



Iowa Regent Universities present  
the 9th Annual

# Research in the Capitol

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11:30am – 1:30pm

Iowa State House, Rotunda

Des Moines, Iowa

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## Welcome

Welcome to the ninth 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, Iowa Center for Research by Undergraduates – University of Iowa

## List of Presenters

### **1. A 3D Tumorigenesis Model of Melanoma Cells Reveals Some Unique Behaviors and Some Behaviors Common to Other Cancer Cells**

**Joseph Ambrose ~ Neurobiology, Tipton, IA**  
**Brian Kroll ~ Health and Human Physiology, Fox Point, WI**  
**Mentors: David Soll and Deborah Wessels**  
**The University of Iowa**

We developed a high-resolution 3D motion analysis system to reconstruct, analyze and test drug responses of tumors formed in a model tumor 3D culture system. Application of this 3D tumorigenesis model led to the discovery of unique behaviors in cancer cells that are not observed in normal cell preparations. We have documented these behaviors in many different cancers including breast, paraganglioma, lung, peritoneal fluid, brain and now melanoma (skin cancer). Initial experiments with fresh melanoma preparations revealed behaviors not observed in other tumors. If these differences hold true for other aggressive melanoma cells, different targets may have to be considered for melanoma drug development. We are now analyzing additional melanoma tissue and the ability of anti-cancer drugs to inhibit the unique melanoma behaviors.

### **2. Creating Null Alleles of Outsiders and tre1 Using the CRISPR/Cas9 System in Drosophila**

**Jasmine Anderson ~ Genetics, La Crosse, WI**  
**Megan Merolla ~ Genetics, Blair, NE**  
**Mentor: Clark Coffman**  
**Iowa State University**

During fruit fly development, germ cells (future eggs and sperm) must migrate from outside to inside the embryo, populating the forming gonads. Two genes, outsiders and tre1, are required for normal germ cell development. Reduced outsiders function decreases germ cell death and results in an excess of abnormal and misplaced cells. Reduced tre1 function causes the germ cells to migrate to parts of the embryo where they shouldn't (this is similar to what occurs in tumor development). We intend to use targeted genome disruption to delete both of these genes, completely removing their activity. The technique that will allow us to make these deletions is known as the CRISPR/Cas9 system. We will then be able to document the phenotypes of these new deletions through live imaging of embryo development.

### **3. What Favorite Words Reveal**

**Robin Anderson ~ Speech and Hearing Science, Long Beach, IN**  
**Lauren Suhl ~ Speech and Hearing Science, Bettendorf, IA**  
**Mentor: Karla McGregor**  
**The University of Iowa**

When asked, "what's your favorite word?" most people readily reply. But what makes a word preferred? Is it a pleasant meaning or is it the word form—a pleasing pattern of consonants and vowels? While adults often report

favorite words that are mellifluous like “shenanigans,” children often report words for favorite activities like “basketball.” Young children use many words but they cannot tell you what a word is. Such explicit analysis of language (termed metalinguistic capacity) develops throughout childhood. We hypothesized that favorite words reflect metalinguistic capacity. We tested this hypothesis in two studies where 500 adults and 60 children answered What is your favorite word? and Why is that your favorite word? Results confirm that adults’ favorite words have a characteristic form and children’s favorite words acquire these characteristics as they gain metalinguistic control. Ultimately, professionals who evaluate children’s language development may find it useful to add a “favorite word inquiry” to their evaluations.

#### **4. Improving Patient Safety: Understanding Door Openings in a Cesarean Section Operating Room**

**Brennan Ayres ~ Biomedical Engineering, Panora, IA**

**Major: Electrical Engineering**

**Mentors: Priyadarshini Pennathur and Loreen Herwaldt**

**The University of Iowa**

Outcomes of surgical procedures are influenced by factors such as surgical skill, patient conditions, and the surgical environment. Environmental factors include operating room (OR) layout and organization as well as distractors such as operating room door openings. This human factors work focuses on identifying the frequency and rationale for door openings in a university hospital labor and delivery (L&D) OR. Numerous studies have correlated door openings with an increased risk of surgical site infections, but have not addressed door openings in specialized ORs such as L&D. Project methods included: a survey to assess staff perceptions of door openings; observations during 14 Cesarean sections, and interviews with L&D OB/GYN nurses and physicians. Results suggested nurses as opening the most doors. Findings from this study will help staff develop recommendations and interventions to reduce the number of door openings and possibly help decrease the rate of surgical site infections after Cesarean sections.

#### **5. Border Crossings of the Heart—Navigating the Transition from Minority to Majority Cultures: A Pilot Study of Young Hearing Adults of Deaf Parents and Young Heterosexual Adults of Gay/Lesbian Parents**

**Amy Becker ~ Carroll, IA**

**Major: Communicative Disorders**

**Mentors: Katie O’Brien and Steve Onken**

**The University of Northern Iowa**

“Emerging Adulthood” is a critical time of identity formulation and social network development. This transition from childhood into adulthood may be significantly more challenging for hearing children raised by Deaf parents and heterosexual children raised by Lesbian/Gay parents. Both populations are “aging out” of a minority culture of belonging and connections and transitioning into the majority cultures. In effect, these emerging adults are crossing an uncharted border from a minority culture into the majority culture, unfamiliar territory to their parents as well. As a member of the “emerging adulthood” culture, I am an essential member of this qualitative study research team. This work highlights the critical role I play in the methods, data analysis, and interpretation of results.

## **6. HCO<sub>3</sub><sup>-</sup> Uptake by HEK Cells is Increased by The HLA3 Protein From *C. reinhardtii***

**Nicholas Bengé ~ Indianola, IA**  
**Major: Biology (AGLS)**  
**Mentor: Micheal McCloskey**  
**Iowa State University**

Some photosynthetic microorganisms have carbon concentrating mechanisms (CCM) that facilitate carbon fixation when CO<sub>2</sub> is limiting. In the microalgae *Chlamydomonas reinhardtii*, low CO<sub>2</sub> induces a suite of CCM proteins, amongst which HLA3 is hypothesized to drive active uptake of bicarbonate (HCO<sub>3</sub><sup>-</sup>). We are testing this hypothesis using pH measurements inside human embryonic kidney (HEK) cells engineered to express HLA3. As a weak base, HCO<sub>3</sub><sup>-</sup> enhances recovery of cytosolic pH from a brief acid pulse. HLA3 expression markedly enhanced rates of HCO<sub>3</sub><sup>-</sup> uptake, particularly at low bicarbonate levels typical of the normal habitat. These data support a role for HLA3 as a HCO<sub>3</sub><sup>-</sup> transporter, though it remains unclear whether or how this is coupled to ATP hydrolysis. Further characterization of CCM components including HLA3 will illuminate details of the CCM that could prove useful in construction of algal strains for sustainable production of biofuels, and conceivably for improvement of crop yields.

## **7. Multiplication on the Punctured Torus**

**Wade Bloomquist ~ Monticello, IA**  
**Major: Mathematics**  
**Mentor: Charles Frohman**  
**The University of Iowa**

A torus is a mathematical surface that can be thought of as a square with opposite sides identified, first the right and the left are identified together to make a cylinder, then the top and the bottom are identified to make a torus (or the frosting on a doughnut). We are looking at the punctured torus so there is a point removed from our torus giving it a hole. We can then look at all of the simple closed curves, a curve that does not intersect itself and ends where it began, on the punctured torus. A multiplication operation can be defined on these curves making an algebra. We look to interpret this multiplication from a more geometrical viewpoint.

