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## 8th Annual Research in the Capitol [Program], March 26, 2013

University of Northern Iowa. University Honors Program.

Iowa State University. Honors Program.

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University of Northern Iowa. University Honors Program., Iowa State University. Honors Program., and University of Iowa. Honors Program.



Iowa Regent Universities present  
the 8th Annual

# Research in the Capitol

*"Changing Landscapes"*

Tuesday, March 26, 2013

11:00am – 1:30pm

Iowa State House, Rotunda

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## Welcome

Welcome to the eighth annual Research in the Capitol. The opportunity for our students to share their knowledge and exuberance with legislators, Regents, and guests in the Iowa State House is a privilege and a special honor.

Research involvement plays a central role in undergraduate education. Students who take part in research are more successful academically, are more developed in their career and professional preparation, and are more satisfied with their college experience. Research engagement provides the conditions for collaborative learning and critical thinking that benefit our students as they move into the workforce or on to graduate or professional training. The presentations before you today required countless hours of effort on the part of the students and their mentors outside of the classroom and represent the shared commitment our students, staff, and faculty place on the undergraduate experience.

As you speak with these outstanding students, you will learn first hand the impact research involvement has on Iowa's students and the impact those students have on the research conducted at our outstanding Iowa Public Universities.

Robert Kirby  
Director

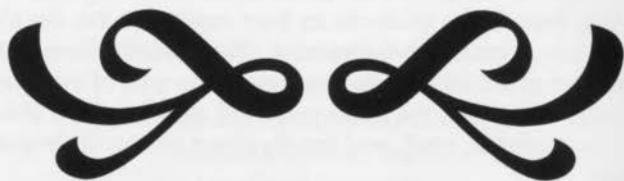
# Schedule

**11:00am**      **Opening Remarks**  
**Bob Kirby**  
Director, Iowa Center for Research by Undergraduates

**Herman Quirnbach**  
Senator, State of Iowa

**Jared Knight — Mount Vernon, IA**  
Senior, Iowa State University

**11:30am-  
1:30pm**      **Student Poster Presentations**



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## **1. Influence of Irradiation and Storage on Cheese Making during Mars Missions**

**Gail Barnum ~ Cedar Rapids, IA**

**Major: Food Science**

**Mentor: Lester A. Wilson**

**Iowa State University**

Due to the effects of increased radiation and long-term storage on a Mars mission (NASA), some processes, like cheese making, must be altered to produce the desired results. To determine these effects, rennet (an enzyme used to curdle milk) was irradiated at different levels and tested in 2010. The remaining enzyme was stored, either sealed or non-sealed until 2012/13, when additional testing occurred using both normal and irradiated milk. In all tests, the enzyme was added to the milk and timed until curds were formed. There were negligible differences between the sealed and non-sealed enzymes, however both took longer at the higher levels of irradiation. Milk irradiated at higher levels increased curdling time and had more effect than the irradiated enzyme. Overall, the increased irradiation in both milk and enzyme decreased the rennet's activity, meaning more enzyme must be sent in order to make cheese.

## **2. Shared Display Interaction Using Mobile Devices**

**Cody Bardell ~ DeWitt, IA**

**Major: Computer Science**

**Mentor: Stephen Hughes**

**University of Northern Iowa**

The Collective Interaction Classroom System (CICS) implements a standard "Clicker" student response system using smartphone devices. This system allows students to send responses to a central display in order to participate and collaborate during lectures. In an attempt to harness the flexibility of the smartphone we can interpret student responses as instructions, allowing students to collectively manipulate a shared display. As part of this study, CICS has been expanded to support the ability to manipulate the cursor's movement using a smartphone to simulate a remote trackpad. The goal of this study is to better understand how a collaborative influence impacts the performance of simple tasks like cursor movement and selection. We will be collecting data on how quickly groups of 2-4 subjects can cooperate to acquire targets of random sizes and distances. This profile can be compared to other understood profiles, i.e. a single mouse.

### **3. New Method for Creating Photoluminescent Nanostructures on Layered Materials**

**Ben Beck ~ Savanna, IL**

**Major: Physics**

**Mentor: Tim Kidd**

**University of Northern Iowa**

We have discovered that photoluminescent nanostructures form after exposing certain layered materials to high energy electrons using a scanning electron microscope (SEM). Intuitively, this exposure would damage the material and cause the exposed area to have material ejected from it. This would be measureable as a depression in the exposed area compared to the surrounding area. However, it was found that high energy electron exposure causes raised structures to form on the substrate in the exposed area. Using Raman spectroscopy, these structures were found to photoluminesce and were characterized as a form of carbon. High energy electron exposure produced three dimensional structures on every sample except Silicon, which is also the only material tested that is not layered. Thus it has worked on every layered material we have tried. The potential applications for these nanostructures could influence fields varying from quantum computing to superconductivity.

### **4. Engineering an Electric Car**

**Matthew Boddicker ~ Tipton, IA**

**Major: Electrical Engineering**

**Mentor: James Maxted**

**The University of Iowa**

Electric vehicles continue to play a key role in reducing fossil fuel dependency. However, high purchase price makes owning an electric vehicle impractical for many drivers, especially with a large market of used gasoline vehicles readily available. This project aims to solve these issues by converting a used gasoline vehicle into a purely electric vehicle by removing gasoline components and replacing them with a battery system, power electronics, and a DC drive motor. This project also assesses safety, legal, financial, and efficiency issues, and analyzes the feasibility of such a conversion for the consumer market.

## **5. Iowa State Lunabotics**

**Ricardo Canahui ~ Muscatine, IA**  
**Major: Mechanical Engineering**  
**Mentor: James Heise**  
**Iowa State University**

Started four years ago, the Iowa State University Lunabotics team began when nine students were challenged to design and build a robot for NASA's 2010 Lunabotics Mining Competition. This team researches innovative technologies that can be applied in the field of lunar mining; once this research is complete, the team will design and build a robot capable of performing in "moon-like" conditions. Team LunaCY also promotes engineering throughout the state of Iowa and by collaborating with the Nebraska Indian Community College in an attempt to get more minority students involved in Science, Technology, Mathematics, and Engineering (STEM) programs. After all the CAD models, building, and testing, Team LunaCY received 1st place in the mining, outreach, and communication categories of the competition. This year spectators can anticipate an autonomous robot that is faster, lighter, and more capable than last year's robot; making Team LunaCY a tough competitor at this year's event.

## **6. Perspectives of Domestic Violence Service Providers: Serving Latinas in Iowa**

**Ruth Cardenas ~ Osecola, IA**  
**Major: Child, Adult and Family Services**  
**Mentor: Brenda Lohman**  
**Iowa State University**

Some barriers that may be present for the victims of domestic violence to seek help include language, access to resources, and documentation status. This study focuses on the perspective of the professionals working with Latina women at domestic violence centers in Iowa and what they perceive as challenges or barriers to getting services, accepting services, and being aware of service because there is limited literature about the administration perspective. The aim of this study is to provide insight on the competence of services that are being provided to Latina victims of domestic violence. Using the service providers' view point, several research questions were explored:

1. What barriers do you perceive while working with these women and families?
2. What kind of outreach is there in the community for Latino families? And
3. How prepared do you feel to work with Latino families?

