynamic affinity of *KpCld* for nitrite ion,  $\text{NO}_2^-$ . This was accomplished by spectrophotometric titration of resting (i.e. ferric) *KpCld* with a standardized stock solution of aqueous  $\text{NO}_2^-$ . The nitrite solution was standardized through a redox titration method wherein  $\text{NO}_2^-$  was oxidized under anaerobic conditions to  $\text{NO}_3^-$  with potassium permanganate,  $\text{KMnO}_4$ . The  $\text{KMnO}_4$  solution was standardized against the primary standard, oxalic acid. The spectrophotometric titration of WT *KpCld* with  $\text{NO}_2^-$  was performed under nitrogen to determine the equilibrium dissociation constant. The value of  $K_d$  was calculated to be  $2.0 \times 10^{-4} \pm 7 \times 10^{-5}$  M. The value of  $K_M$  for enzyme-substrate complex, *KpCld*– $\text{ClO}_2^-$  is  $4.4 \times 10^{-4} \pm 6 \times 10^{-5}$  M, suggesting  $\text{NO}_2^-$  and  $\text{ClO}_2^-$  have similar binding characteristics.





**Brian Jordan**

Innovative Strategic Health Communication: Challenges of Infectious Diseases in a Global Sphere

The objectives of this project are to explore the new and innovative health communication strategies that can and will be used to spread awareness and knowledge about infectious diseases. Different areas of the world have challenges unique to their region in terms of health and disease and each will need strategic health communication plans tailored to their specific needs. Methods of research chosen for this project include using scholarly articles with topics ranging from general health to environmental factors of health in populations. Coding will be used in these articles and publications to organize data and to find patterns that will allow for analysis to determine the best way to aid populations against infectious diseases. The predicted results are that developing areas of the world will be at higher risk for infectious diseases and will need more radical communication strategies. Also, first world countries will have more strategies already in place but will need to use more innovative strategies that can also be passed to countries and regions that struggle with resources. The overall implications of this research is a potential call to action for health organizations worldwide. Understanding how to effectively and efficiently communicate health messages to the public is vital to maintaining a disease-free population.

**Aaron Knudtson  
Tim Straus  
Christian Eiyneck  
Stacy Staab**

Three Degrees of Freedom Artificial Wrist

Our motivation for this project stemmed from the extreme cost of artificial limbs and limited degrees of freedom, specifically in the wrist. Our goal is to increase the range of motion of a prosthetic wrist while decreasing the cost. A prototype was designed and printed for further tests and proof of concept that such an idea is possible. Upon testing our prototype, we found that the Range of Motion was within a few degrees of what the average human wrist can achieve. The first test found that two degrees of wrist freedom were within human specifications (pitch and roll). We also found that the last degree (yaw) was within a small measurable distance, but could use further refinements. Currently we are putting all our effort into refining this final degree of motion and implementing it into the current design. Once we are successful in meeting our goal of decreasing the cost of a capable wrist while simultaneously increasing range of motion, our design will lead the way for low cost prosthetic joints.

**Joshua Krank**

PGAM5 Isoforms Mediate Divergent Cell Death Reactions in HeLa Cells When Treated with the Chemotherapy Drug Arsenic Trioxide

Phosphoglycerate mutase 5 (PGAM5) is a protein located in the mitochondria of most cells. It has two splice isoforms, PGAM5L (long) and PGAM5S (short); functional differences between these isoforms are currently unclear. The presence of PGAM5 in a cell has been reported to promote cell death in a variety of situations including TNF-alpha treatment, modulation of reactive oxygen species, and other stimuli that can cause and signal cellular stress. The goal of this project was to determine the effects of PGAM5 overexpression on the survival of the cervical cancer cell line known as HeLa. Using a lentiviral gene delivery system, we stably overexpressed both PGAM5 isoforms using green fluorescent protein as a selectable marker. Cells were then treated with arsenic trioxide (ArO3) in order to trigger cell death, and viability was assessed by propidium iodide staining and flow cytometry. We observed that in comparison to control cells PGAM5 short increased survival following treatment, whereas PGAM5 long reduced survival under the same conditions. These data suggest that PGAM5 isoforms differ in their ability to control cell death pathways.



**Kally Kvidera**

Influence of Hypoxia on Longevity and Antioxidant Expression in the Alfalfa Leafcutting Bee

The alfalfa leafcutting bee, *Megachile rotundata*, a cavity-nesting solitary bee of North America and an emerging alternative pollinator, was shown to have an increased lifespan when exposed to hypoxic conditions. When compared to a set of individuals reared under normoxic conditions, those exposed to hypoxia had a lifespan that was nearly double. The mechanisms behind this increase in longevity, however, are unclear. Hypoxic conditions may have an impact on oxidative stress, which occurs in organisms when the production of reactive oxygen species (ROS) and the organism’s capacity to lessen their negative effects through neutralizing antioxidants becomes imbalanced. Perhaps under hypoxic conditions, with a lower oxygen concentration, the organism’s metabolic rate decreases and thus produces less energy with a lower level of reactive oxygen species as by-products. One way to start exploring this idea is to look at antioxidant capacity using a spectroscopy assay to reveal how much work the organism is undergoing to neutralize reactive oxygen species. According to the results, for adults there was a general increase in antioxidant capacity over time, but no significant difference among oxygen treatments. In prepupa, the level of antioxidant capacity remained relatively consistent over time. In comparing adults and prepupa, prepupa overall had higher antioxidant capacity over time. This can have important implications for the longevity of *Megachile rotundata* and ultimately, the well-being of the plants that benefit from its pollination.

