

Welcome

Welcome to the seventh 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

Schedule

- 11:30am Opening Remarks
Bob Kirby
Director, Iowa Center for Research by
Undergraduates
- 11:35am Spencer Walrath, Cedar Rapids, IA
Senior, University of Northern Iowa
- 11:45am-
1:30pm Student Poster Presentations

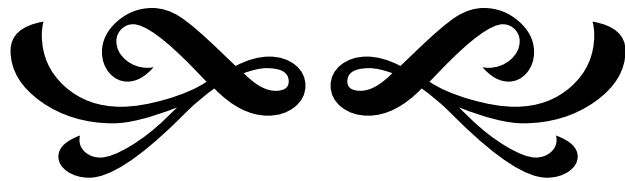


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1. Designing Decision Aids for Reproductive Health Communication

Brandon Alvarado, Cedar Falls, IA

Major: Graphic Design

Leah Willadsen, Council Bluffs, IA

Major: Graphic Design

Mentors: Sunghyan Kang and Deb Satterfield

Iowa State University

Building a trusting relationship with your healthcare provider is an important aspect of leading a healthy lifestyle. Unfortunately, reproductive health is a difficult topic for many young women to discuss. This research aims to design an information device, including a website and mobile application, helping college-aged women and their healthcare providers engage in and maintain productive, comfortable conversations regarding reproductive healthcare issues. Focusing on visual aspects of design, we hope to provide women with the informational tools necessary to form trusting relationships with their healthcare providers. We conducted focus group studies where participants, women ages 18-24 years old, were shown six varying sets of websites, icons, and logos. We found that women preferred imagery showing an empowering young woman with whom to identify with in combination with a clean, organized design. They preferred a bold, interesting look using bright colors and a design that felt trustful and made information accessible.

2. Effects of Seed Dispersal by Bison on Post-Dispersal Seed Predation

Emily Artz, Iowa City, IA

Major: Animal Ecology

Mentor: W. Sue Fairbanks

Iowa State University

Seed dispersal by animals is a key process in maintaining many ecosystems. In tallgrass prairies, much potential seed dispersal was eliminated by the removal of bison. Bison carry seeds in their hair, which is shed every spring. I examined post-dispersal predation on seeds in shed bison hair by birds, rodents, and insects. I hypothesized that seeds in bison hair would suffer lower predation than seeds deposited on the ground. I used five replicate plots containing four enclosures: accessible to insects, to rodents, to birds, and a control open to all predators. Enclosures contained two dishes with seeds in substrate or in shed bison hair. I exposed the dishes in two week-long trials, the first in June and the second in August. Seed removal was higher in the second trial, and more seeds were removed from substrate than from bison hair in rodent, insect, and control dishes. Shed hair may deter seed removal in late summer when rodents and insects are abundant, and foraging efficiency is important.

3. Elucidating the Mechanisms of Contaminant Uptake from Groundwater

Jonathan Bachman, Clarendon Hills, IL

Major: Chemical Engineering

Mentor: Michelle Scherer

University of Iowa

This research aims to determine the implications of the dissolved and solid iron redox reactions. The Fe(II)-Fe(III) redox couple is ubiquitous in groundwater environments and plays a critical role in the fate and transport of contaminants. Fe(II) has shown to catalyze contaminant-mineral redox reactions which render the contaminant less toxic as well as drive the incorporation of contaminants into the mineral structure. This work will allow the prediction of the fate and transport of contaminants in groundwater, specifically arsenic and chrome. Many regions of the world, including Iowa, have unacceptably high levels of arsenic in groundwater which poses a threat to human health. The present study ties Fe atom exchange to trace metal release, elucidating the mechanism of contaminant transformation by showing that Fe(II) driven Fe atom exchange in goethite have the same kinetic profile as Ni release. Additionally, it was verified that this mechanism occurs in groundwater-like conditions by adsorbing anions such as phosphate and silicate, as well substituting cations such as aluminum into the mineral structure.