## **8. Information in Attentional Template Affects Response Time**

**Frank Bowers ~ Des Moines, IA**  
**Major: Psychology**  
**Mentor: Shaun Vecera**  
**The University of Iowa**

The environment is littered with unimportant information. We use positive templates to search for items in the environment which are important and negative templates to reject unimportant items. While crossing the street, we use a positive template to look for a car, and a negative template to ignore unhelpful information, such as a parked car instead of a moving one. Previous research has suggested that response times using the positive template are lower than response times using the negative template. The present experiment manipulated the amount of information held in the template. By controlling the amount of information in the positive and negative template, a more accurate comparison between the two is achieved. The present experiment found that response times were negatively correlated with information. The difference between response times from the positive and negative templates is not as great as first appeared.

## **9. Development of Ultralight Permanent Magnets**

**Derek Bradley ~ Iowa Falls, IA**  
**Major: Biology**  
**Mentor: Tim Kidd**  
**The University of Northern Iowa**

We start with cellulose, found in the walls of many plants, as our starting material. We then utilize ultrasonic agitation to break down the cellulose into nanocellulose, a new sustainable material with a variety of applications that is also edible. After freeze-drying the nanocellulose, an aerogel is made which is composed of over 95% percent air. This project involves incorporating magnetic metals into nanocellulose aerogels. We have been able to create a permanent magnet by putting the sample into a strong magnetic field, which produces an ultralight magnet that is 50 times lighter than a normal magnet of similar size. These materials can be utilized as formed, or compressed into thin sheets of magnetic paper. While our ultra-light magnets are not as strong as their much heavier counterparts, their light weight responds strongly to external magnetic fields and could be used in applications where weight is important.

## **10. Genetic Similarity Between Urban and Adjacent Rural White-Tailed Deer Populations in Iowa**

**Whitney Briggs ~ Willits, CA**  
**Major: Animal Ecology**  
**Mentor: Julie Blanchong**  
**Iowa State University**

Although urbanization has had a negative impact on many wildlife species, white-tailed deer have successfully adapted to living in urban environments. Abundant resources, such as food and shelter, draw deer to urban habitats, increase their survival rates and support high population densities which pose challenges for those tasked with managing overabundant urban deer. Understanding the magnitude of movement between deer in urban and surrounding rural deer areas is pivotal to designing effective population control efforts. The objective of our research is to estimate the degree of genetic similarity between adjacent urban and rural deer populations in several Iowa cities to better understand the amount of movement between them. If urban and rural deer are genetically similar this indicates that there is a high rate of movement between the two areas, suggesting that rural deer should be included when devising management strategies for reducing urban populations.

## **11. Housing Markets in College Towns: The Case of Ames, Iowa**

**Molly Carpenter ~ Highlands Ranch, CO**  
**Major: Community and Regional Planning**  
**Mentor: Monica Haddad**  
**Iowa State University**

The deficit of affordable housing in Ames, Iowa has been an issue recently coming under debate by local policymakers (Ames Tribune, 2013). One factor often not taken into consideration is the effect the student population has on the housing market of a college town. Property owners often engage in renting practices that favor college students, proving exclusionary for non-student renters. The recently increasing enrollment at Iowa State University also puts pressure on the housing market, driving rent up, and creating housing scarcity. Within this context, my research explores the relationship between Ames population (including students and non-students) and the housing stock. Using geographic information systems (GIS) to examine the housing market as a whole, as well as local housing and demographic data, this analysis provides the basis for policy suggestions that involve the targeting of non-student renters.

## **12. Organic Carbon Isotope Stratigraphy as a Tool for Identifying the Devonian-Carboniferous Boundary in the Mid-Continent of North America**

**Christopher Coble ~ Des Moines, IA**

**Major: Geoscience**

**Mentor: Bradley Cramer**

**The University of Iowa**

Organic carbon isotopes were analyzed in a section of core from Pike County, Indiana, to re-evaluate the Devonian-Carboniferous Boundary interval (~ 359 Million years ago) in the Mid-Continent of North America. This boundary between the Devonian Period and Carboniferous Period was a time of significant global extinction, known as the Hangenberg Extinction Event, as well as a major change to the global carbon cycle, known as the Hangenberg Positive Carbon Isotope ( $\delta^{13}\text{C}$ ) Excursion. This change in global carbon isotopes was also coupled with a significant fall in global sea level, and as a result, there are very few places on Earth with a thick stratigraphic record of the Devonian-Carboniferous Boundary interval. However, the Mid-Continent of North America contains a good record of the Late Devonian and Early Carboniferous, which is the main focus of this study. Preliminary results suggest the presence of a significant positive carbon isotope excursion.

## **13. Microwear Analysis of Lithic Artifacts from Scott County, Kansas (Site 14SC409)**

**Delaney Cooley ~ Iowa City, IA**

**Major: Anthropology**

**Mentor: Matthew E. Hill**

**The University of Iowa**

This research examines the Protohistoric (AD 1500 to 1800) occupation at the archaeological site 14SC409 in Scott County, Kansas. Using data from chipped stone artifacts, we examine past economic and subsistence practices of the local population. The energy placed into creating and maintaining this one tool type over others implies that the tool served a function integral to their lifestyle. The primary results revealed the use of scrapers to work hide, wood, and bone and unmodified stone tools for cutting and butchering. Observations were also made to determine whether these implements were formal (long-life use) or informal (short-use life) tools. The combination of morphological and microwear evidence suggests that the site was a short-occupation used primarily for hide processing. A hide-based economy in the area is consistent with historical reports of Apache occupying Scott County after being displaced by European colonization.

## **14. The Morphological Relationship Between the Premaxillary Region and Nasal Septum in European- and African-Derived Adult Populations**

**Lily Doershuk ~ Iowa City, IA**

**Majors: Anthropology and Spanish**

**Mentor: Robert Franciscus and Nathan Holton**

**The University of Iowa**

The nasal septum, a midline structure that divides the nasal cavity into left and right passages, is thought to have a significant influence on the forward growth of the skull. Previous research emphasizes the importance of an early developmental association between the septum and premaxilla, which holds the front teeth. We predict that individuals with a larger nasal septum should have a relatively longer premaxilla. Our results show that a larger nasal septum was associated with a relative increase in the length of parts of the premaxilla while other parts showed the opposite of the predicted pattern. This suggests that while the nasal septum is correlated with the morphology of the premaxilla, its influence on growth may be limited or difficult to detect in adults. Studies such as this are important to understanding human developmental variation and change through time.