## **7. Magnetic Behavior of Nanostructured Mn<sub>0.23</sub>TaS<sub>2</sub> Near Ferromagnetic Transition**

**Corey Cooling ~ Vinton, IA**  
**Major: Physics/Philosophy**  
**Mentor: Paul Shand**  
**University of Northern Iowa**

We have investigated the changing magnetic properties of tantalum disulfide intercalated with 23% manganese. Tantalum disulfide has a crystal structure that is conducive to intercalating a variety of atoms in different concentrations. Manganese in particular was chosen because manganese ions themselves are highly magnetic, while bulk manganese samples do not exhibit aggregate magnetic properties. With the help of Dr. Strauss in the Chemistry Department, our samples were grown in nanotube form, with diameters ranging from 30nm to several hundred nanometers. Due to the elongated nanotube structure of the sample, it has atypical magnetic properties. The strength of the magnetization of the sample varies with temperature, and transitions from a weak magnetic state to a highly magnetized state around 85K. This transition can be described by calculating critical exponents taken from data collected as we cool the sample from 100K down to 5K. Our measurements indicated that the ferromagnetic transition had atypically high exponents, suggesting a multicritical transition. Further work includes making measurements on bulk crystalline samples and comparing those to the nanostructured sample. C. Cooling was supported by NSF Grant No. DMR-1206530

## **8. Optical spectroscopy of topological insulator nanoplates**

**Conor Delaney ~ Arlington Heights, IL**  
**Major: Physics**  
**Mentor: Rui He**  
**University of Northern Iowa**

Topological insulators emerge as a new type of material. Their surfaces are conducting but the interiors are non-conducting (insulating). Charge carriers on the surface carry a net spin and conduct electricity without much dissipations of heat. These properties make topological insulators promising candidates for spintronic and quantum computing devices which hold great promise to build faster and more energy efficient computers and devices. In this project we use optical spectroscopic techniques to explore the interface properties of nanoplates of a representative topological insulator material Bi<sub>2</sub>Te<sub>3</sub>. By using Raman spectroscopy we probe the vibrational properties of ultrathin Bi<sub>2</sub>Te<sub>3</sub> nanoplates. These studies reveal inversion symmetry breaking in Bi<sub>2</sub>Te<sub>3</sub> nanoplates as-grown on SiO<sub>2</sub> substrates and shed light on the interaction between the topological insulator nanostructures and the substrate. This work has been published in scientific journal Nanotechnology in October 2012 (Nanotechnology 23, 455703 (2012)).

## **9. Wireless Wheel Bearing Temperature Monitoring System**

**Michael DeSloover ~ Sumner, IA**  
**Major: Electrical Engineering Technology**  
**Mentor: Jin Zhu**  
**University of Northern Iowa**

Wheel bearings are key components in keeping trailers moving smoothly down the highway. These bearings are lubricated with petroleum-based grease, which has a breakdown point (approximately 500°F) at which it no longer acts as a lubricant. At this breakdown point, the axle begins to heat up, which can lead to bearing failure and an unsafe situation at highway speeds. The objective of our research is to develop a system which can read the temperature of the axle near the wheel bearings with a resistance temperature detector (RTD), wirelessly transmit the temperature to the cab of the tow vehicle, and display it on a screen for the driver to monitor. Therefore the driver can safely keep track of the bearing temperature and if a dangerous situation arises, they can pull over and check the situation before a catastrophic failure.

## **10. Does Success on the Grid-Iron and Court Increase Applications to FCS Schools?**

**Andrew Dykstra ~ Sheldon, IA**  
**Major: Economics: General Economics**  
**Mentor: Bryce Kanago**  
**University of Northern Iowa**

Athletics create a substantial financial commitment for a university. Previous research investigates the benefits athletic success may provide to a university. These benefits might include advertising for a university, which may lead to increased applications. A number of studies have examined the benefits of athletic success for universities. Stephen Perez (2012) used athletic and local enrollment data for California universities, and Devin and Jaren Pope (2012) used SAT scores sent and athletic data for Division-I football and basketball schools. Rather than using local enrollments or SAT scores as a proxy of applications, I use application data from the Integrated Postsecondary Education Data System (IPEDS) to investigate if athletic success for FCS football and basketball programs affects the number of applications these universities receive. Key independent variables are winning percentages, Sagarin ratings, dummy variables for if the team reached the football playoffs or NCAA tournament, and if so, for how far each team went.



## **11. Design and Implementation of an Altered Auditory Feedback Device for Speech Therapy**

**Colby Easterday ~ Altoona, IA**

**Major: Electrical Engineering Tech./Communicative Disorders**

**Mentor: Jin Zhu**

**University of Northern Iowa**

It is estimated that approximately one percent of adults are affected with a speech disorder known as a “stutter.” While the cause for stuttering is still not entirely understood, it has been observed that a stutterer’s dysfluencies may be immediately and effortlessly alleviated by nearly 100% with the use of the “Choral Speech Effect.” Choral speech works while a stutterer is speaking in unison with another person. By combining a microphone, microprocessor, and speaker, we can replace the second person with an altered version of the stutterer’s own voice, essentially tricking the brain into believing true choral effect has occurred. With advancing technology in the field of Digital Signal Processing (DSP), we can effectively reproduce this effect using a process known as Altered Auditory Feedback (AAF). In my project, a low cost, DSP technology-based, portable AAF system that may be used to alleviate stuttering significantly will be designed and implemented.

## **12. UNI Solar Boat Telemetry Project**

**Corey Eichelberger ~ Altoona, IA**

**Major: Electrical Engineering Tech./Networking & System Admin**

**Mentor: Jin Zhu**

**University of Northern Iowa**

The UNI Solar Boat project is an extracurricular undergraduate program promoting clean energy to keep Iowa waters free of pollution. The team competes annually in an international collegiate competition called Solar Splash. During the 2012 Solar Splash Competition, the data collection method used for the UNI solar boat proved to be a serious impairment. In the past, the primary solution during testing and competition was to use a laptop located within the boat using proprietary data collection software and hardware. This solution not only added weight but was also expensive to maintain and expand. The new telemetry project implemented a low-cost, light-weight solution based on the Raspberry Pi module that is easily expandable and based on open source software with all project work being released to open source.

### **13. The Archaeology of the Berry Patch Site in the Context of the Cedar Valley**

**Justin Elkins ~ Maquoketa, IA**

**Major: Anthropology**

**Mentor: Donald Gaff**

**University of Northern Iowa**

Since 2008 the University of Northern Iowa has been conducting an archaeological field school at Hartman Reserve in Cedar Falls. In 2009 the school discovered the Berry Patch site which is small, and would appear to be a satellite location for other prehistoric sites throughout the Cedar Valley, two of which are hypothesized to specialize in the manufacture of maple sugar. The artifacts uncovered from the Berry Patch suggest that this site was used for a very brief period of time, possibly as a hunting encampment. This project focuses on interpreting the Berry Patch site in the context of other archaeological sites in the Cedar River Valley.

### **14. Why Do Working Adults Return to School? How Employees Understand the Relationships Between Educational Credentials and Employment Opportunities**

**Nicole Fillon ~ Tama, IA**

**Major: Sociology**

**Mentor: David Bills**

**The University of Iowa**

Non-traditional age students (those aged 25 and older) make up nearly 40% of the enrollment in Iowa colleges and universities, and that number is trending upward. Additionally, these numbers exclude traditional age students who may only attend school part-time or who have parental obligations, making the non-traditional student population even larger. Many non-traditional students have had a break at some point in their education and are currently or have been an active part of the labor force. To understand how these working adults gather and interpret information, I interview adult workers and assess how accessible and accurate information informs their perceptions of the relationships between education and work. By understanding the needs and desires of working adults, higher education institutions and other organizations may develop policies which improve information transmission to adult learners and create programs to assist adult student populations successfully achieve their educational and occupational goals.

## **15. What and Where It Is Matters: How Category Knowledge Affects Children's Memory for Location**

**Luke Franzen ~ Arlington, IA**

**Major: Psychology**

**Mentor: Jodie Plumert**

**The University of Iowa**

Remembering the location of an object is central to human functioning. Without this ability, navigating daily life would be nearly impossible. Despite the importance of linking "what" and "where" information, little is known about how people use object information to remember spatial information. Previous research has shown that when nearby objects are categorically related (e.g., all animals), both children and adults remember those objects as closer together than they really are (Hund & Plumert, 2003). To follow up on this work, we examined how the degree of category relatedness among exemplars in a group influences spatial bias and whether switching the category exemplars from learning to test during a memory task influences spatial bias.