**Sam Marolt**

Silicified Stereom

Microfossils can yield important ecological information from sedimentary rocks, but different forms of microfossil preservation can artificially inflate abundance patterns in rock samples. To understand more about these preservational differences, we extracted microfossils from ten Mesozoic limestone samples from Nevada, which were deposited in shallow marine conditions ~210 million years ago. These rocks were dissolved in dilute acetic acid, and we collected microfossil populations of one hundred specimens per sample. The most common microfossils include carbonate materials like echinoderm stereom and bivalve shell fragments, and some siliceous fossils like glass sponge spicules. The (originally) carbonate microfossils from these bulk samples did not react to dilute hydrochloric acid, suggesting that their original carbonate mineralogy had been replaced after deposition. Other siliceous microfossils indicate that there must have been an above average amount of dissolved silica flowing through the original depositional environments for the sediments became silicified after deposition, indicated by the sometimes-abundant glass sponges and high-silica demosponge spicules. This silica may have percolated through the rocks, causing recrystallization, as evidenced by the abundant silicified stereom.

**Jared M. Melville**

Salvation or Damnation: The Explanation, Applications, and Serious Implications of CRISPR-Cas9 Genetic Engineering

Despite its vast publicity in recent years, few have considered the potential applications and ethical implications surrounding CRISPR-Cas9 genetic modification. CRISPR-Cas9 wields the potential to ameliorate many of humanity’s greatest ailments, but its impact extends far beyond simply editing the human genome. The principle purpose of this informative analysis is to spread awareness of the subject matter to a general audience. By evaluating previous research and other works of scholarly merit, this analysis offers a concise background on the CRISPR hack and dissects two of its more interesting applications: vector control and de-extinction. While CRISPR might revolutionize the medical field, its continued integration into society bears ethical implications which demand scrutiny: its potential role in exacerbating inequality and its potential use as a weapon of terrorism. How the research field proceeds shall determine whether or not CRISPR is the key to humanity’s salvation or its damnation.



**Rui Miao**  
**Louis Miller**  
**Jiaming Zhao**

Study and Evaluation of Operating  
Experiences with Existing  
Geothermal Heat Pump Systems  
in North Dakota

A Geothermal Heat Pump (GHP) system may be considered as a “green” system, due to its use of clean geothermal energy that, as a type of renewable energy, has a large potential for saving energy in buildings and reducing CO2 emissions. GHP systems have the ability to convert the underground thermal heat into usable energy at high efficiency to provide heating and cooling to buildings. Many factors, however, determine the operational performance of GHPs, such as the control strategy, the system age, etc., any of which could have a significant impact on the normal operation of a GHP system. Therefore, in this project, the developing and operating status quo of the existing GHP systems currently installed and used in North Dakota are being studied and evaluated. Specifically, at least 20 buildings equipped with GHPs are involved. Data will be collected through on-site visits and then analyzed for each building with the assistance of computer simulations. These data include the current system operational parameters, the mechanical design documents, and the cost analysis related to the purchase, installation and use of GHP systems. The results of this project can be used 1) by the state to review its incentive or tax credit program for the geothermal application and then adjust or revise if necessary; and 2) to help building owners to identify and solve operating difficulties and improve their buildings’ performance. This research is supported by the North Dakota Department of Commerce – State Energy Program.

**Jenna Murphy**

Benefits of Integrated Writing  
Across the Disciplines  
Pedagogy in a Mid-Level  
Geomorphology Course

The Writing Across the Disciplines movement has gained substantial impetus in the past decades within higher education, impacting the way in which content areas are taught and received in the geosciences. A mid-level course at NDSU, Geomorphology (GEOL312), has implemented adaptations to unite pedagogy and content in the fields of both writing composition and geology. This approach was taken to provide geology majors with tailored writing instruction within their discipline, rather than the more generalized instruction found in a “Writing in the Sciences” course currently utilized by the program. In order to develop professional and portable writing skills in the course, writing goals were selectively matched with geology content to emphasize particular aspects of professional writing. These goals included the use of specific and precise language, appropriate topic sentences, logical organization, adequate development and supporting evidence, appropriate transitions, unity of ideas and coherence, and sentence variety. A term project required students to evaluate the rhetorical efficacy of two genre-distinct articles while incorporating the above mentioned writing goals in their analysis. Embedded writing assignments spaced throughout the course also asked students to incorporate these specific writing goals. Data resulting from the integrated approach in the form of student scores indicate a positive response to the writing goals and various interventions, such as individualized conferences and written and verbal feedback. In addition, student writing samples, as well as student self-assessment surveys, indicate an overall more effective and professional ability to communicate in various written forms by the conclusion of the course.



**Sean Nash**

Transcriptional Regulation During  
Interrupted Development in  
Alfalfa Leafcutting Bees,  
*Megachile rotundata*

Insect development can be dramatically affected by outside conditions such as temperature changes. In alfalfa leafcutting bees (*Megachile rotundata*), if a low temperature environment interrupts development, neurological defects can be observed in the emerging adults. This has major environmental ramifications, as *M. rotundata* are an alternative pollinator species. However, if the bees are exposed to intervals of warm temperature, the developmental defects can be lessened. In this study we looked at gene expression in *M. rotundata* pupae at eight time points during exposure to constant or fluctuating temperatures. During the STR (Static Thermal Regime) treatment, pupae were stored in a constant 6°C environment. Conversely, those in the FTR (Fluctuating Thermal Regime) treatment were exposed to a daily pulse of 20°C. We hypothesize that the warm temperature pulses associated with the Fluctuating Thermal Regime protocol serve to protect against the deleterious effects of interrupted development via stress response mechanisms.