## **15. Investigating Water Quality by Polymerase Chain Reaction**

**Brady Evans ~ Wichita, KA**

**Major: Civil Engineering**

**Mentors: Michelle Soupier and Toss Tuttle**

**Iowa State University**

Agricultural runoff from tile drained fields in recent years has diminished the quality of surface and ground waters in Iowa. The natural effects of runoff and drainage cause contamination in surface and ground waters by enterococci bacteria, found in swine manure applied as an economical source of nutrient fertilizer for crops, resistant to Tylosin, an antibiotic used at subtherapeutic levels to enhance animal growth and prevent disease. This study investigates the potential harm to human and animal health of these antibiotic-resistant bacteria. PCR (polymerase chain reaction) experiments are performed to amplify the presence or absence of known genes, which promote resistance. Before beginning PCR, however, bacteria samples are isolated on a selective agar infused with Tylosin. Bacteria colonies that grow are then considered Tylosin-resistant. The genomic DNA is then extracted from the Tylosin-resistant bacteria cells and PCR experiments are performed in order to find the antibiotic-resistant genes in the bacteria.

## **16. Public Knowledge of the Federal Physical Activity Guidelines**

**Nolan Gall ~ Dubuque, IA**

**Major: Kinesiology**

**Mentor: Panteleimon Ekkekakis**

**Iowa State University**

Due to the lack of clarity of physical activity guidelines over the past decade, the general population's knowledge was surveyed to find evidence of confusion as well as assess guideline marketing productivity. 587 people were questioned using a 14-question survey accessed through an online format. Questions were formatted to be answerable by the general population while testing their knowledge of the government issued physical activity guidelines. Of the survey respondents, the majority claimed physical activity is one the most important behaviors to benefit health. The majority also knew that at least moderate physical activity is needed for significant health benefits. However, the majority of the sample didn't know specific time usage for both moderate and vigorous intensity. The survey did, however, show the population has significant knowledge of children's physical activity guidelines.

## **17. Hispanic Women and Their Perception of Anti-Aging: Buying the Foundation of Youth**

**Norma Garcia Tellez ~ Marshalltown, IA**

**Major: Family Services**

**Mentors: April Chatham-Carpenter, Catherine MacGillivray, and Fernando Calderon**

**The University of Northern Iowa**

Statistics show that the Hispanic population in the United States is growing rapidly, which means that the number of older Hispanic adults will increase over time in the U.S. Due to the population change, our society will have to consider the Latino population. This study focuses on the meaning and the value Hispanic women place on their appearance as middle-aged women. It is a replication of an already existing qualitative study of middle-aged Caucasian women who use anti-aging products (Williams, 2013). My study looks specifically at Hispanic women in their 50's that use anti-aging products. Through research and in-depth interviews of Hispanic women, I better understand how middle-aged Hispanic women deal with anti-aging.

## **18. Finding a Cure for Barth Syndrome**

**Michelle Gorecki ~ Palatine, IL**  
**Major: Health and Human Physiology**  
**Mentor: Matthew Gillum**  
**The University of Iowa**

Barth Syndrome is a serious genetic disease that causes muscle weakness, heart failure, and immune system problems. It is very rare, only 200 people in the world are living with the disease, and the symptoms start showing up shortly after birth. The root cause of the symptoms associated with Barth Syndrome is due to one missing protein. My project is determining how this protein, called tafazzin, functions normally. If we determine the specific function of tafazzin, we will be able to develop a cure for Barth Syndrome. On a day to day basis, I work with mice that have Barth Syndrome, and cell culture. We look at the differences between the mice with Barth Syndrome and normal mice in pursuit of a cure.

## **19. Modeling Urban Storm Water Runoff in the Dry Run Creek Watershed, Iowa Using LiDAR, GIS, and the WinSLAMM Model**

**Rebecca Gronewold ~ Ackley, IA**  
**Major: Geography**  
**Mentor: Bingqing Liang**  
**The University of Northern Iowa**

Urban watersheds are complicated environments which contribute to flooding and degraded water quality. To better model urban hydrology, accurate digital elevation model (DEM) data are needed to effectively estimate drainage areas. The goals of this project are to derive accurate information from LiDAR elevation data and high resolution GIS data and to incorporate those information into a community-wide storm water modeling application called WinSLAMM (the Windows Source Load and Management Model) to estimate runoff and pollutants from the urban extent of the Dry Run Creek Watershed in Black Hawk County, Iowa. This project will investigate the feasibility of utilizing LiDAR for realistic drainage area delineation versus traditional elevation data. It is expected the collaborative use of LiDAR-derived DEMs, aerial photography, zoning data, and high-resolution land cover data will improve the accuracy and results of the WinSLAMM model.

## **20. Anti-Bullying Advocacy and State Legislation**

**Molly Hammer ~ Muscatine, IA**  
**Majors: Ethics & Public Policy, Journalism & Mass Communication**  
**Mentor: Rachel Young**  
**The University of Iowa**

The media's coverage of incidences of bullying has increased over the last decade. The research includes a look into the media's response to instances of bullying, the statistics surrounding the issue, and examines the Anti-Bullying advocacy movement and its effect on state legislation. The project will analyze legislation from a sample of states, including legislation currently proposed in Iowa. The work focuses on the capacity of legislation to effectively increase protections against bullying, specifically, cyber-bullying.

## **21. Enhancing Metabolic Rate to Promote Weight Loss**

**John Hartnett ~ Health and Human Physiology, Sioux City, IA**

**Emily Farmer ~ Health and Human Physiology, Indianola, IA**

**Mentor: Harald Stauss**

**The University of Iowa**

Obesity is a growing problem in the United States. The Center for Disease Control reports that 35.7% of the American population is obese. Overweight and obese individuals are at a greater risk of developing certain cancers, cardiovascular problems, and type 2 diabetes. In recent years, chronic vagus nerve stimulation (VNS) has been viewed as a potential treatment for obesity. Clinically, VNS is used as an end-treatment for epilepsy and depression and weight-loss is a major side-effect. We use chronic VNS to determine its effectiveness in treating obesity. Adult male mice are implanted with the stimulators and are stimulated chronically for 21 days. The effects of the stimulation are determined by measuring food and water intake, body weight, and metabolic data. The preliminary data from the experiments shows a substantial decrease in body weight of the experimental mice compared to the control mice.

## **22. Immune Activation Components from Raw Milk and Colostrum**

**Christopher Hinojo ~ Elizabeth, NJ**

**Major: Microbiology**

**Mentor: Joan Cunnick**

**Iowa State University**

Raw milk has many bioactive components that have health benefits such as alpha lactalbumin that modulates the immune system. Colostrum, the first secretion from the mammary glands after giving birth, is also rich with immunoglobulin and believed to have the same health benefiting proteins raw milk preserves. It is assumed that raw milk carries the same functional proteins as colostrum but diluted greatly by additional milk proteins. Consumption of raw milk is dangerous as it can carry pathogenic microbes if left unpasteurized, however, these health enhancing proteins may be lost during the pasteurization process. This study is to identify the fractions of raw milk and colostrum which contain these small proteins and characterize the immune enhancing properties. This study tested the primary and secondary antibody response of mice orally exposed to E. coli heat labile toxin B with and without milk and colostrum fractions.