## **16. Perceptions of "Americanism": U.S. high school students' attitudes towards non-standard English accents**

**Christina Goering ~ Agency, IA**

**Major: Spanish**

**Mentor: Ardith Meier**

**University of Northern Iowa**

The presence of English Language Learners (ELL) in high schools across the U.S. is growing, and students' attitudes towards one another can influence academic success. Little research has investigated the attitudes of native-English speakers towards ELLs. This research investigates the degree to which native-English speaking students perceive ELLs as being American and the likelihood of native speakers choosing to participate in social activities with ELLs. Eight anonymous voice samples were recorded from speakers across the U.S. and abroad. Thirty high school students listened to each of these recordings and completed a survey asking the students to rate each speaker on her degree of Americanism. They were then asked to rate how likely they were to engage in fifteen specific activities with the accented speaker. This study found that being perceived as foreign greatly increases the likelihood of not being included in social activities but being perceived as American does not guarantee acceptance, either.

## **17. Oxford Bibliographies Online - Europe and the Globe, 1350-1700**

**Elise Goodman ~ Dubuque, IA**

**Major: Art History and Studio Art**

**Mentor: Julie Hochstrasser**

**The University of Iowa**

Development of an annotated art history bibliography on Europe and the Globe, 1350-1700, for publication with Oxford Bibliographies Online. This will provide a valuable resource for research, but the work is also proving to be a process of discovery about what work has or has not yet been done on visual arts related to early modern global interactions and cross-cultural exchanges between Europe and various other parts of the world.

## **18. 3D Tumorigenesis Models Reveal Unique Behaviors in Cancer Cell Lines and Human Tumor Tissue**

**Brett Hanson ~ Ames, IA**

**Major: Microbiology**

**Mentor: David Stoll**

**The University of Iowa**

There are currently no in vitro (outside the living organism) models to perform long-term studies of tumor development in the laboratory. To fill this need, we developed 2D and 3D models of tumor growth that utilize high-resolution imaging and image reconstruction software. Application of our 2D and 3D models to the analysis of in vitro tumor growth revealed that cancer cells, but not normal cells, eventually coalesce into large aggregates. Researchers have speculated that an aggregation process contributes to tumor growth in many cancers, but the process has never been modeled. Importantly, use of this model led to the discovery of specific single cell behaviors that facilitate aggregation and drive in vitro tumor growth. Finally, we are using our model to identify targets for new cancer treatments. In particular, we are testing many different monoclonal antibodies and analyzing their ability to inhibit the stages of tumor formation as revealed by our model.

## **19. Analysis of Fracture Mechanics of a ROMP-based Bio-resin Using the Essential Work of Fracture (EWF) Method**

**Riley Hanus ~ Clear Lake, IA**  
**Major: Materials Engineering**  
**Mentor: Michael Kessler**  
**Iowa State University**

The development and characterization of bio-based polymer systems is of increasing interest due to the unstable price of petroleum-based polymers and efforts to increase sustainability. There is a need for bio-based polymers with mechanical properties sufficient for use in structural applications. One bio-based polymer that shows respectable mechanical properties is synthesized from a modified Linseed oil (Dilulin) and dicyclopentadiene (DCPD) through ring opening metathesis polymerization (ROMP). The fracture mechanics of this bio-resin were investigated by the essential work of fracture (EWF) method. By analysis of tensile testing and EWF data, the composition containing 30 wt% Dilulin was found to have the greatest fracture toughness and showed an EWF of 23.1 kJ/m<sup>2</sup>. The EWF testing method results were verified by comparison with the well-established J-integral method. This study successfully characterized a novel bio-resin with mechanical properties sufficient for structural use.

## **20. Identifying neuronal genes that control protein misfolding in disease**

**Steven Henning ~ Waterloo, IA**  
**Major: Biology**  
**Mentor: Veena Prahlad**  
**The University of Iowa**

Protein aggregation, a result of the misfolding of proteins within cells, is a consequence of numerous stressful conditions and is associated with several neurodegenerative illnesses, including Huntington's Disease, Alzheimer's Disease, etc. Oddly, although repair mechanisms exist within cells that can alleviate aggregation, in the case of disease, they aren't activated. One such highly conserved repair mechanism is the heat shock response. This mechanism recognizes and repairs misfolded proteins. Counterintuitively, in the metazoan *C. elegans*, the thermosensory neurons inhibit the repair mechanism from being activated despite protein misfolding within cells. We suspect this is due to the high metabolic cost associated with repairing misfolded proteins. We are dissecting the genes involved in the neuronal inhibitory signal. Ideally, understanding how neurons control the response of cells to protein misfolding can provide insight on therapy for people in Iowa and around the world who suffer from neurodegenerative illness.

## **21. Treasures of the Textiles and Clothing Museum: Understanding Iowa and International History through Material Culture**

**Amy Hersheway ~ Geneva, IL**

**Major: Apparel, Merchandising, Design and Production**

**Mentor: Sara Marcketti**

**Iowa State University**

The roots of the Textiles and Clothing Museum date to the beginning of Iowa State and the Home Economics discipline. The exhibit Treasures of the Textiles and Clothing Museum highlights key Collection holdings including: earliest Museum items (men's coats circa 1725 and 1745); objects that epitomize the "look" of each decade (including Des Moines native and high fashion designer, Halston), objects related to the history of Iowa State University and the State of Iowa (dress of Carrie Chapman Catt from 1915), and ethnographic objects from every corner of the globe. My work as an honors student on this project involved: researching and preparing summaries of the cultural significance of each object; object preparation for photography for the accompanying exhibit catalog; and exhibit installation. This research is relevant because viewers will better understand the history of Iowa and of global cultures represented in Iowa's population through material culture.

## **22. Understanding the Basis of Antibiotic Tolerance in Bacteria by Use of a Nematode (*Caenorhabditis elegans*) Model**

**Kai Hillman ~ Cedar Rapids, IA**

**Major: Microbiology, Genetics**

**Mentor: Gregory Phillips**

**Iowa State University**

While much is known about antibiotic resistance, much less is known about how bacteria tolerate antibiotics, a phenomenon known as persistence. Persistent bacteria represent a small subpopulation of cells that enter a dormant, nondividing state, surviving antibiotic treatments without acquiring resistance. Persistence occurs in many bacterial species and can contribute to chronic infections and also lead to full drug resistance. To better understand the role of persistence in infection, we used *Caenorhabditis elegans*, a simple nematode worm, in place of more conventional vertebrate models. Many strains of bacteria that are pathogenic to humans and animals, including *Salmonella* and *E. coli*, also kill *C. elegans*. By measuring changes in the lifespan of *C. elegans* using new mutants that show significantly higher levels of persistence we can determine the impact of persistence on bacterial infection. These studies should eventually lead to improved drug therapies to cure infectious disease.

## **23. Divide and Conquer: Deletion analysis identifies functional domains of a bacterial cell division protein**

**Chun-Sing (Kevin) Huang ~ Iowa City, IA**

**Major: Microbiology**

**Mentor: David Weiss**

**The University of Iowa**

There is an urgent need for new antibiotics because bacteria are rapidly becoming resistant to the drugs we have been using for decades, like penicillin and tetracycline. Our lab recently identified a new class of proteins involved in bacterial cell division. My research project has been to dissect one of these proteins to get a better understanding what parts of the protein are essential, and what parts are dispensable. My results indicate a region of the protein called the "SPOR domain" is critically important. Because SPOR domains are found on many other bacterial proteins as well, we suggest they might be exploited as a target for a new class of broad spectrum antibacterial drugs.