**Leanne Oakes**  
**Abigail Ford**  
**K. Lyman**  
**K. Gange**  
**T. Hanson**

Measurements of Acromiohumeral  
Distance with the Application  
of Kinesio® Tape at 30, 60, 90,  
and 120 Degrees of  
Glenohumeral Abduction

Background: One of the common causes of shoulder impingement and a frequent cause of non-traumatic shoulder pain is a decrease in subacromial space. Inhibiting specific muscles (supraspinatus, posterior deltoid, and anterior deltoid) is proposed to create an inferior translation of the humeral head and potentially increasing acromiohumeral distance. Results of the increased space are reported to alleviate pain during overhead motions common in athletic participation as well as Activities of Daily Living (ADL).  
Methods: 48 participants (24 females, 24 males) were recruited from the Fargo-Moorhead community who fit the inclusion criteria. Based on random assignment, participants received 1 of 3 treatments: (1) inhibition of Supraspinatus; (2) inhibition of Posterior and Anterior Deltoid; (3) inhibition of Supraspinatus, Posterior Deltoid, and Anterior Deltoid. Diagnostic ultrasound measurements were taken with the caliper function pre-tape application and with tape applied at 30, 60, 90 and 120 degrees of shoulder abduction.  
Results: An ANOVA model was estimated with the difference in pre- and post-measurements as the dependent variable and tape technique (F[2,42]=0.596,*p*=.556), angle (F[3,42]=0.439,*p*=.648), and biological sex (F[1,42]=0.605,*p*=.441) as independent factors. None of the independent factors were statistically significant.  
Conclusion: The proposed tape applications to the supraspinatus and/or deltoids did not affect the subacromial joint when the glenohumeral joint was placed in 30, 60, 90, & 120 degrees of shoulder abduction. Alternative tape applications and unhealthy joints need to be investigated in order to provide evidence-based recommendations for allied health practitioners who treat individuals with symptoms common to a shoulder impingement diagnosis.



**Whitney Ong**  
**N. Dandu**  
**S. Kilina**

Oxidation of PbSe Quantum  
Dots: Insights from First-Principle  
Calculations

It is known that quantum dots (QDs) exposed to air commonly demonstrate decrease in their photoluminescence (PL). However, mechanisms of QD’s oxidation causing the PL quenching are not fully understood. We use density functional theory (DFT) and time dependent DFT (TDDFT) to investigate the interaction of oxygen in its molecular, atomic, and ionic forms with different surfaces of PbSe QDs and its effect on the electronic and optical properties of QDs. We found that oxygen concentrations and positions at the QD facets govern an appearance of trap states at the bandgap of QDs. For 2 nm PbSe QDs, as the concentration of oxygen atoms at the surface increases, oxygen attempts to penetrate inside the QD, substituting and shifting seleniums in the outer shell of the QD. In contrast, oxygen ions attempt to bind and then remove Pb ions from the QD’s surface, resulting in Se-enriched QDs of smaller sizes, when O2- exposes at high concentrations at the QD’s surface. In both cases, adsorption of oxygen atoms and ions creates surface reconstructions but rarely introduce additional oxygen-associated trap states inside or at the edges of the QD’s bandgap. Molecular oxygen shows minor effects on the geometry of the QDs but has O2-localized trap states appearing in the bandgap.

**Alexander C. Reimers**  
**B. Laabs**

Mountain Glacier Retreat Rates  
During the Last Pleistocene  
Glaciation in the Western  
United States

Cosmogenic <sup>10</sup>Be exposure ages of terminal moraines deposited by mountain glaciers during the last glaciation are well established and provide useful limits on the time of glacier maxima. Age limits on recessional moraines and other glacial features representing ice retreat are relatively fewer in number in the western U.S., but can provide insights about how climate changed during the last deglaciation interval of the Pleistocene. Retreat rates of glaciers in several mountains of the Great Basin and Rocky Mountains were determined by recalculating cosmogenic <sup>10</sup>Be exposure ages of terminal and recessional moraines and other glacial features using newer models of in situ production of <sup>10</sup>Be in quartz. Although exposure ages of terminal moraines and retreat rates vary among glacial valleys, results of our calculations reveal some consistency in the regional pattern of ice retreat. Retreat rates from terminal moraines were at a maximum during the early part of deglaciation at 19-17 ka, ranging from 2-7 m/yr. After glacier lengths were substantially reduced by 17 ka, retreat rates decreased dramatically to 1 m/yr or less until ca. 15 ka. After 15 ka, retreat rates increased to ca. 2-5 m/yr. A relatively rapid retreat from 19-17 ka reflects the maximum sensitivity of glacier lengths to warming induced by increasing solar radiation and atmospheric CO2 concentrations. Reduced retreat rates at 17-15 ka likely reflect changes in ice dynamics, thickness and shape, but may also indicate a response to regional cooling associated with the Oldest Dryas/ Heinrich Stadial 1. For the interval 15-13 ka, corresponding to the Bølling-Allerød interval, regional warming is the most likely cause of the increased retreat rates. These findings are further considered in the context of the results of glacier modeling experiments and regional compilations of paleoclimate records.



**Alex Rischette**

Germination Success of *Ratibida*  
*pinnata* Outside Its Native Range

Invasive species have negative effects on agricultural and native grasslands in the Great Plains states. *Ratibida pinnata* (grey headed coneflower) has demonstrated, in several locations in North Dakota, its ability to grow. Not much is known about germination success of *Ratibida pinnata* within the borders of North Dakota. In order to better understand its reproductive success, we conducted a greenhouse experiment looking at numbers of germinated seed from three different sights. These sights are located in Fargo, moving west towards Long Lake, ND. Seeds from each sight were planted in their own group of four flats inside a greenhouse at North Dakota State University. We observed successful seedlings from each location, but number of seedlings per flat decreased moving west across the state. This shows that plants are able to produce viable seed within different climates in North Dakota. Future research should focus on limiting factors for *Ratibida pinnata* and its competition with native species.