## **23. Monitoring and Predicting Land Use and Land Cover Change on Cedar River Watershed of Iowa for the Next 30 Years**

**Xin Hong ~ Foshan, China**

**Major: Geography**

**Mentor: Bingqing Liang**

**The University of Northern Iowa**

Mapping the pattern of land use and land cover (LULC) and predicting its future trend are important for creating and maintaining a sustainable environment. The current project tends to predict LULC change on Cedar River watershed of Iowa for the next 30 years by analyzing past LULC patterns at three time frames: 1990, 2000, and 2010, using satellite images collected by SPOT satellite, ASTER sensor, and Landsat satellite, respectively. After initial processing, these images will be classified using object-oriented algorithms to derive ten classes: water, wetland, forest land, grassland, corn/soybeans, barren land, industrial/commercial, roads, residential, and

shadow/no data. The resultant classified images will then be analyzed to predict future LULC patterns using the Idrisi Land Change Modeler built on the Markov-chain algorithm. It is expected the results from this project will help to understand the trend of LULC pattern in heavily farmed watershed of Iowa.

## **24. Barriers to Accessing Augmentative and Alternative Communication (AAC): Pogo Boards as a Potential Solution**

**Amanda Huisman ~ Osage, IA**  
**Major: Communicative Disorders**  
**Mentor: Ken Bleile**  
**University of Northern Iowa**

Many of us enjoy the ability to carry on conversation with others, but for some communication is extremely difficult and speech may not be possible. Fortunately, there are several types of technology available to help these individuals communicate. However, this technology has a unique set of issues an individual must overcome to successfully use. One example is Pogo Boards, an application created by Talk To Me Technologies, located in Cedar Falls, Iowa. Pogo Boards can be used on computers, iPods, and iPads to help individuals communicate through the use of pictures and symbols organized into boards. Pogo Boards allows users to share their boards with others eliminating time spent without the ability to communicate and has several voice options to fit each unique user. While Pogo Boards does not eliminate all challenges of using technology to communicate, it is a viable option for many users.

## **25. Imagine the Possibilities: Impact of Drama on the Development of Social Skills Among Youth on the Autism Spectrum**

**Sean Klippel ~ Theatre, Cedar Fall, IA**  
**Tyler Gracey ~ Theatre, Bondurant, IA**  
**Mackenzie Roth ~ Theatre, Washington, IA**  
**Sam Card ~ Theatre, Waterloo, IA**  
**Mentor: Gretta Berghammer**  
**The University of Northern Iowa**

An early profile marker for a child with Autism Spectrum Disorder (ASD) is the inability or the hesitation to engage in pretend play--to hold a stick in their hand and pretend it is a sword or to turn a cardboard box into football helmet. Pretend play gives us the opportunity to make believe, that is to visualize different worlds, envision creative solutions and futures and develop the ability to empathize. Most of us experienced this state naturally, but there are children who are born without the innate ability to pretend or to make believe. The focus of our creative activity proposal was to create and implement a drama and theatre program designed to embrace the specific creative, social, and physical needs of youth with autism between the ages of 6 and 12 in order to discover best practices for artistically serving them.

## **26. Examining the Effects of Fluid Shear Stress on Cancer Cells Through Micropipette Aspiration**

**Benjamin Krog ~ Des Moines, IA**  
**Major: Biomedical Engineering**  
**Mentor: Michael Henry**  
**The University of Iowa**

Cancer cells traveling to distant tissues during metastasis must survive passing through the circulation. The

influence of the circulatory fluid microenvironment on these cells is poorly understood. It has been suggested that exposure to the shear forces within circulation was inhospitable to cancer cells, causing them to be destroyed. Recent evidence from our lab indicates that transformed cells selectively adapt following exposure to fluid shear forces and become resistant to subsequent exposure to shear force. Through micropipette aspiration, a technique used to measure mechanical properties of cells, we are able to examine changes in cells under various conditions, including fluid shear stress. One such mechanical property we evaluated is the elastic modulus. The elastic modulus, a measure of stiffness, is altered upon exposure to fluid shear stress. We are currently investigating the role of membrane stiffening in the fluid shear stress resistance response in cancer cells.

## **27. Rethinking Electrical Illumination in a Passive Solar Home**

**Isabelle Leysens ~ Johnston, IA**

**Major: Architecture**

**Mentor: Ulrike Passe**

**Iowa State University**

This project seeks to evaluate energy performance and occupant comfort in a passive solar home. Minute-by-minute illumination data is studied in relation to current national and international building standards using a single case study solar home, originally designed and constructed for the 2009 US Department of Energy Solar Decathlon Competition. Research has revealed a remarkable tolerance held by occupants for natural illumination (daylighting), suggesting an opportunity for adjustment of building design standards used by architects and building professionals. Rethinking standards offers an opportunity to reduce energy consumed by building lights, which makes up 12% of total US energy consumption, as reported by the US Energy Information Administration. Daylighting research is part of the larger building energy assessment project conducted by the ISU Center for Building Energy Research (CBER), as a part of the Iowa NSF EPSCoR research infrastructure development team.

## **28. Validation of a System for Intra-Operative Assessment of Fracture Reduction**

**Steven Long ~ Roswell, GA**

**Major: Biomedical Engineering**

**Mentors: Don Anderson and Geb Thomas**

**The University of Iowa**

Post-traumatic osteoarthritis (PTOA) is a debilitating disease that most predictably occurs following a fracture involving a joint such as the hip, knee, or ankle. PTOA accounts for roughly 12% of patients with osteoarthritis of these joints and is the leading cause of chronic disability among U.S military personnel from battlefield injuries. This translates into an economic loss of approximately \$12 billion annually from disability. The objective of this project is to develop a mechanical fixture that precisely controls the position and orientation of a bone fragment surrogate within an x-ray image. I have led the design and manufacture of a fixture supporting the point landmarks and the surrogate bone fragment. We have analyzed the resulting images to locate the fragment. Consequently, we can now validate the computational methods for assessing a fracture intra-operatively to aid in decreasing PTOA likelihood following these fractures.

## **29. Assessment of Shrub Willow (*Salix* spp.) Genotypes for Insect Pest Resistance Through Feeding Bioassays and Field Observations**

**Jonathan Mahoney**

**Major: Horticulture**  
**Mentor: Larry Smart**  
**Cornell University**

Fast-growing shrub willows (*Salix* spp.) have displayed valuable attributes as dedicated bioenergy crops. However, the long-term viability of *Salix* crops will depend on stable resistance to pests and diseases. Growth and productivity of willow plantations can be adversely affected by the susceptibility of certain genotypes to pests. Field observations conducted on the 2010 Loomis Fuel Field Trial and 2012 Geneva Association Mapping Trial revealed variation in pest susceptibility among genotypes, especially among the 130 genotypes in the 2012 Association Mapping Trial. Within the 2010 Loomis Fuel Field, overall beetle damage from imported willow leaf beetle (*Plagioderma versicolora*) and Japanese beetle (*Popillia japonica* Newman) was greatest for 'SV1'. Tests were conducted to see whether field observations could be replicated under controlled conditions. There was a significant positive correlation between no-choice Japanese beetle bioassay and field surveys of total beetle damage.