## **24. Does Baby Sign Open the Door to Second Language Learning?**

**Nicole Hulme ~ Cedar Falls, IA**

**Major: Communicative Disorders**

**Mentor: Ken Bleile**

**University of Northern Iowa**

Baby Sign is a system of hand gestures that infants learn to enable them to communicate their wants and needs. It is an increasingly popular method of communication used with infants who are not yet able to speak. A large body of popular, non-research based literature claims that benefits of Baby Sign include everything from accelerated language development and increased IQ to heightened self-esteem. This thesis examined the importance of language development during infancy and then compared what popular literature says about the benefits of Baby Sign to results reported in the scientific research literature. As a part of the study, the question of whether Baby Sign improves a child's ability to acquire a second language was posed and research pertaining to second language learning was analyzed in order to draw conclusions about whether or not the use of Baby Sign positively impacts that process later in the child's life.

## **25. Evaluation of a Modified Paleolithic Dietary Intervention in the Treatment of Relapsing-Remitting Multiple Sclerosis**

**Amanda Irish ~ Coralville, IA**

**Major: Human Physiology**

**Mentor: Dr. Warren Darling**

**The University of Iowa**

Multiple Sclerosis (MS) is a progressive disease where the body's immune system mistakenly recognizes portions of the central nervous system as foreign and attempts to destroy them. It can cause vision and memory loss, pain, paralysis, and even death. An estimated 8,500 Iowans are affected. Disease-modifying drugs are typically prescribed to reduce or prevent future disability with limited benefit and serious side effects. Dietary modifications are not typically prescribed unless needed for other co-occurring disease(s). Improvements in fatigue and quality of life have been seen in MS patients adhering to a modified Paleolithic dietary intervention (MPDI) in combination with other non-conventional therapies. However, no research has been conducted evaluating effects of the dietary intervention alone. To evaluate the MPDI for treatment of Relapsing-Remitting MS (RRMS), we observe 20 men and women with neurologist-verified RRMS: one-half randomized to a "usual care" (control) group; the other half taught the MPDI.

## **26. The Role of RGS6 in a Spinal Interneuron Migration Defect**

**John Jung ~ Sioux City, IA**

**Major: Biology, English**

**Mentor: Diane Slusarski**

**The University of Iowa**

Embryonic development requires communication among cells. G protein signaling is a common and robust cell communication mechanism and is modulated by Regulator of G protein Signaling (RGS) proteins. My research examines the role of one such RGS protein, RGS6, in the development of the zebrafish spinal cord. To elucidate the function of RGS6, I manipulated RGS6 expression and characterized the zebrafish's motor reflex and spinal cord anatomy. My results demonstrate that normal zebrafish larva execute a smooth swim reflex, whereas larva with reduced RGS6 activity exhibit an uncoordinated twitching response. This faulty motor response correlates with an anatomical defect; fish with reduced RGS6 activity accumulate extraneous cells in the dorsal spinal cord. These results indicate that an RGS6 deficiency prevents normal development of spinal cord neurons and simultaneously causes an abnormal swim reflex.



## **27. Topographical Inscriptions**

**John Kerner ~ Shellsburg, IA**

**Major: Architecture**

**Mentor: Peter P. Goche**

**Iowa State University**

The study is to investigate production of a support system for the re-use of a dormant seed-drying chamber located south of Ames, Iowa. The outcomes are a greater understanding of the Iowan landscape and its agrarian/industrial past and exposure to the intimate scale of the family farm unit with respect to the enormity of its host (agri)culture. A variety of means are used to understand the seed drying production including photography, drawing, writing, video and 3 dimensional modeling. Temporary research assemblies within the dormant seed-dryer develop an experiential space through an ethno-specific logic. The investigation crafts a deeper understanding of fundamental human conditions pertaining to identity, farm labor, and the construction of experiential space.

## **28. Frontal and Temporal Lobe Coherence in Humans during Self-Vocalization**

**Johnathan Kingyon ~ West Burlington, IA**

**Major: Biomedical Engineering/Pre-Medicine**

**Mentor: Nandakumar Narayanan**

**The University of Iowa**

Vocalization is one of the most vital functions of human interaction as well as our ability to adjust our pitch in response to environmental cues. These two communicative functions are located in the frontal and temporal lobe of our brain. Electro-corticography (ECoG) data were collected from ten subjects using electrodes during patient speech. By learning the dynamic between these two brain areas during vocalization, we had the ability to create a map of brain activity. By understanding how and where these regions interact, physicians will be able to localize a patient's speech and hearing disorder more accurately and treat it more confidently. These findings have the potential to better clarify the manner in which our brain adjusts to environmental stimuli during voicing and localize the pathway of inter-regional brain communication. We hope to understand how the frontal and temporal cortex works together to produce and understand speech.

## **29. Economic Impact of Panther Athletics on Black Hawk County**

**Nathan Klyn ~ Pella, IA**

**Major: Economics: General Economics**

**Mentor: Lisa Jepsen**

**University of Northern Iowa**

Athletic Departments around the nation are a source of pride and revenue for the communities they reside in. Athletic departments have become a large source of revenue for the schools they belong to in recent years. The University of Northern Iowa (UNI) is home to six male varsity sports and nine female varsity sports. UNI athletics has had a sustained level of success in recent years. This report estimates the economic impact of the UNI athletic department on Black Hawk County, Iowa. Using input-output analysis by way of IMPLAN software, the economic impact of UNI athletics on Black Hawk County is more than six million dollars.

## **30. The Debt Effect: Is Student Debt Creating Ex-lowans?**

**Jared Knight ~ Mount Vernon, IA**

**Major: Political Science**

**Mentor: Peter Orazem**

**Iowa State University**

Iowa faces two related problems: the brain drain of young, educated people and the fourth-highest student debt in the country. This study examines the effect of student debt on locational choices of 2001, 2005, and 2009 graduates of Iowa State University by regressing their student debt load against their current state's average income, controlling for ability, socioeconomic class, and other factors. We find that increased levels of student debt in Iowa State University graduates increase the chances of locating in states with higher average incomes than Iowa.

## **31. Nature: The Beautiful**

**Dusty Kriegel ~ Coggon, IA**

**Major: Art: Studio**

**Mentor: Ken Hall**

**University of Northern Iowa**

My thesis culminates in the form of paintings. I predetermined qualities I wanted to use as a set of guides and as an acknowledgment of qualities I value in art work. These qualities were light versus dark, variance in edge quality, muted colors, and organic shapes. However, the final component of this thesis is discovery. Images from nature (such as leaves) are used as the starting imagery for the paintings. After the initial phase when the images are rendered realistically on the canvas, the paintings then take an abstract turn that incorporates the qualities mentioned above. A part of the creative process is allowing new developments to occur within the pieces and to decide what steps or changes will lead to the best final work. Overall, this thesis utilizes predetermined qualities and imagery to being and guide paintings, but the process of discovery is as important as those elements.

## **32. Influence of Wind Turbines on the Atmospheric Surface Layer**

**Matthew Lauridsen ~ Urbandale, IA**

**Major: Meteorology**

**Mentor: Eugene Takle**

**Iowa State University**

Using data from the Crop/Wind-energy EXperiment 2011 at a central Iowa wind farm, the impact of wind turbines on surface temperature, atmospheric stability, and dew duration was quantified. As air passes through the turning blades of wind turbines, turbulence is generated, in turn enhancing the vertical mixing of the atmosphere. This enhanced mixing is seen to produce a greater effect at night as the atmospheric boundary layer is much more shallow than during the day. These facts lead to three hypotheses: 1) the turbine-enhanced mixing will lead to an increase in near-surface temperature at night, 2) if (1) is correct, then surface-layer stability will be decreased at night, and 3) if (2) is correct, then dew duration should be shortened. The motivation for this study is that crop vulnerability to diseases is enhanced by the presence of dew, so an impact of turbines on dew duration could indirectly impact crops.