**Jonas M. Sahouani**  
**A. Yu**  
**D. Webster**

Highly Functional Methacrylated  
Bio-based Resin System for UV  
Curable Coatings

Methacrylated epoxidized sucrose soyate (MESS) was synthesized from epoxidized sucrose soyate (ESS) and methacrylic acid, producing a highly viscous bio-based resin. Because of this, styrene was used as a reactive diluent to lower its viscosity. MESS was characterized using Fourier transform infrared spectroscopy (FTIR), proton nuclear magnetic resonance spectroscopy (1 H-NMR), gel permeation chromatography (GPC), and viscosity measurements. Various formulations containing styrene were used to produce thermally initiated, free-radically cured, bio-based thermosets with high glass transition temperature with good mechanical properties. The versatility of this resin was explored and applied in UV-cured coatings for dental composite applications. This resin was combined with various di- and trimethacrylated reactive diluents and cured using a photoinitiator (Irgacure 1173) at a 4:1:0.25 ratio, respectively. The extent of cure was determined by % gel content using Soxhlet extraction and confirmed using FTIR. The thermal and mechanical properties were determined by thermogravimetric analysis (TGA), dynamic mechanical thermal analysis (DMTA), and tensile testing. Coatings made from these formulations displayed good solvent resistance and hardness due to the high crosslinking. Consequently, the coatings were very brittle and inelastic, shattering easily when subjected to impact testing and Mandrel bending. Commercially available Bisphenol A glycerolate dimethacrylate (BisGMA) was used as the control.

**Levi Schlosser**

Animal Inside: A Closer Look  
at Humanity

Humans share a majority of their DNA with other species, and taxonomically, can be classified as animals. Biologically, we are indeed a form of animal, but there exists a line, a stigma, that often separates humans from other animals. By examining the similarities and differences between the two, I plan on identifying a number of medical, ethical, and possibly cultural benefits to combining these schools of thought. I will draw from existing statistics on animal-human interactions, as well as examine many other publications and eventually develop my own data. This data will provide a basis on which to field conclusions on my thesis. My research will build to a general outline, or consensus, on the matter, as well as the possible implications of the matter and what can be done to combat the stigma entirely. As a result, I intend to examine the stigma that currently exists between identifying humans as animals, and how that can apply to the field of ethics, humanitarianism, and even medicine.





**Megan Schwalbe**

Using Course Artifacts  
to Improve Teaching and  
Learning in Science  
General Education

A common assessment practice in undergraduate science courses is having students generate questions about course concepts. Analysis of student-generated questions can yield fruitful information on students’ ability to critically evaluate scientific findings while also identifying when instructional interventions are needed. Critical thinking skills are especially important in general education courses where non-science majors find their first and often last opportunity to learn how to effectively evaluate scientific findings published from a variety of multimedia sources. We collected (1) student-generated questions from a general education biology lab course, pre and post course, and (2) demographic data including academic year, ethnicity, and gender. Using a modified version of the student-generated reading question (SGRQ) rubric, we coded a total of 143 student models and achieved an inter-rater reliability of greater than 85%. This research will inform instruction to support further learning of critical thinking skills in non-majors biology.

**Nolan Schwarz**

Improving Radiation Therapy  
for Lung Cancer Cells by using  
Piperlongumine

More than half of lung cancer patients in the United States are treated with radiation therapy, yet radiation therapy leads to significant radiation injury for healthy tissues. Piperlongumine (PL) is a natural product and a reactive oxygen species (ROS) inducer that has shown radiosensitizing effects for breast cancer cells. We hypothesized that PL will radiosensitize lung cancer cells, but not healthy lung cells, by repressing the hypoxic response in cancer cells and enhancing the antioxidant response in healthy cells. Several in vitro assays were performed to test our hypothesis. DCFDA staining was done to assess the level of ROS within the cells. Clonogenic survival assays and propidium iodide staining were done to evaluate the effect of PL on long-term and short-term growth, respectively. qRT-PCR was done to determine the effect of PL on antioxidant expression. A luciferase assay was done to evaluate the effect of PL on transcriptional activity of the hypoxia response element. Our results show that PL radiosensitizes lung cancer cells, raises ROS levels, alters antioxidant gene expression in lung cancer, and inhibits HRE-luciferase activity. Further studies are need to determine the impact of PL treatment on normal lung cells, and to define the mechanisms for PL’s radiosensitizing effects.

**Halley Score  
Jonathan Carlson  
Sam Karschnia**

Alternative Prosthetic  
Arm Attachment

Our research focuses on the development of enhanced pediatric prosthetic arm attachments and their integration into a prosthetic limb. The goal is to provide a more affordable and comfortable alternative to what is currently available. To achieve this goal, we designed a suspension sleeve to eliminate the need for straps or harnesses, a socket printed out of a flexible material to enhance comfort, and a printed system of parts that will integrate the sleeve and socket with a prosthetic arm. Preliminary data from prototypes of our suspension sleeve shows that the design is capable of withstanding weight with minimal stretch. While still ongoing, preliminary experiments show a promising outlook for our designs and methods as we continue moving forward.