### **30. Effects of Traumatic Brain Injury on Domestic Violence Survivors**

**Lizzie Martin ~ Urbandale, IA**  
**Major: Social Work**  
**Mentor: William Downs**  
**The University of Northern Iowa**

Very little research exists on the topic of traumatic brain injury within the context of domestic violence. The purpose of this research is to increase the body of knowledge on traumatic brain injury in domestic violence survivors. More specifically, this research serves to understand the frequency of traumatic brain injury among domestic violence survivors with the subsequent foci of analyzing the relationship between traumatic brain injury and domestic violence, identifying the impact of traumatic brain injury on domestic violence survivors, and discovering strategies for serving domestic violence survivors who have sustained traumatic brain injury. A secondary data analysis of a study measuring rates of traumatic brain injury and domestic violence among incarcerated women indicated an influential relationship between traumatic brain injury and domestic violence. An analysis of existing literature on these topics shed more light on this relationship as well as ways to incorporate awareness of traumatic brain injury into domestic violence services.

### **31. Determinants of College Hockey Attendance**

**Max Martino ~ Cedar Rapids, IA**  
**Majors: Psychology and Economics**  
**Mentor: Lisa Jepsen**  
**The University of Northern Iowa**

I examine the determinants of annual attendance at Division I men's college hockey games. I have collected panel data from the past ten years on the 58 schools that have Division I programs, which gives me a sample size of 580. With annual attendance as the dependent variable I have run econometric regression to test the significance of different variables on attendance. Based on variables that were relevant in related past studies I explore the impact of a team's success in the previous season, demographic variables such as the size of the college and average income of the local population, and competition from other sports. A key question is how attendance is affected by other winter sports, specifically whether the success of the basketball team and location near a professional hockey franchise affect attendance. Attendance is a major source of revenue; therefore the results of this study may be of interest to athletic programs concerned about increasing revenue.

### **32. Solutions for Improving Dairy Farm Management in Northern Rural Vietnam**

**Alyssa Meyer ~ Sumner, IA**

**Majors: Dairy Science and Global Resource Systems**

**Mentor: Howard Tyler**

**Iowa State University**

Vietnam's rapid growth in agriculture has presented many challenges and opportunities for the country's dairy industry. The goal of the following research was to give an updated perspective on the successes, weaknesses, and challenges facing Northern Vietnam's rural dairy farmers, as well as potential solutions to these difficulties. Data was collected through personal interviews with farmers, in three distinct models of management. Solutions were then provided based on a collection of previous research. By identifying strengths and weaknesses of many different farms, individual farmers can be more successful and efficient with the shared information. This information can then be transferred to other developing dairy systems, to avoid difficulties before they occur. By bringing strengths, weaknesses, and solutions to the surface, extension workers and policy makers can be more aware of areas of improvement over a wide range of farm sizes and methods.

### **33. Optimizing Stereoselective Aldehyde alpha-Oxygenation**

**Justin Mikesell ~ Clear Lake, IA**

**Major: Chemistry**

**Mentor: Jason Chen**

**Iowa State University**

Complex molecules involved with biological processes often contain many oxygen atoms and chirality (3-D shape). Chirality is often critical to the function of molecules in medicine. My goal is to insert an oxygen next to an aldehyde while controlling the chirality of the product. This is currently achievable using a selective catalyst. The chiral selectivity is about 75%, but the goal is to reach above 90% selectivity. There are catalysts on the market able to do this, but they are expensive, and hard to make. It doesn't make sense to use such catalysts because my reactants are relatively cheap. Instead, I will be optimizing parameters of the reaction; solvent, atmosphere, temperature, and counter ions of the catalyst will be tested. My research will help in the synthesis of Nigriganoside A, a molecule potentially able to fight cancer.

### **34. The frontier of nanoelectronic devices: Controlling the properties of a single atomic impurity in a semiconductor.**

**Jeffrey Moore ~ Muscatine, IA**

**Major: Physics**

**Mentor: Michael Flatte**

**The University of Iowa**

Life as we know it today would be impossible without semiconductors; nearly every electronic device we own is equipped with a computer chip composed of semiconducting material. Over the past few decades, the scale of electronic devices has been shrinking rapidly. Commercially available mobile electronic devices alone have been the genesis of billion-dollar industries, and there is an enormous amount of motivation to decrease device dimensions further. Therefore, the ability to control and manipulate a wide range of properties of a single atom embedded in a semiconductor is of crucial importance for the development of future nanoelectronic devices. In our research, we have demonstrated previously unobserved manipulations of a single magnetic impurity in a semiconductor using a scanning tunneling microscope (STM), and have produced theoretical calculations which support our observations. These results expand the range of changes that can be induced electronically for a

single magnetic impurity in a semiconductor.

### **35. Born Too Early: Studying Blood Volume in Extremely Premature Babies**

**Samuel Mueting ~ Normal, IA**

**Majors: Biochemistry**

**Mentor: John Widness**

**The University of Iowa**

Studying disease and treatment of anemia in extremely premature infants can be facilitated by knowing the blood volume. By knowing the volume of blood given in a clinically-indicated transfusion and the change in the ratio of adult to fetal hemoglobin from before transfusion to a 24-hour post-transfusion sample, it is possible to calculate the blood volume of the infant. This is clinically important because many drugs are dosed based on the volume of blood in an infant, and for babies that are extremely premature we now have a way to accurately determine their blood volume without using more than a drop of blood. These blood samples are available without even having to draw extra blood from the infant because the Neonatal Intensive Care Unit regularly runs blood tests on the infants that leave a little blood leftover in the tube, which can be used in this study.

### **36. Annual Energy Consumption in a Community Lab and Analysis of Electricity Energy Flow**

**Esdras Murillo ~ Des Moines, IA**

**Major: Electrical Engineering**

**Mentor: Ulrike Passe**

**Iowa State University**

In order to achieve net-zero energy buildings, the electricity energy flow throughout a whole year needs to be analyzed. This can be achieved with improving energy consumption efficiency and renewable energy production. A community lab designed to be a net-zero building was set up to study the balance between the electrical energy consumption and solar electrical energy production. By analyzing the different percentages of energy consuming terminals and the energy production all year round, it is revealed that the system design and operation of the solar house has great potential to achieve net-zero. The air conditioner and the hot water heater are the biggest energy consumers in the house. Suggestions are made to improve the energy efficiency. With this study house users will be able to understand and better manage the energy flow for a net-zero energy building, and researchers can design the structures and mechanical systems of buildings with higher energy efficiency.

### **37. Efficient Synthesis of Magnetic Nanocomposites**

**Connor Parker ~ Colfax, IA**

**Major: Microbiology**

**Mentor: Sarah Larsen**

**The University of Iowa**

Nanocomposites are materials that combine and utilize the structure and function of two or more different nanomaterials. If something is "nano" it has at least one dimension of its form less than 100 nanometers. When nanomaterials are brought together, numerous applications such as cancer drug delivery, environmental remediation, and bio-imaging are possible. This work demonstrates the efficient synthesis of large volumes of a nanocomposite formed from iron and silica starting materials. Iron functions to serve as a magnetic core for the

nanoparticles, and the silica forms a porous layer around the iron nanoparticles. The resulting nanocomposite can potentially complete tasks such as delivering cancer drugs to sites of tumors and thus minimizing healthy tissue damage, or cleaning up water contaminated with metal and other man-made waste.