### **33. Wireless Wheel Bearing Temperature Monitoring System**

**Andrew Leinen ~ Red Oak, IA**  
**Major: Electrical Engineering**  
**Mentor: Anton Kruger**  
**University of Northern Iowa**

Wheel bearings are key components in keeping trailers moving smoothly down the highway. These bearings are lubricated with petroleum-based grease, which has a breakdown point (approximately 500°F) at which it no longer acts as a lubricant. At this breakdown point, the axle begins to heat up, which can lead to bearing failure and an unsafe situation at highway speeds. The objective of our research is to develop a system which can read the temperature of the axle near the wheel bearings with a resistance temperature detector (RTD), wirelessly transmit the temperature to the cab of the tow vehicle, and display it on a screen for the driver to monitor. Therefore the driver can safely keep track of the bearing temperature and if a dangerous situation arises, they can pull over and check the situation before a catastrophic failure.

### **34. Automated Sensor for Flowering and Vegetative Budburst**

**Guanduo Li ~ Zhengzhou, China**  
**Major: Biology**  
**Mentor: Anton Kruger**  
**The University of Iowa**

The study of the timing of bud opening that leads to leaf or flower formation on plants has significant implications in population dynamics and ecosystem functions, and is of great interest to biologists and ecologists. We describe a sensor for measuring budburst and blossom in plants and trees. A pair of plastic optical fibers is placed behind a bud. One fiber carries modulated light to the bud and the other fiber carries reflected light to detector electronics. When the plant's bud opens, the amount of reflected light changes. The sensor uses lock-in detection to suppress ambient and other light noise. Data are saved on a secure digital memory card for future use. The sensor incorporates calibration, and the user can set the integrated real-time clock. The sensor is power efficient and can operate for an entire growing season without having to replace its batteries.

## **35. Enhanced Kinetic Processes of Alkaline Batteries by Magnetic Modification**

**Ryan Loris ~ Hawthorn Woods, IL**

**Major: Chemistry**

**Mentor: Johna Leddy**

**The University of Iowa**

My research in Dr. Johna Leddy's lab at the University of Iowa has been focused on magnetically modifying alkaline batteries. Over the past year I have been analyzing the effects magnetic particles have on the capacity of the battery. In theory, the magnetic particles should speed up the electron transfer process leading to a more efficient battery. Results obtained have shown improved capacity in magnetically modified batteries. This is important because it could lead to a new way to make batteries with higher capacities and longer lifetimes. Industry always needs higher performing batteries and our research suggests that this method can create a higher performing battery.

## **36. Determining the prevalence of Staphylococcus aureus among two Iowa populations**

**Thomas Meirick ~ Protivin, IA**

**Major: Biochemistry**

**Mentor: Tara Smith**

**The University of Iowa**

Methicillin-resistant Staphylococcus aureus is responsible for around 18,000 deaths per year in the United States. It has been shown that two of the most vulnerable populations are workers in the health care industry and workers who come into contact with livestock. Because these two industries make up such a large part of Iowa's economy, learning more about MRSA is vital to continuing to improve public health. This project focuses on determining the prevalence of both methicillin-resistant and methicillin-susceptible Staphylococcus aureus among Iowans, as well as determining the risk factors associated with transmission. We are accomplishing this by having members of just under 100 families send in a swab of their nose and throat once per week and testing the swab for traces of Staph through a number of different tests. The participants also send in a weekly survey including some of their weekly habits, which allows us to identify any actions or risk factors associated with transmission.

## **37. Analysis of Tylosin Concentrations in Soil and Water Samples**

**Melissa Mika ~ Superior, CO**  
**Major: Civil Engineering**  
**Mentor: Michelle Soupir**  
**Iowa State University**

The veterinary medicines used in agricultural practices potentially have strong adverse effects on water quality. These antibiotics are administered to livestock to prevent disease. Low concentrations of these antibiotics are spread and absorbed into the soil. However, processes such as tile drainage prevent these antibiotics from being fully absorbed by the soil. The remaining low concentrations are then distributed into surface waters. There is limited information available regarding the transport, absorption, and persistence of these antibiotics in wastewater and surface waters. The objective of this research study is to use various analytical instruments, such as a High-Performance Liquid Chromatography (HPLC) to detect concentrations of antibiotics such as Tylosin and Sulfamethazine in water and soil samples. Standard methods of detecting low concentrations are explored, as well as modeling antibiotic transport and absorption in locally common soils.

## **38. A Heroic Journey Within Videogames and the Effects on Player Experience**

**Jeremiah Moffitt ~ Waterloo, IA**  
**Major: Anthropology**  
**Mentor: Anne Woodrick**  
**University of Northern Iowa**

The global popularity of videogames is increasing dramatically. The gamer explores first hand fantastic worlds. The story structure of many games follows the hero's journey—a rite of passage that social scientists view as a transformative experience. Although the content of the journey may be culturally specific, the similar structural components of the journey enable the hero to ultimately complete his/her journey as a changed person. I hypothesize that during the playing process, the gamer incorporates the experiences of his/her character and shares in some of these transformative processes. My research is based on participant observation and open-ended interviews with individuals who play 'Mass Effect.' Conclusions indicate that story driven games will have a social community forming effect, and impart moral messages on the gamers who play them.

## **39. Overcoming Conflict: Dimensional Experience Improves Performance in the DCCS Task**

**Stephen Molitor ~ Gilman, IA**

**Major: Psychology, Integrative Physiology**

**Mentor: Larissa Samuelson**

**The University of Iowa**

A growing body of evidence indicates that the development of executive function during childhood is critical for children's classroom performance throughout grade school. One common tool used to study the development of executive function is the dimensional change card sort (DCCS) task. In the DCCS, children are asked to sort two-dimensional cards (e.g., blue circle) using one dimension (color) and then the other (shape). Four-year-olds can switch between sorting rules, but 3-year-olds struggle, continuing to sort by the first rule provided. The source of this rapid developmental change has been widely debated. We present results showing that intensive visual experience with the dimensions children base their sorting decisions on improves 3-year-olds' performance in the DCCS. This suggests that visual experience with feature dimensions may be the developmental mechanism of flexible task switching in the DCCS. These findings open new avenues to help prepare children to succeed as they enter school.

## **40. Which Economic Factors Reduce Stress or Improve Employment Prospects and Pay in Dislocated Workers?: The Electrolux Case**

**Spencer Oh ~ Ames, IA**

**Major: Liberal Arts & Sciences**

**Mentor: Peter Orazem**

**Iowa State University**

This paper investigates how the dislocated workforce is coping with the closing of the Electrolux plant in Webster City, Iowa. With cooperation from Iowa Workforce Development, we surveyed all the displaced workers 17 months after the closing. We compiled information on the availability and use of Trade Adjustment Act assistance, the use of unemployment insurance, and whether the workers have found alternate employment. Analysis shows which policies and demographic factors helped or hindered the path to recovery. We find that only 50% of the displaced workers were employed 17 months after the plant closing. In addition, our analysis shows that stress levels for all groups are higher for the displaced workers relative to national norms, but that women and households without other workers face even greater stress. As a package, unemployment benefits, severance and the presence of Trade Adjustment Act assistance lower stress, but none of the programs individually ease pressures on the household.

## **41. Vitality Assisted Living Facility**

**Ashley Olson ~ Mount Pleasant, IA**

**Major: Interior Design**

**Mentor: Lee Cagley**

**Iowa State University**

Vitality Assisted Living Facility is in Panama Pacifico—one of the most sustainable areas in the world. We created the name, brand, and designed the facility from the ground up in an energetic, safe, sustainable way, heavily influenced by context. The members of Vitality reside in apartment pods providing privacy and semi-independence. The main facility in the center is where residents experience staffed dining, bar, lounge areas, salon-spa, workout and physical therapy spaces, and the theatre/chapel. The memory care apartments and facilities are in the main building for proximity to staff, and dining services. Material selections were made to assure responsible design, including green guard certified products, cork flooring, and selecting manufactures within the closest possible proximity to the site. Vitality's orientation capitalizes on the costal Panama trade winds and sun harvesting. Its location provides easy access to public transportation and intentional walking paths to the Town Center.