**Vijay Shah**

Structure and Stability of Silicon  
Nanoparticle Dispersions

Silicon nanocrystal (SiNC) nanoparticles have attracted much interest recently because of their unusual physical properties intermediate between those of bulk and molecular structures and their low toxicity compared with most alternatives. Practical applications to thin-film photovoltaic devices are facilitated by self-assembly of nanoparticles into a crystalline array (superlattice). By coating nanoparticles with adsorbed ligand brushes, bulk dispersions can be sterically stabilized against aggregation due to van der Waals forces between particles. Creating superlattices in the laboratory remains a practical challenge, however, because the equilibrium structure is very sensitive to system parameters. To investigate the dependence of superlattice stability on interparticle interactions, we performed molecular dynamics (MD) and Monte Carlo (MC) simulations to model bulk dispersions of SiNC nanoparticles governed by effective pair potentials that combine short-range steric and longer-range van der Waals interactions. The MD simulations were performed using the LAMMPS molecular simulator, while the MC simulations were developed within the Open Source Physics library. From particle configurations, we computed radial distribution functions and static structure factors to explore equilibrium structure and phase stability. By varying ligand length and stiffness and bulk volume fraction, we characterized the tendency of SiNC nanoparticles to self-assemble into ordered crystals or amorphous clusters. Our results may help to guide the choice of system parameters in experiments.

**McKenzi Shelton  
L. Reynolds  
A. Conley  
C. Dahlen  
K. Vonnahme  
B. Neville  
M. Crosswhite  
M.Crouse  
A. Tanner  
A. Grazul-Bilska**

Accumulation of Lipid Droplets  
(LD) in the Corpora Lutea of  
Pregnant Cows

Scientific Background: The corpus luteum (CL), an ovarian structure, forms after ovulation and is the primary source of the gestational-support hormone progesterone. Lipid droplets are cellular organelles serving as an energy reservoir, precursors for steroid and other hormones, as well as mediators in physiological and pathological conditions. We hypothesized that LD accumulation in the CL will differ in cows with induced parturition vs. controls. The aim of this study was to investigate the accumulation of LD expression in the CL from cows at the late stage of pregnancy. Methodologies: The CL were collected from cows (n=14)at late pregnancy (day 275; length of pregnancy in cows is ~280 days). Approximately 40 h before tissue collection, cows were treated with dexamethasone (n=7) to induce parturition, or with vehicle control (n=7). Portion of each CL was frozen in OCT compound, sectioned using cryostat, fixed in formalin, and then stained with BODIPY, a marker of LD. Images of luteal tissues were generated using microscopy to determine percentage area occupied by LD/cell followed by image and statistical analyses. Results: Lipid droplets were detected in cytoplasm of luteal cells. The area occupied by LD/cell tended (P=0.1) to be greater in control than induced group. Conclusions and Implication: Accumulation of LD in luteal tissues decreases after parturition induction, and is associated with a decrease of progesterone secretion. This indicates an association between LD and steroid production in the CL. These data will help to better understand regulation of steroid hormone production before parturition.



**Alexandra Sherrard**

Accuracy of Nutrient Information  
Provided by Popular Smart  
Phone Apps and Impact  
of User Differences

Americans consume the majority of daily calories away from home and may rely on smart phone apps to quickly identify nutrition information when making food choices. While the availability of apps providing nutrition information can offer convenience, a recent pilot study revealed up to 40% error in the most popular apps. The objective of this study was to compare four dietary analysis tools with the gold standard for accuracy. Dietary analysis tools included the “gold standard” ESHA program, My Fitness Pal, Spark People Calorie Counter, My Net Diary, and Calorie King. Two standardized recipes were analyzed using all five dietary analysis tools. The research team included two registered dietitians, three graduate/ undergraduate dietetic students, and one undergraduate non-dietetic student. All team members evaluated each recipe using all dietary analysis tools. Nutrients of interest, including all those required on the current FDA Nutrition facts label, were compared for significant mean differences using factorial ANOVA. Individual analysis of nutrients was compared for significant differences to evaluate inter-rater reliability. Accuracy of dietary analysis tools is important for consumer and nutrition professional use and recommendation. Significant differences among nutrient analysis tools may negatively contribute to consumer food choices and ability to control diet-related chronic disease.

**Jacob Shreffler**

Validation of the Fitbit  
Accelerometer for Tracking  
Behavior of Unweaned Pigs

Tracking the behavior of livestock over extended periods of time has historically involved the use of a camera to record the animals, followed by painstaking review of the recordings. This process uses up vast amounts of data, is time consuming to interpret, and is subject to the interpretation of the researcher. The purpose of this project was to determine if the Fitbit accurately records the sleep/wake behavior of young piglets. The Fitbit accelerometer is a standardized and accurate way to track the movement and sleep/wake behavior of livestock. In order to do this, Fitbit accelerometers were fitted around the neck of piglets as a collar, and a camera was set up to take a photograph of the litter every five minutes. The Fitbits and camera were left to record the pigs’ sleep/wake behavior for more than three hours for each day the pigs were monitored. Fitbit data and photographic data were compared to determine their correlation in reporting of sleep/wake activity. The camera and Fitbit were in agreement for 96% of the sleep/wake observations. This shows that Fitbit accelerometers are an effective way to track the sleep/wake behavior of unweaned pigs. Fitbits could be an accurate and simple way to track the behavior of livestock for other research that involves quantification of movement, such as studies involving the behavioral effects of nutrition, management, and health interventions.

**Annika Sidhu  
Sarah Brawthen  
Tessa Keller**

Media Portrayal: A Case Study  
of Universities in the Media

Upon researching media portrayal of universities from around the world, various information has been gathered about the relationship between universities and the media. The main focuses of this research are what creates a positive university display in the media, what the media looks for in university news stories, and how these stories impact the university. These research findings have concluded that universities with higher diversity percentages and excelling athletics have received better media attention, despite the university’s academic standing. In addition, the media tends to gravitate towards social issues of university campuses rather than the success of students. A negative display in the media often results in lower enrollment rates, disorderly conduct on campus, and disrespectful student body. Finally, understanding how universities are presented in the media allows students and faculty to achieve more self-awareness while on campus or when representing their university. The purpose of this paper is to reveal research findings on how universities are displayed in the media; and, therefore, universities will have a deeper understanding of their presence in the media.