### **38. Predicting Changes in Dimensional Accuracy of Steel Castings**

**Kyle Patterson ~ Cedar Falls, IA**  
**Major: Mfg Technology: Metal Casting**  
**Mentor: Scott Giese**  
**The University of Northern Iowa**

The effect of various sand expansion rates on the dimensional accuracy of steel castings was studied. Step cone test castings were used to simulate multiple cooling rates which have been previously shown to affect finished casting dimensions. Several sand blends were used to produce cores for the test castings. It was demonstrated that none of the dimensions of the test castings matched the published shrink rate of the metal. The expansion of the various sand blends were determined and compared to the temperature at the adjacent metal's liquidus temperature. It was found that once poured, the liquid metal conformed to the shape of the core until the metal reached its liquidus temperature. The casting then cooled according to the published shrink rate. By using the physical characteristics of the molding material and metal, computer simulation can be used to help predict the final dimensions of a casting.

### **39. The Role of Maternally Supplied Cell Death Components in Primordial Germ Cell Development of Drosophila Melanogaster**

**Danielle Pohl ~ Center Point, IA**  
**Major: Biology**  
**Mentor: Clark Coffman**  
**Iowa State University**

During development, Drosophila melanogaster primordial germ cells migrate from the posterior pole to somatic gonadal precursor cells, forming the gonads. During this migratory process, about half of the germ cells die via an unknown mechanism. Maternally supplied gene products play a large role in germ cell development. The mother deposits mRNA into the egg, expressed prior to embryonic transcriptional activation. This project investigates this contribution on the primordial germ cell development in the embryo. To generate maternal loss-of-function conditions, germ line clones lacking key apoptosis components were created. Through antibody staining, the effect of loss of maternally supplied cell death components on embryos 0 to 12 hours post fertilization were observed. This will test if the main form of programmed cell death in germ cells is apoptosis. Further experimentation will determine whether it is dependent on caspases and apoptosis, autophagy, a combination of apoptosis and autophagy, or a different mechanism.

### **40. The Effects of Potential Hospital Closings on the Quality and Proximity of Hospital Options for Rural Residents**

**Deepak Premkumar ~ Ames, IA**  
**Majors: Economics, Global Resource Systems, and Mathematics**  
**Mentor: Peter Orazem**  
**Iowa State University**

Medicare's Critical Access Hospital program provides additional income to 82 of 118 Iowa hospitals. As a cost-saving initiative aimed at controlling healthcare expenditures, the federal government is considering a rule change

which would cut millions of extra dollars from many rural Iowa hospitals. It is likely that the changes would lead to closing several rural hospitals in Iowa. This study simulates how the hospital choices of rural Iowa patients would be affected by the hospital closings. The simulations are based on a conditional logit model that estimates how rural residents decide between the nearest rural hospital, metro hospital, or the specialty hospital. The future of rural hospitals will depend on their ability to adapt to the changing demand that exists in the face of evolving technology and changes in rural demographics. This research illustrates the burden of plausible hospital closing scenarios on rural residents.

## **41. Understanding Interactions Between Butterflies and their Floral Resources in Iowa Grasslands**

**Toni Proescholdt**

**Major: Biology**

**Mentor: Diane Debinski**

**Iowa State University**

Grasslands provide habitat for many animal species and they also serve to improve soil and water quality. Given historic and ongoing losses of grasslands to row crop agriculture and development, it is essential to better understand the complex relationships between grassland animals and their environment in order to conserve and restore grassland habitat. This research focused on improving the understanding of the interactions between grassland butterflies and their environment. Topics explored include landscape history and management, nectar production, flower diversity, and butterfly abundance patterns and behavior. We analyzed butterfly activity in grassland plots as a function of floral resources (nectar volume and concentration). This research was conducted in three grassland types: 1) remnant prairies, 2) reconstructed prairies, and 3) moderately grazed cattle pastures. This work will provide an improved understanding of the interactions between butterflies and their resources and it will inform decision-makers interested in managing grasslands for pollinators.

## **42. Current Developments in Forensic Science: Establishing Forensic Linguistics through Authorship Analysis**

**Annette Putnam ~ Andover, IL**

**Major: TESOL**

**Mentor: Ardith Meier**

**The University of Northern Iowa**

In legal systems around the world, language is everything. Five little words can send a man to his death. A series of text messages can serve as the crucial evidence to convict a murderer. Forensic linguistics is an emerging field that responds to such legal concerns regarding language. This thesis discusses the development of this young discipline, its notable contributions to our criminal justice system, and the approach of the forensic linguist when presented with questionable language in a criminal investigation. By examining the linguistic analysis used in the Derek Bentley case and, more recently, cases involving SMS text messages, the pivotal role of language in crime will be further evaluated. Finally, the promising future of forensic linguistics will be explored, assessing the credibility of forensic linguistics as a forensic science.

## **43. Black sheep phenomenon: Women's sense of belonging in the sciences across generations**

**Tori Quist ~ Davenport, IA**

**Majors: Chemistry Education**

**Mentor: Dawn Del Carlo**  
**The University of Northern Iowa**

A lack of sense of belonging has been shown to contribute to women leaving the sciences. This qualitative study focuses on the life experiences of women established in science fields to examine how they perceived their own sense of belonging in the field. Participants ranged in age from undergraduate women pursuing a science related undergraduate degree to women who have retired from an academic career in the sciences. Women 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 women often established themselves in a science field based on positive experiences/achievements in the sciences rather than social support mechanisms. This led to a feeling of being a "black sheep" among their non-science female family and peers. An explanation for this phenomenon is found in the sociological Distance from Privilege model.

#### **44. Soil Moisture Dynamics: A Comparison of the SMOS Satellite to the South Fork In-situ Soil Moisture Network**

**Wesley Rondinelli ~ Urbandale, IA**  
**Majors: Meteorology and Accounting**  
**Mentor: Brian Hornbuckle**  
**Iowa State University**

A lack of accuracy in weather models stems from a poor representation of soil moisture. Currently, soil moisture is gathered through the use of soil probes which frequently have variances in measurements tied to their locations. These variances can be caused by soil composition, soil density, and the vegetation above the soil. The Soil Moisture and Oceanic Salinity Satellite (SMOS) is a remote sensing instrument that will help improve soil moisture and oceanic salinity measurements globally. This study compares the surface soil moisture dynamics seen from the SMOS satellite to an in-situ network of soil probes by showing how the soil moisture from SMOS and the in-situ networks change during following a rain event. The hypothesis is that soil drying in the Midwest is depicted differently by measurements from SMOS compared to the in-situ network because SMOS averages the soil moisture through a five centimeter layer and within its footprint..

#### **45. U.S. Demand For Farm Tractors: 1950-2011**

**Stephanie Sailer ~ Manchester, IA**  
**Major: Economics**  
**Mentor: Bryce Kanago**  
**The University of Northern Iowa**

My research investigates potential determinants of the demand for farm tractors. The dependent variable in my regression is real gross investment in farm tractors by farmers. The independent variables I consider include the real interest rate, the relative price of farm tractors, the lagged purchases of farm tractors, real net farm equity, real farm income, acres per farm, the real wages of farm workers, and real exports. Previous papers have investigated this topic. However, many of these examined the demand for all farm machinery. I find that the real interest rate and the relative price of tractors have negative coefficients, while lagged purchases of farm tractors, has a positive coefficient. In some specifications, either real hired wage, acres per farm, or real equity also have positive coefficients.