## **42. Competition and Extrinsic Motivation in the Band Classroom: A Review of Literature and Suggestions for Educational Practice**

**Stephanie Opsal ~ West Des Moines, IA**

**Major: Music Education, Instrumental**

**Mentor: Daniel Galyen**

**University of Northern Iowa**

Public school band directors face the possibility of using competitive or noncompetitive goal structures to maintain student interest and achievement in their music programs. The idea of participating in a band competition often draws strong student interest and cooperation within the group initially. However, the extrinsic motivation growing out of competitions often lacks the depth of genuine intrinsic interest in music performance. The outward desire for winning can actually hinder a student's personal interest in music itself, and contests typically only increase motivation for the highest achievers. Though competitions have inconsistent results on musical achievement, many inspire large amounts of rehearsal time on specific, technical skills at the expense of spending time learning a larger range of musical concepts. This study examines literature and analyzes the benefits and drawbacks of competition on student interest in school bands.



### **43. Racial Stress, Acculturation, and Social Support for Latino/as in PanHellenic Organizations Within Predominantly European American Collegiate Institutions**

**Roberto Orozco ~ Sioux City, IA**

**Major: Marketing, International Business, Psychology**

**Mentor: Loreto Prieto**

**Iowa State University**

The presence of fraternities and sororities is common on many college campuses. Although promoting brother- or sisterhood, academic excellence, community service, and many other virtues, these organizations may not always provide the socio-cultural environments sought by culturally diverse students. Peer-related support and involvement in student organizations predict improved personal and academic adjustment (Schneider & Ward, 2003), and being part of a Latino/a PanHellenic organization (LPO) can help to provide Latino/a students with social support and a source of cultural identity. We examined the history and foundations behind Latino/a PanHellenic organizations and created a literature review that documents the potential benefits and costs for Latino/a students who are members of LPOs. The primary construct we examined was social support, based on Saranson's (1983) model. We assessed how this construct was related to students' level of enculturation and acculturation with their indigenous and the majority cultures, respectively. Finally, we examined and documented various experiences Latino/a students may encounter within LPO environments.

### **44. Paleoenvironmental conditions at the Oligocene-Miocene boundary in Sumatra, Indonesia: Environmental template for the evolution and dispersal of Hominoidea in Island Southeast Asia**

**Natalie O'Shea ~ Des Moines, IA**

**Major: Anthropology**

**Mentor: Art Bettis**

**The University of Iowa**

Changing habitat availability combined with global and regional fluctuations in temperature and rainfall played an important role in how and why members of Hominoidea, apes and humans, radiated into Southeast Asia. Little is known about this tectonically active region where much of the land area formed after the radiation of higher primates began in earnest about 23 million years ago, during the Oligocene. A stratified sequence of ancient soils, or paleosols, from the Oligocene-Miocene boundary in Sumatra provides a localized record of environmental changes as significant land areas emerged and joined with the Asian mainland. In this study, preliminary interpretations of changing environmental conditions during this critical time period based on morphological, geochemical and isotopic studies of the paleosol sequence indicate a mosaic of local environmental conditions in the lower reaches of a large river system. Our data suggest a persistently wet rainforest environment, an environment favorable to the dispersal of Hominodea.

## **45. The “Spanish” Cannons of the University of Northern Iowa**

**Jared Parker ~ Bussey, IA**

**Major: Political Science, History**

**Mentor: Tom Connors**

**University of Northern Iowa**

At the University of Northern Iowa there are two cannons that are traditionally considered to be of Spanish origins, hailing from the Castillo de San Marco in St. Augustine, Florida. However, the information does not lend itself to support the claim that the cannons are truly Spanish. Evidence suggests that these cannons are actually either British or American in origin, and not from the late 1600's, instead arriving at the fort in the mid 1700's. The inventory does not suggest that these cannons are of the right size or material; they are not of the era suggested by other historians, though there is no evidence to dispute their origin at Castillo de San Marco, but simply the time they first arrived and their nation of origin.

## **46. Oriented Growth of Bone Marrow-Derived Stem Cells on Micropatterned Polymer Substrates for Nerve Regeneration Strategies**

**Emma Petersen ~ Parkersburg, IA**

**Major: Biology**

**Mentor: Donald Sakaguchi**

**Iowa State University**

Peripheral nerve injury can result in serious neurological deficits including paralysis. This project is focused on investigating the potential use of nerve guidance conduits paired with bone marrow-derived mesenchymal stem cells (MSCs) to facilitate nerve regeneration. MSCs are a useful cell source since they are easily isolated and maintained in culture, are multipotent, and can be used for autologous grafting procedures. In this study we cultured MSCs on micropatterned and nonpatterned polymer substrates. Immunocytochemistry and cell staining procedures were used to examine changes in MSC morphology and alignment. We demonstrate that MSCs align themselves in the direction of microgrooves when grown on micropatterned substrates. In contrast, MSCs grown on smooth, nonpatterned surfaces are randomly orientated. These results indicate substrate topography strongly influences morphology and growth of MSCs. Our future studies are aimed at optimizing growth and differentiation of MSCs on micropatterned, biodegradable, polymer substrates, for potential nerve regeneration studies.

## **47. If You Build It, Will They Come? Fiscal Federalism, Local Provision of Public Tourist Amenities, and the Vision Iowa Fund**

**Deepak Premkumar ~ Ames, IA**

**Major: Economics, Global Resource Systems**

**Mentor: Peter Orazem**

**Iowa State University**

The philosophy of fiscal federalism presumes that local communities will under- or over-provide public amenities in the presence of externalities. We test this hypothesis using data from Vision Iowa, a state program which provided partial funding to communities to build tourist attractions. We find that a 10% increase in investment increased county taxable retail sales by 0.1%. The State's internal rate of return from program-induced sales tax revenue averaged 11.8%. Because they faced a greater cost and get a smaller share of the sales tax, local communities' return was much smaller at 1.2%. We also find a small but significant increase in surrounding areas' sales. The positive spillover benefits to neighboring counties and the state suggest that local communities would undersupply public amenities without state subsidies.

## **48. Using Geographic Information Systems to Map Teen Driving Errors**

**Morgan Price ~ River Forest, IL & Iowa City, IA**

**Major: Biomedical Engineering**

**Mentor: Corinne Peek-Asa**

**The University of Iowa**

Young drivers have higher crash risk due to inexperience, immaturity and tendency to engage in high risk driving behaviors (Williams, 2003). Although crash risk is initially low for novice drivers, they are typically driving with an adult. The crash risk for young drivers increases about tenfold when independent driving begins (Mayhew, Simpson & Oak, 2003). DriveCam event recorders captured the locations where young drivers committed driving errors. The global positioning (GPS) coordinates were imported into ArcGIS, a mapping software for mapping and analysis. Events located within a half mile radius of the high schools were analyzed. There are substantial clusters that occur within a half mile radius from school. Because the results at each school varied, interventions specifically tailored to each school should be considered.

## **49. RNA Preparation for RNA-seq to Compare Low and High RFI Pigs**

**Austin Putz ~ Lacona, IA**

**Major: Animal Science**

**Mentor: Chris Tuggle**

**Iowa State University**

This project was focused around preparing ribonucleic acid (RNA) samples to compare low and high residual feed intake (RFI) pigs. Residual feed intake is the difference between what an animal actually consumes and what it is predicted to consume. Low RFI values are desirable. RFI represents roughly 30% of the variation in feed efficiency. Feed costs represent the highest variable cost for producers (65-75%). If we can find an inexpensive way to determine which pigs are going to be feed efficient, we can save producers money and reduce environmental impact due to the reduced amount of manure. RNA-seq is a recent technology used to quantify gene expression. The more research is completed on this technology the cheaper and easier it will be for breeding companies to adopt. Determining if there are noticeable differences in gene expression is the goal of this project.