**Patrick Simpson  
N. Bresinka  
C. Ulven**

Melt Processing Polyacrylonitrile/  
Lignin-Based Carbon Fiber

Due to carbon fiber’s excellent strength to weight ratio, it has found uses in many demanding aerospace and other high-end applications. The high cost of polyacrylonitrile (PAN)-based carbon fiber, \$10–20 per pound, has limited its use in the automotive industry as a way to decrease vehicle weight and, by doing so, increasing the fuel economy and efficiency. The use of PAN as a precursor in the production of current carbon fiber is responsible for 50% of the cost associated in its manufacture. By incorporating lignin, the second most abundant natural polymer and byproduct of the paper industry, the cost of carbon fiber could be reduced to as little as \$3-5 per pound. Due to PAN decomposing before reaching its melting point, current methods of manufacturing carbon fiber involve the use of organic solvents. To decrease cost and environmental impacts, the goal of this research is to develop PAN/Lignin-based carbon fiber that can be melt processed without the use of organic solvents. To achieve this goal, several different additives were incorporated into polymer blends that were then comparison molded. The samples were then taken through the pyrolysis process used to make PAN-based carbon fiber. The resulting samples were evaluated using RAMAN spectroscopy to determine their composition. The samples had the same RAMAN spectra as commercially available PAN-based carbon fiber, but, currently, the melt flow properties do not allow for the blends to be used in current melt processing production methods.

**Lauren Singelmann  
Ellen Swartz  
Jerika Cleveland**

RF Exposure on Primary Cell Lines

This research consists of creating an experimental procedure to analyze the effects of Far-Field Radio Frequency (RF) on RNA expression in mouse heart and brain cells. There is currently no standardized procedure for conducting RF exposure experiments on cell cultures; therefore, this work is setting a foundation for further innovative research. Analyzing RNA changes would allow us to see the effect of RF on genetic expression, leading to new research in RF therapy techniques. First, a cell environment is currently being developed that keeps cells alive without disrupting or scattering the RF field. This is being accomplished by characterizing current incubation chambers and evaluating how they affect RF exposure. Second, experimental procedures are being developed to harvest brain and heart cells. Finally, a test group of cells will be harvested and kept in the incubator while being exposed to RF. Following the exposure, the procedure will be repeated with a control group that is not exposed to RF. These groups will then be compared using RT-PCR, allowing us to quantify the changes in RNA expression due to RF exposure. Development of this technique would allow for new and innovative research in RF-induced therapy.

**Marissa Spear  
S. Travers**

Shifts in Flowering Phenology  
at Bluestem Prairie

Plants rely on seasonal cues, including temperature and rainfall, to begin blooming and successfully reproducing. Climate change affects these seasonal cues, which then may affect reproduction in the diverse plant species of the prairie. To track these effects on prairie plants, we visited Bluestem Prairie weekly and recorded when plant species began to flower. Then, we compared these dates to historical flowering times recorded from 1910 to 1961 to see if flowering times had shifted earlier, later, or stayed consistent. We then looked at the relationship between the current flowering times and the rainfall and temperature of the 2016 growing season. We found that most species are blooming earlier as temperatures increase and precipitation patterns change. This research demonstrates that climate change does affect flowering and reproduction of prairie plants. These effects have implications for plant-pollinator interactions, potential species hybridization, and conservation efforts.



**Caleb Stubstad**  
**Kristen Zattera**  
**Carly Deal**

Reasons Why Abstinent  
Adolescents Report They  
Have Not Had Sex

Despite declining teen birth rates, pregnancy and sexually transmitted infections (STIs) remain considerable public health challenges in the United States (Hamilton, Martin, & Osterman, 2015). Research shows negative consequences for adolescent parents, their children, and the nation at large (TNC, 2014). As such, a community-based comprehensive sexual health education program to prevent pregnancy and STIs was developed and implemented targeting adolescents in the upper Midwest. The current study focuses on a subset of program participants who indicated reasons for never having had sex on a survey assessing sexual reproductive health knowledge, attitudes, and behaviors (N =101, mean age =15.33, SD=1.69). Descriptive statistics showed that the most commonly reported reasons for never having had sex were: not wanting to have sex, not wanting to get an STI, and being afraid of getting pregnant or getting someone pregnant. Findings will be used to make recommendations to promote protective factors for delaying sexual initiation.

**Chengyao Tang**

A Parallel Platform for Chip-seq  
Enrichment Analysis Using  
MACS Abstracts

Chip-seq enrichment has attracted lots of attention for its accurate prediction. Chip-seq enrichment is a method to analyze protein interactions with DNA. This method is used to detect location of protein that has direct contact with the genome. Model-based analysis of Chip-sequence (MACS) is a computing method to identify genome-wide locations of transcription factor binding1. However, Chip-seq experiments generate extremely large data sets. Researchers are eager to find more efficient methods to analyze these large data sets. To solve this issue, I will explore a parallel platform that uses MACS to analyze Chip-seq data. By using parallel computing, I will be able to increase the speed of computing. Data sets from previous studies will be used to test the performance of the proposed platform. With the progress of this research, researchers will be able to do Chip-seq analysis much faster than with previous methods.

[1]. Feng J, Liu T, Qin B, Zhang Y, Liu XS. Identifying ChIP-seq enrichment using MACS. Nat Protoc.2012;7:1728–1740. doi: 10.1038/nprot.2012.101.