## **46. Social Exclusion and Health: The Moderating Role of Social Support**

**Manuel Salinas ~ Poteet, TX**

**Major: Psychology**

**Mentor: Robert Hitlan**

**The University of Northern Iowa**

Research on social exclusion and rejection indicates that both chronic and acute episodes are aversive for the targets of such behavior. Many such experiences are also linked to altered neuroendocrine and immunological functioning. Although existing levels of social support are argued to ameliorate some of the negative outcomes/correlates of such behavior, few studies have attempted to systematically examine if (and how) this buffering effect is contingent on the source of support. Participants completed a survey assessing their psychological and physical health and perceptions of being excluded within their social world. Participants also provided saliva samples. As predicted, perceived exclusion, cortisol, and c-reactive protein levels were significantly related to psychological and physical health symptoms. Social support from significant (i.e. special) others moderated the relation between exclusion and some outcomes.

## **47. Industrial Democracy: Working Hard or Hardly Working?**

**Cody Schmidt ~ Epworth, IA**

**Major: Economics**

**Mentor: Chris Larimer**

**The University of Northern Iowa**

The issue of industrial democracy, or the extension of democratic principles into the economy, has been increasingly more important with the economic downturn that has recently plagued the global economy. Using a quantitative analytical approach, this study examined industrial democracy's correlative effect on economic security measured by proxy indicators (such as unemployment rates, income equality, investment, etc.) This study took a sample of European countries and gave an industrial democracy value for each. This value was created using the scope of industrial democracy in each country and was measured in terms of the amount of firms and establishments where worker representation was present. A linear regression was then conducted, comparing industrial democracy to the indicators. Using these trend lines, this study concludes that countries with more industrial democracy present generally have a more beneficial economic climate.

## **48. Gilt Approachability to a Human When Selected for Feed Efficiency**

**Johanna Scholar ~ LaGrange Park, IL**

**Majors: Animal Science and Music**

**Mentor: Anna Johnson**

**Iowa State University**

As feed efficiency is becoming more of a priority to producers, our objective was to determine if divergent selection for residual feed intake (RFI) alters gilt approachability behavior. Twenty low-RFI (more feed efficient) and 20 high-RFI (less feed efficient) gilts from the 9th generation of the ISU Yorkshire RFI selection lines were randomly selected and evaluated using a human approach test. Data was analyzed to determine differences between genetic lines for latency, frequency, and duration of escape behaviors and location in relation to the human. Low-RFI gilts tended to spend a shorter duration interacting with the human, but engaged in fewer total escape attempts compared to high-RFI gilts. These data suggest that while there are differences in approach behavior to a novel human between low- and high-RFI selection lines, selecting for improved feed efficiency did not adversely affect the pig-human interaction.

## **49. A Historical Perspective on Humanitarianism in Action: Witnessing and Responsibility in Doctors Without Borders**

**Lauren Sillman ~ Ames, IA**  
**Majors: History and English**  
**Mentor: Paul Greenough**  
**The University of Iowa**

The Red Cross was formed in response to tragedy and suffering, positing human dignity and medical care in the face of war and destruction and shows that action in the interests of humanity, rather than in political, economic, or social institutions, may be possible. However, some aid, whether in the form of developmental schemes or emergency relief, can be futile or even destructive. Doctors Without Borders emerged from the Red Cross and has played an important role in international discourse on the role of humanitarian work. This study focused on work in Afghanistan, Bosnia and Syria. A historical perspective has allowed for an analysis of their decision-making process and the perceptions of a global audience over time, in different political climates. Visibility is essential to publication and funding of projects, but the "ideal" level of notoriety is subject to context and contemporaneous opinions.

## **50. Implicit and Explicit Prejudice toward Transsexual Women**

**Naomi Skarsgard ~ Creston, IA**  
**Major: Psychology**  
**Mentor: Helen Harton**  
**The University of Northern Iowa**

Certain sub-groups within the transgender community may face more prejudice than others (e.g., transsexual men vs. transsexual women; Grant et al., 2011). Transsexual women may be implicitly associated with disease-threat (causing feelings of disgust similar to gay men; Schaller & Neuberg, 2012) and prosocial morals threat (causing feelings of distrust similar to atheists; Gervais, Shariff, & Norenzayan, 2011). The current study focuses on assessing implicit feelings of disgust and distrust of transsexual women. In addition it examines willingness for social closeness and relationships with transsexual women. Lastly, the study analyzes relationships between comfortability with social closeness/relationships involving transsexual women and prejudice towards transsexual women.

## **51. A Glimpse into NASA's Planetary Protection Implementation: Bacterial Communities Residing on Mars Bound Spacecraft**

**Garrett Smith ~ San Diego, CA**  
**Majors: Microbiology and Genetics**  
**Mentor: James N. Bedardini**  
**Iowa State University**

Space agencies, such as NASA, abide by Planetary Protection laws dedicated to preserving the scientific integrity and foreign body nature. Thus, the NASA Standard Assay quantifies heat-tolerant microbes to meet bioburden requirements. Isolated microorganisms are cultivated to purity and stored in frozen stocks. Bacteria collected from the Mars Exploration Rover and Phoenix missions were revived, then their ribosomal DNA extracted, amplified and sequenced. Based on the sequences, 101 isolates from the MER craft and 52 isolates from the Phoenix Fairing were identified. Bacillus and Bacillus-like genera comprise over 50% (77 isolates), and Staphylococcus comprise 23% (35 isolates) of the studied isolates. Additionally, low sequence identity (<97%) suggests 4 putative novel species in the Bacillus, Paenibacillus, and Virgibacillus genera. Further biochemical tests will be performed to understand their metabolism and characterize novel species. The elucidated diversity and physiology enhance microbial reduction techniques and build a bank of false-positives for future missions.

## **52. Fabrication of Nanostructures using Electron Beam Radiation**

**Kyle Spurgeon ~ Bloomfield, IA**  
**Majors: Physics**  
**Mentor: Tim Kidd**  
**The University of Northern Iowa**

Layered materials have exhibited a variety of unique characteristics with benefits in many fields, but recently a technique was discovered which allowed for the creation of nanoscale structures on the surface of these layered materials. This technique utilizes Scanning Electron Microscopy to grow or etch these materials in and on to the surface of the materials by applying a concentrated electron beam for long periods of time. We grew squares onto the surface of various layered materials. The variety of materials allowed us to test the properties of these new structures on various materials to see what was consistent in all materials. Atomic Force Microscopy was utilized to examine the topographical characteristics of the new structures. Though experiments were extensive and successful, we were unable to identify the composition of the new structures formed on the layered materials.

## **53. Gaps in Family Knowledge of Alzheimer's Disease**

**Lauren Stratton ~ Ankeny, IA**  
**Major: Gerontology: Social Sciences**  
**Mentor: Elaine Eshbaugh**  
**The University of Northern Iowa**

Education about Alzheimer's disease needs to become more readily available for family caregivers to increase their knowledge about the disease. The level of knowledge of Alzheimer's disease in family caregivers was analyzed in this study. One-hundred and forty-two family caregivers completed an online survey to assess their knowledge about Alzheimer's disease. The results revealed most participants knew that people with Alzheimer's do best with simple one-step instructions but many were unsure of the risk factors for the disease. Analyses showed that years of education are a strong predictor of Alzheimer's knowledge. Ideas for future educational programs and interventions are discussed.