## **50. If You Build It, Will They Come? Fiscal Federalism, Local Provision of Public Tourist Amenities, and the Vision Iowa Fund**

**Austin Quackenbush ~ Chanhassen, MN**

**Major: Finance, Economics**

**Mentor: Peter Orazem**

**Iowa State University**

The philosophy of fiscal federalism presumes that local communities will under- or over-provide public amenities in the presence of externalities. We test this hypothesis using data from Vision Iowa, a state program which provided partial funding to communities to build tourist attractions. We find that a 10% increase in investment increased county taxable retail sales by 0.1%. The State's internal rate of return from program-induced sales tax revenue averaged 11.8%. Because they faced a greater cost and get a smaller share of the sales tax, local communities' return was much smaller at 1.2%. We also find a small but significant increase in surrounding areas' sales. The positive spillover benefits to neighboring counties and the state suggest that local communities would undersupply public amenities without state subsidies.

## **51. The influence of life experiences on women's science career decision-making across generations**

**Tori Quist ~ Davenport, IA**  
**Major: Chemistry Education**  
**Mentor: Dawn Del Carlo**  
**University of Northern Iowa**

Previous research has shown several factors including self-efficacy affect women's choices of Major and careers (Grunert & Bodner, 2011). Most research has focused on a small age range of women, mainly from the completion of their undergraduate degree through the very early stages of their career. This qualitative study explored the differences in life experiences of women from diverse generations who have chosen to pursue science at a primarily undergraduate institution (PUI). Participants in the study included women beginning their science undergraduate degree through women well into their science careers. Participants completed personal statements and in-depth interviews which explored past choices as well as current perceptions of the results of those choices. Results indicated that the primary factors that influence women's career choices were their accomplishments and goals, challenges, confidence, motivation, support, and interest in science. Women's stories about their specific challenges, support, and interest in science will be presented.

## **52. Techno-Economic Analysis of a Biorefinery**

**Bailey Richardson ~ Lake City, IA**  
**Major: Biological Systems Engineering**  
**Mentor: Kurt Rosentrater**  
**Iowa State University**

As the biofuels industry expands, it is important to identify potential costs, as well as possible sales prices for the biofuels. Many industries use computer simulation programs for this, and to see how using different operations can affect the production at the plant. The objective of this project was to determine how operation scenarios affected capital, operational, material, and utility costs of a biorefinery. These costs were examined using a techno-economic modeling program for a soybean oil plant. It was clear after seeing analyses for each scenario that the price spike in soybean oil from 2005 to 2012, decreased the profitability of the facility by almost 250%, and that different operational scenarios increased profitability and decreased the amount of materials needed. This study demonstrated the utility of techno-economic modeling programs for illustrating how prices and operations can determine costs and revenue of a biofuel facility.

## **53. Vitality Assisted Living Facility**

**Erica Riha ~ Cresco, IA**

**Major: Interior Design**

**Mentor: Lee Cagley**

**Iowa State University**

Vitality Assisted Living Facility is in Panama Pacifico—one of the most sustainable areas in the world. We created the name, brand, and designed the facility from the ground up in an energetic, safe, sustainable way, heavily influenced by context. The members of Vitality reside in apartment pods providing privacy and semi-independence. The main facility in the center is where residents experience staffed dining, bar, lounge areas, salon-spa, workout and physical therapy spaces, and the theatre/chapel. The memory care apartments and facilities are in the main building for proximity to staff, and dining services. Material selections were made to assure responsible design, including green guard certified products, cork flooring, and selecting manufacturers within the closest possible proximity to the site. Vitality's orientation capitalizes on the coastal Panama trade winds and sun harvesting. Its location provides easy access to public transportation and intentional walking paths to the Town Center.

## **54. Iowa State Lunabotics**

**Garrett Schieber ~ Olathe, KS**

**Major: Mechanical Engineering**

**Mentor: James Heise**

**Iowa State University**

This Started four years ago, the Iowa State University Lunabotics team began when nine students were challenged to design and build a robot for NASA's 2010 Lunabotics Mining Competition. This team researches innovative technologies that can be applied in the field of lunar mining; once this research is complete, the team will design and build a robot capable of performing in "moon-like" conditions. Team LunaCY also promotes engineering throughout the state of Iowa and by collaborating with the Nebraska Indian Community College in an attempt to get more minority students involved in Science, Technology, Mathematics, and Engineering (STEM) programs. After all the CAD models, building, and testing, Team LunaCY received 1st place in the mining, outreach, and communication categories of the competition. This year spectators can anticipate an autonomous robot that is faster, lighter, and more capable than last year's robot; making Team LunaCY a tough competitor at this year's event.

## **55. Emission Characteristics of a Foundry Binder**

**Anne Shepherd ~ Fairbank, IA**

**Major: Biology/Pre-Prof: Dentistry**

**Mentor: Scott Giese**

**University of Northern Iowa**

Emissions from the casting process, labeled as hazardous air pollutants (HAP's), can cause long-term health issues for foundry workers when emitted into the workplace environment. In North America, the widely used sand binder system is phenolic urethane to produce ferrous and non-ferrous cast products. Thermo-gravimetric analysis and differential scanning calorimetry connected to the mass spectrometer provided a way to identify the emission of compounds and evaluate decomposition rate for the phenolic urethane binder. The experiment using the phenolic urethane discs was increased to 1200oC at a rate of 10oC per minute under an oxidizing (oxygen), reducing (carbon monoxide) and neutral (nitrogen) atmosphere. Some of the major HAP's identified were benzene, toluene, naphthalene, and xylene. The atmosphere had a tremendous effect on the emission rate and decomposition temperature which was able to determine the atmosphere inclined to controlling hazardous air pollutants more effectively. This research provides opportunities for further investigation on the development of binder systems that are capable of improving the workplace environment.

## **56. Privy Findings: Ceramics from the Plum Grove Septic System**

**Samantha Skaar ~ Sheldon, IA**

**Major: Anthropology and Linguistics**

**Mentor: James Enloe**

**The University of Iowa**

My research primarily consists of ceramic analysis from the septic system at the Plum Grove Historical Site in Iowa City. The site is the home to the first territorial governor of Iowa, Robert Lucas. The home, which was once a fully functioning farm, is currently located within the Iowa City's city limits. The ceramic artifacts have been collected over the course of 35 years from archaeological field schools that have occurred at the site through the University of Iowa. The analysis of these ceramics, where they came from and during what time period, begins to shed light on what Iowa was like early in our statehood.

## **57. Automation of Android Malware Analysis**

**Daniel Stiner ~ Iowa Falls, IA**  
**Major: Computer Engineering**  
**Mentor: Suraj Kothari**  
**Iowa State University**

Over 10,000 new and dangerous Android apps with malware have appeared in the last six months alone. Mobile anti-virus apps and measures by Google catch most of these, but for the smartphones of government employees, most is not always good enough. The DARPA program APAC (Automated Program Analysis for Cybersecurity) challenges teams to address this with tools that enhance the ability of a human analyst to examine Android app source code for the presence of malware and exploitable security holes. As part of the ISU APAC team, we develop a "security toolbox" using discrete math and graph theory to identify violations of confidentiality, integrity, and availability (CIA) security properties in Android apps. We work in tandem with the developers of J-Atlas, a program that provides an interface into the syntax graph of Java source code, to identify envelopes that enclose these CIA violations.

## **58. Embedded Electronics for a Mussel-Based Biological Sensor**

**Hannah Taylor ~ Mount Pleasant, IA**  
**Major: Electrical Engineering**  
**Mentor: Anton Kruger**  
**The University of Iowa**

University of Iowa researchers have been investigating using freshwater mussels as biological sensors. The goal is to use changes in a the mussel's gape, the regular opening and closing of the mussel as it filters nutrients from the water, as an indicator for toxins. The focus of my work has been on developing a system that is placed on the mussel to measure the gape and wirelessly communicate this information back to computers located at The University of Iowa. In my research I designed a "backpack" to be attached to a mussel that included a small battery, a gape sensor, temperature sensor, moisture indicator, battery life indicator, microcomputer, clock, and radio module. This system was tested in a lab where mussels from the Iowa River were kept in tanks. Five mussels were equipped with backpacks and data were wirelessly collected for several months.