**Todd Tingelstad**

The Leading Women in Edgar  
Rice Burroughs’ Fiction:  
A Close Look at Dejah Thoris  
of “A Princess of Mars” and Jane  
from “Tarzan of the Apes”

When A Princess of Mars was published by Edgar Rice Burroughs in 1917, it was the first book in a series of 11 that featured the charismatic swordsman John Carter. Alongside the publishing of the John Carter books was another character created by Burroughs. This was Tarzan, first introduced in 1912 in Tarzan of the Apes. Both main characters had many similarities such as being intelligent warriors who, through cunning and skill, seldom lost a battle. Both men also had leading ladies: Dejah Thoris for John Carter, and Jane Porter for Tarzan.

I will attempt to answer the question “Why did Tarzan become so famous while John Carter was left by the wayside?” More specifically, I will explore Dejah’s and Jane’s roles in these books. Jane was the traditional lady of the time, swooning when appropriate, seemingly chaste, always the damsel in distress. Dejah was a different type of woman, perhaps too far ahead of her time to have a chance at fame. A natural born leader and a warrior, Dejah seldom needed protection, overtly sexual and always in charge of who she is with and when. Through a close reading of these books, I will explore the differences between these ladies to see if they actually helped (Tarzan) or held back (John Carter) their leading men. I believe that Dejah Thoris was too modern for her time and, ultimately, caused A Princess of Mars to be lost to history.



**Olivia Vaadeland**  
**Olivia Vogt**  
**Mara Zinda**

The International Journal of  
Strategic Communication:  
Uncovering Its Contents

The International Journal of Strategic Communication (IJSC) has been publishing annually since 2007. Since that time, it has been gaining traction and recognition within the strategic communication academic community and the respective field. The IJSC is the only journal being published for the discipline. Strategic communication, the process through which an organization builds relationships inside and outside itself, is a fairly new area of study. Despite its relatively new nature, it is an internationally accepted field; internationally, universities have added strategic communication classes and organizations have been implementing strategic communication plans. IJSC records the progression of strategic communication and facilitates the research it has produced. However, there has yet to be an in-depth analysis of the journal’s contents. Without periodic evaluation, the journal faces risk of stagnation. Because of these circumstances, this study will evaluate the nature of each issue in terms of theories used, contributors included, and disciplinary reach. Methods will be qualitative analysis and quantitative compilation of findings to best summarize results.

**Janessa Veach**

Solid Waste in Community  
Detention Basins: Where Does  
It Come From?

The Fargo project is a pilot project to turn a storm drainage detention basin into a community green space and natural area. A significant problem in the area is solid waste pollution, and in order to mitigate future problems, we need to understand the source. Our main objective is to find out the method of transport of the waste in this area. We have set up an observational study to identify the source of the solid waste. There is uncertainty if the solid waste is coming from the storm water drainage system or being blown into the basin. Our method to collect solid waste coming in via water included a large mesh bag and a smaller filter bag to collect varying sizes of solid waste material. We attached these bags to inlets in two additional detention basins in Fargo. The survey of windblown solid waste used a randomized transect method. We recorded the solid waste into categories based on type and size (cm). This study is important because many places across the U.S. have detention basins that have solid waste pollution issues. Many places have clean-up projects semi-regularly which can be costly, time-consuming, and damaging to the environment. If we can understand the source of this solid waste, our potential to mitigate the problem before it occurs will increase significantly. This study is ongoing and will report results when all of the data has been collected and analyzed.

**Jonathan Vollmer**  
**M. Rahman**

The Effect of Simulated Hail  
Damage on Yield for Four  
Different Varieties of Spring  
Canola (*Brassica napus*)

Pre-flowering hail damage has been shown to significantly reduce yields in canola. However, whether defoliation or stem damage has a greater effect on yield has yet to be addressed. Therefore, the objective of this study was to assess whether defoliation or stem damage was the larger contributor to yield loss as a result of hail damage. In order to answer this critical agronomic question, a Randomized Complete Block Design (RCBD) experiment was planted in the field with three repetitions using four different released varieties (DKI 70-10, DKI 71-14BL, 45S56, and Westar), which were assigned to be tested using one of three different treatments administered at bud stage, with a control set as a comparison. The treatments included 50% defoliation of total leaf area, 50% of total stems damaged, and a more severe treatment which included both stem damage and leaf damage. Relationships between treatments were determined using the Statistical Analysis System (SAS). Upon the completion of harvest and analysis, it was found that, on average, 50% stem damage reduced yield by approximately 19%, while 50% defoliation of total leaf area reduced yield by approximately 8%. These results were dependent on the variety of canola used, with DKL 71-14BL being the most resistant to damage. Our findings of differential yield reductions by defoliation and stem damage will help producers and crop adjusters more quickly and accurately assess the severity of hail damage in canola through appraisal of stem damage.





**Sierra Walker**  
**J. Talley**  
**M. Wheling**

Vision in Tabanidae

The primary aims of this project were to further develop histological protocols and techniques for use in the Natural Systems Sensing Laboratory and collect electrophysiological data in the electroretinogram (ERG). In addition to field collections to obtain specimens from the Horsefly Family (Tabanidae), this project required improving dissection and preservation techniques. To have interpretable results, the dissection samples needed to be stained, which established a need to understand and properly use Bodian and antibody staining. The ERG data collection also required specimen collection and identification. After all wavelengths of light had been controlled for intensity measurements, they were recorded to provide insightful information for a more complete understanding of their neurological sensitivities and overall make-up. For the most part, the results are as anticipated: the animals have a peak response in the blue-green region and another in the ultraviolet region. There was an anomaly contrary to what was predicted, as the animals also had some responses in the red range of the electromagnetic spectrum, despite other dipteran relatives having a well-documented lack of response in this range. Histological protocols still need to improve to produce more consistent and reliable results.