## **54. Balancing the Board: An Analysis of the Implementation and Implications of Iowa's Gender Balance Legislation for Appointed Boards and Commissions**

**Morgan Todd ~ Windsor Heights, IA**  
**Major: Political Science**  
**Mentor: Valerie Hennings**  
**Iowa State University**

In 1987, the state of Iowa became one of the first to require that all appointed boards and commissions at the state level be gender-balanced. Continuing to break new political ground, the Iowa House passed legislation in 2009 stating that appointed boards and commissions must be gender-balanced not only at the state level, but also at the county and municipal levels. This new legislation went into effect on January 1, 2012. This research focuses on seven boards and commissions at the county level in all of Iowa's 99 counties, as well as nine municipal boards and commissions in a sample of 205 cities throughout the state. Through the data collected, I study the extent to which counties and cities are adhering to the latest gender-balance law, as well as the implications of having women serve on appointed boards and commissions at all levels of state and local government.

## **55. Cutting carbs: Ebola virus entry into cells**

**Madeline Walkner ~ Solon, IA**

**Major: Health and Human Physiology**

**Mentors: Wendy Maury and Nicholas Lennemann**

**The University of Iowa**

Filoviruses, such as Ebola virus, cause fatal hemorrhagic fever. Virus entry into host cells is mediated by sugars on the surface of the virion. Sugars on glycoproteins from other viruses are known to mediate protein stability, affect virus entry, mask conserved regions from antibodies and bind to receptors on cells, leading to virus entry. Here, we seek to understand the role of the two conserved N-linked glycosylation sites, N563 and N618 that are present on glycoprotein 2 (GP2). To date, we have found that elimination of the sugars individually somewhat diminishes GP stability on virions. Surprisingly, loss of the sugar at N563 enhanced infection by two fold. These findings suggest that the conserved sugar chains located at N563 of GP2 decrease entry efficiency. We also propose that by exposing GP amino acids, removal of these sugars may lead to the development of an attenuated Ebola virus strain useful for vaccinations.

## **56. Combating obesity by targeting tissue-specific components of the renin-angiotensin system**

**Benjamin Weidemann ~ Waterloo, IA**

**Majors: Chemistry and Biology**

**Mentor: Justin Grobe**

**The University of Iowa**

Orlistat acts to decrease calories absorbed through the gastro-intestinal (GI) tract and is one of three successful pharmacological approaches towards treating obesity, a disease state affecting a large proportion of our population and costing billions of taxpayer dollars every year. The renin-angiotensin system (RAS) contributes to metabolic control in the brain and fat tissue and has been implicated in diabetes, heart, and kidney disease. Mice with hyperactivity of the brain RAS (sRA mice) exhibit reduced body mass, elevated resting metabolic rate and are resistant to diet-induced diabetes type II. All components of the RAS are also expressed in GI tract, leading to the hypothesis that the RAS controls digestive efficiency. sRA mice had increased caloric intake and caloric loss in the GI tract. We conclude that the brain and circulating RAS help control digestive efficiency and metabolic rate, and hypothesize a role for GI tract angiotensin II type I receptors.

## **57. Variation in State Funded Grant Programs: Political and Economic Factors**

**KaLeigh White ~ Ottumwa, IA**

**Majors: Public Administration: Human Resources and Sociology**

**Mentor: Chris Larimer**

**The University of Northern Iowa**

As the cost of college continues to increase, state funding for higher education is decreasing. Students now face a growing burden to finance their education. As a result, state funded grant programs, both need and merit based, are becoming increasingly important to improving the accessibility of higher education. Using data presented by the Annual Survey Reports on State-Sponsored Student Financial Aid, this paper seeks to understand what factors best predict the structure and outcomes of state funded grant programs. These factors include state educational attainment levels, state income distribution, citizen/government ideology, state economic wellbeing, and state spending on social support programs. I find more liberal states are not only more likely to fund state-funded grant programs, particularly need based programs, but do so at a higher rate. I conclude by noting the

broader implications of funding need-based grants, including the effects on income inequality, educational attainment levels, state unemployment rates, and citizen access to social support programs.

## **58. Excavation and Stratigraphic Analysis Surrounding an Early 20th Century Boiler House**

**Ariel Williams ~ Washington, IA**  
**Majors: Anthropology and Earth Science**  
**Mentor: Donald Gaff**  
**The University of Northern Iowa**

In 1878, a greenhouse was built on the corner of 13th and Tremont Street in Cedar Falls, Iowa. Prior to its construction, however, another building existed in the same patch of property, possibly a mill with attached boiler house and smokestack. The foundations of this building and debris from the destroyed green house still remain. Stratigraphically, there is a very clear accumulation of layers from before there were any buildings on the property at all to today. In order to study these layers, two units of land were excavated and samples were collected of both debris and artifacts. The resulting data was analyzed to provide an understanding of the historical stages of development at the site, as well as to enrich understanding of the industrial history of Cedar Falls.

## **59. Using Microbes to Enhance Plant Drought Tolerance**

**Jeffrey Williams ~ Ames, IA**  
**Major: Microbiology**  
**Mentor: Gwyn Beattie**  
**Iowa State University**

Drought is a major limitation to agricultural production. Like plant nutrition and disease resistance, plant drought tolerance is likely influenced by closely associated microorganisms. Many plants benefit from their diverse interactions with microorganisms, such as by obtaining nitrogen and phosphorus. We hypothesize that plants select for microbial communities that enhance plant drought tolerance. To test this, we studied whether plants select for different microbes in the presence or absence of drought. Of the crops we used for this study, dry beans and soy beans, our data showed enhanced drought tolerance of some varieties during the course of serial growth cycles, suggesting enrichment for microbes that benefit plants in drought conditions. We are now exploring correlations between increased plant growth and changes in microbial communities. Once we understand these community changes, we can examine the mechanisms of the interactions between plants and microbes to develop new strategies in helping crop production.

## **60. Good things come in small packages: Fruit fly models of muscle and heart disease**

**Grant Young ~ Waverly, IA**  
**Major: Biochemistry**  
**Mentor: Lori Wallrath**  
**The University of Iowa**

Mutations in the human LMNA gene give rise to a collection of diseases that cause muscular dystrophy, heart disease, diabetes and early onset aging. The LMNA gene encodes lamins, proteins that form a filamentous network inside the nucleus of a cell. It is not known how mutant lamins cause disease. To determine the function of mutant lamins in specific tissues, we generated fruit flies (*Drosophila*) that possess the same mutations found

in patients with muscular dystrophy and dilated cardiomyopathy. The flies with muscular dystrophy mutations develop muscle weakness; larvae have deteriorated muscles and crawl very slowly. Similarly, flies with cardiomyopathy mutations have age-dependent heart problems; the adult hearts collapse and show irregular beating. We are currently using these flies to identify gene products and compounds (drugs) to correct the muscle and heart problems. Our studies will identify potential treatments and lead to personalized medicine.