## **59. Scene-Based Contextual Cueing in Pigeons: Responding on Cue**

**Yuejia (Mandy) Teng ~ Beijing, China**

**Major: Psychology**

**Mentor: Edward Wasserman**

**The University of Iowa**

The environment is rich with visual information. Navigating through the environment in our daily lives requires that we selectively attend to relevant information and ignore irrelevant information. Do other organisms also selectively attend to information in the environment? To find out, we required pigeons to peck a target stimulus located in eight photographic scenes which changed from time to time. Consistently pairing half of these scenes with a particular target location directed the pigeons' attention to the location of the target; this directed attention resulted in shorter times to peck the target in these scenes than in four other scenes which were not consistently paired with the location of the target. Our research provides a sensitive animal model for future research to explore the biological bases of this contextual cueing effect; this follow-up research may help us understand and treat amnesic patients who have deficits in visual attention.

## **60. Automation of Android Malware Analysis**

**Curtis Ullerich ~ Atlantic, IA**

**Major: Computer Engineering**

**Mentor: Suraj Kothari**

**Iowa State University**

Over 10,000 new and dangerous Android apps with malware have appeared in the last six months alone. Mobile anti-virus apps and measures by Google catch most of these, but for the smartphones of government employees, most is not always good enough. The DARPA program APAC (Automated Program Analysis for Cybersecurity) challenges teams to address this with tools that enhance the ability of a human analyst to examine Android app source code for the presence of malware and exploitable security holes. As part of the ISU APAC team, we develop a "security toolbox" using discrete math and graph theory to identify violations of confidentiality, integrity, and availability (CIA) security properties in Android apps. We work in tandem with the developers of J-Atlas, a program that provides an interface into the syntax graph of Java source code, to identify envelopes that enclose these CIA violations.

## **61. Community Resources and Literacy Development**

**Christina Valle ~ Davenport, IA**

**Major: English**

**Mentor: Deborah Linebarger**

**The University of Iowa**

While many research studies examine factors that enhance or hinder student achievement, few studies focus specifically on the community environment. Many existing studies address household factors that influence literacy development. Others focus exclusively on the classroom. The aim of this study is not only to link the home and school environments, but also to place them in the larger context of the community. To accomplish this, data is gathered from schools, libraries, and local business in four different neighborhoods. Ultimately, the goal of this research project is to determine what relationship exists between the neighborhood environment and literacy development of intermediate level students. Focusing on the community as a whole may help educators, research analysts, and the public better understand how reading practices are influenced by everyday settings outside of the home and school.

## **62. Wind Ramp Events at Turbine Height - Spatial Consistency and Causes at Two Iowa Wind Farms**

**Renee Walton ~ Indianola, IA**

**Major: Meteorology**

**Mentor: William Gallus**

**Iowa State University**

Ramp events cause a change in power output of 50% or more of the total capacity of wind turbines. As wind energy becomes a more prevalent power source, an understanding of ramp events becomes important. This study analyzes the spatial consistency of ramp events between two Iowa wind farms approximately 160 km apart in order to improve wind forecasting. The meteorological causes, timing, and consistency from the surface to wind turbine height were all studied in relation to the spatial consistency between wind speed data from a meteorological tower in Pomeroy, IA and nacelle data from six 80 m wind turbines in a central Iowa wind farm. Finally, there were several cases at the central Iowa wind farm where some turbines experienced a ramp, but others did not. The causes of these anomalies were also explored.

## **63. Effect of Urban Heat Island on Minimum and Maximum Temperatures of a Metropolitan Area in Central Iowa**

**Benjamin Walton ~ Hiawatha, IA**

**Major: Meteorology**

**Mentor: Tsing-Chang Chen**

**Iowa State University**

With a 20.5 percent increase in population from 481,394 people in 2000 to 580,255 people in 2011, the Des Moines Statistical Metropolitan Area is one of the fastest growing metropolitan areas in the country. This growth in population has caused an increase in man-made surfaces, buildings and streets, and a reduction of natural surfaces, grasslands and fields. Temperature and wind data from 2002 to 2011 was collected from weather stations within 50 miles of downtown Des Moines to determine differences in minimum and maximum temperatures and differences of timing of diurnal variations between stations. Data shows colder temperatures are pulled south to the west of the city and warmer temperatures are pulled north to the east of the city suggesting a possible mesoscale low pressure center over the city. Diurnal variations in temperatures are not apparent as there is little statistical significance in the differences.

## **64. Topographical Inscriptions**

**Justin Wang ~ Cedar Rapids, IA**

**Major: Architecture**

**Mentor: Peter Goche**

**Iowa State University**

The study is to investigate production of a support system for the re-use of a dormant seed-drying chamber located south of Ames, Iowa. The outcomes are a greater understanding of the lowan landscape and its agrarian/industrial past and exposure to the intimate scale of the family farm unit with respect to the enormity of its host (agri)culture. A variety of means are used to understand the seed drying production including photography, drawing, writing, video and 3 dimensional modeling. Temporary research assemblies within the dormant seed-dryer develop an experiential space through an ethno-specific logic. The investigation crafts a deeper understanding of fundamental human conditions pertaining to identity, farm labor, and the construction of experiential space.

## **65. Metolachlor inhibits human alveolar cell growth**

**Hannah Wilson ~ Cedar Falls, IA**

**Major: Biology-Honors Research, Biochemistry**

**Mentor: Kavita Dhanwada**

**University of Northern Iowa**

The chloroacetanilide herbicide Metolachlor has been increasingly detected in US surface and ground water, and studies show it has the potential to be inhaled by humans via drift during application. It has been shown to have harmful effects in non-target cells, including inhibition of cell growth, DNA damage, and altered protein activity. Our laboratory's previous work shows growth of human liver cells and fibroblasts is inhibited after low-level exposure. As mentioned, inhalation is a potential mode of exposure of this herbicide, yet little is known about its effects on lung health. The objective of this study is to evaluate metolachlor's effects on cells that help maintain lung immune homeostasis: human alveolar monocytes/macrophages. Results show low-levels of metolachlor, as low as 50 parts per billion, significantly reduced cell growth ( $p < 0.05$ ) of the undifferentiated monocytes relative to unexposed controls after 48 and 72 hours. Differentiated macrophages will be similarly evaluated.

## **66. The Effect of Nutrient Availability on the Evolution of Physiology in Two Tallgrass Prairie Species**

**Angela Wrage ~ Gladbrook, IA**

**Major: Biology, Chemistry**

**Mentor: Mark Sherrard**

**University of Northern Iowa**

Species from fertile environments generally display faster growth and higher metabolism than those from infertile environments, suggesting that nutrient availability has shaped the evolution of plant physiology. We tested whether nutrient availability influences natural selection on physiological traits in *Heliopsis helianthoides* (a competitive forb) and *Desmodium canadense* (a stress-tolerant legume). We measured height, chlorophyll content, and specific leaf area of 375 individuals per species split among three soil types with contrasting nutrient availability, then estimated selection as the relationship between each trait and relative height. For *Heliopsis*, selection favored plants with high chlorophyll content, especially in nutrient-rich soil. In contrast, *Desmodium* plants showed little relationship between chlorophyll content and fitness. For both species, low SLA increased fitness. Our results suggest that high chlorophyll content is indeed adaptive for *Heliopsis* in fertile soil. In contrast, symbioses with nitrogen-fixing bacteria reduce the adaptive significance of high chlorophyll content for *Desmodium*.



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