**Prajakta Warang**  
**S.T. Dorsam**  
**S.L. Kaminski**  
**C.S. Bass**  
**D.A. Redmer**  
**A.T. Grazul-Bilska**

Angiopietins (ANGPT) mRNA  
Expression in Ovine Corpora  
Lutea (CL): Effects of Diet  
and Arginine

Background: Plane of nutrition can alter animal reproduction including CL functions and expression of selected genes. Arginine (Arg) is a precursor for proteins, selected amino acids, nitric oxide, and polyamines that are involved in the regulation of vascularity. Angiopietins (ANGPT) are factors that regulate blood vessel formation (angiogenesis) and function. The aim of this study was to investigate the effects of Arg on ANGPT 1 and 2, and receptor Tie2 mRNA expression in the CL of nutritionally compromised ewes. Methodologies: Ewes (n=110) were randomly assigned into either maintenance control (C, 100% requirements), excess (O; 2xC), or restricted (U; 60% of C) diets. Ewes in each group were treated with Arg or Saline. Tissues were collected at the early-, mid- and late-luteal phases of the estrous cycle. mRNA was extracted from CL followed by quantitative real time RT-PCR and statistical analyses. Results: During nutritional treatment, C maintained BW, O gained 6±1.2 kg, and U lost 14±1.3 kg. ANGPT 1 and 2 mRNA expression was greater at the mid- and late- than in early- luteal phase. Expression of Tie2 mRNA and ANGPT1/2 ratio were greater at the late-, less at the mid- and least at the early- luteal phase. Diet or Arg did not affect mRNA expression of any gene. Conclusions and Implications: We have demonstrated that inadequate diet and/or Arg-supplementation does not have negative effects on ovarian functions measured by selected gene expression in luteal tissues. This project brings contribution to the area of animal nutrition, and results may have some implications for human health.



**Braden Weight**

Structure and Stability of  
Charged Colloid-Nanoparticle  
Mixtures

Colloidal suspensions play an important role in everyday life; for example, in medicinal absorption, sewage disposal, purification of water, and the formation of river deltas. In a polar solvent, colloidal particles can acquire charge through dissociation of counterions. The resulting electrostatic interactions between particles stabilize the suspension against aggregation due to van der Waals forces and strongly affect physical properties. Our research explores the influence of added nanoparticles on structural properties of charge-stabilized colloidal suspensions. To reduce the complexity of the problem, we model electrostatic interparticle interactions via effective Yukawa (screened-Coulomb) pair potentials, which implicitly include microions (counterions and salt ions) in the Debye screening constant. Within this coarse-grained model, we perform molecular dynamics simulations of mixtures of charged colloids and nanoparticles using the LAMMPS package. Over ranges of parameters, including charges, sizes, and concentrations of the two species, we analyze particle configurations to compute radial distribution functions and static structure factors. These structural properties reveal that nanoparticles weaken correlations between colloids and, thus, destabilize colloidal crystals. Our results suggest that nanoparticles may be implicitly incorporated into the effective pair potential in a fashion similar to microions, which would facilitate modeling of more complex multicomponent systems.

**Amber Winter**

Investigation on the Determinants  
of Travelers’ Intention to Visit a  
Destination and Destination  
Brand Loyalty

Destination marketing/management organizations (DMOs) have made significant efforts to enhance destinations’ brand loyalty that encourage tourists to revisit the destination. Although there is numerous research that investigated the factors on brand loyalty, the role of attitude to brand logos could not attract much attention among scholars. This study, thus, is to explore the roles of various attitudes to destination brand and logo of DMOs on brand loyalty. This study will shed light on understanding tourists’ attitude to destinations’ brand and image of the place. Identity recognition and affective reaction about logo design, and cognitive and affective destination image were explored to explain the destination brand loyalty. Using a survey taken by 505 respondents who visited Fargo-Moorhead-West Fargo or requested travel information, we have found there are significant relationships between brand loyalty and destination images. Interestingly, there was no statistically significant relationship between brand logo attitudes and brand loyalty. Through further analysis, we hope to see if there are any other indirect relationships that weren’t seen directly. These findings would be helpful to destination marketing organizations as they would be better able to focus their marketing efforts. Detailed analysis and implications will be discussed in a full paper.

**Heather Yelle**  
**E. Fassbender**  
**T. Rust**  
**A. Bezbaruah**

Iron Cross-linked Alginate Beads  
for Removing Phosphate from  
Wastewater and Storm Runoff  
and Their Reuse

Phosphorous is an essential element for plant growth and the other biota. However, phosphorous is a nonrenewable resource, and world reserves (mines) are running out. There will be global phosphorous short supply from around 2033. Further, elevated levels of phosphate can result in eutrophication of waterbodies. This research aims to address both these issues by the removal and recovery of phosphate using iron cross-linked alginate biopolymer beads. When placed in eutrophic waters, the beads sorb phosphate. Once phosphate is sorbed, the beads can be directly applied to plants as a fertilizer. Our laboratory experiments indicate that the beads remove aqueous phosphate very effectively. Currently, we are applying these beads in the West Fargo Wastewater Treatment Lagoons and Prairiewood Golf Course (Fargo, ND) retention ponds to evaluate their effectiveness in the field. The larger implications of this research are the possible use of iron cross-linked alginate beads to treat bodies of water experiencing eutrophication, and a new “mine” of phosphorous fertilizer.