4. Recent Leadership Trends in the Iowa General Assembly: A Gendered Analysis

Sawyer Baker, Altona, IL
Majors: Political Science and Sociology
Mentor: Valerie Hennings
Iowa State University

Iowa has seen multiple female leaders pass through the Capitol doors, yet some leadership positions have never been filled by a woman. Assuming a presence of women in legislatures is needed to impact policy on a substantive level, there would also be a need for women to be seated in legislative leadership roles where they have additional power to shape policy. This research looks to uncover the recent leadership trends within the Iowa legislature by analyzing leadership positions in the Iowa House and Iowa Senate, as well as in legislative committees. Through Iowa General Assembly data archives, I studied the 80th General Assembly (2003-2005) through the current 84th General Assembly (2011-2013) as a snapshot of female leadership at the state level. This particular type of data has never beforehand been compiled in Iowa and will be fill a gap in the research on the status of women in Iowa politics.

5. Characterization of a mutant exhibiting age-dependent chromosomal fragmentation in *C. elegans* meiotic oocytes

Nathan Balukoff, Ankeny, IA
Major: Biology
Mentor: Sarit Smolikove
University of Iowa

Our lab focuses on meiosis, which is the specialized cell division that produces gametes, such as eggs and sperm, from a normal cell. Most animals we commonly think of, including humans, contain two copies of each chromosome. In order for meiosis to successfully occur the chromosome number must be divided in half with each cell (gamete) receiving one copy of each chromosome. For the cell to differentiate and partition all of the chromosomes, each pair must align together before they are divided into separate cells. This pairing is very important and if there are any defects in this pairing machinery, the chromosomes will not properly divide, which can lead to severe outcomes such as down syndrome, abortion, and miscarriages. Our lab is investigating this pairing. I am specifically examining a mutant worm that displays normal chromosome pairing in meiosis at an early age but as the worm ages the chromosomes display severe defects and an inability to pair correctly. Finding out what causes the age dependent defectiveness can help us understand what exactly is needed for proper chromosome dynamics and possibly aid us in developing treatments for people who have meiotic abnormalities.

6. Investigation into the Correlation between Electrical Conductivity and Total Dissolved Ions for Application in Watershed Modeling

Conrad Brendel, Elizabethtown, PA
Major: Environmental Engineering
Nick, Terhall, Morris, IL
Major: Aerospace Engineering
Mentor: Michelle Soupir
Iowa State University

Hickory Grove Lake, located near Nevada, IA, has been identified as an important recreational resource for the citizens of Iowa, as well as a lake with elevated nitrogen and bacteria levels. This is thought to be caused by storm related surface runoff from nearby agricultural land. Fortunately, changes in land use could help to improve overall water quality in the lake. Our focus within this project is to investigate the correlation between total dissolved nitrogen, total dissolved solids, electrical conductivity, and water flow, which are key indicators of water quality. Currently, lab analysis of these indicators is a time consuming process which also has a significant monetary expense. If our research finds a significant correlation between these factors, the time and cost associated with sample analysis would be substantially reduced. The data we collect will also be used to verify the accuracy of a watershed computer model currently in development.

7. Maize and Soybean Albedo Variations with Zenith Angle over Ames, Iowa

Lyndee Clark, Colfax, IA
Major: Meteorology
Mentor: Brian Hornbuckle
Iowa State University

Although surface albedo is dependent on many different variables, such as surface properties or plant type, it is also known to vary due to changes in the solar zenith angle. This project examines a possible inverse linear relationship of albedo with the solar zenith angle observed from data taken at the Been Field, maintained by the United States Department of Agriculture (USDA) Agricultural Research Service (ARS) National Laboratory for Agriculture and the Environment (NLAE) on the Iowa State University campus in Ames, Iowa. Data was observed for maize and soybean from 2007 to 2011. The observed albedo had a diurnal variation, so it increases as the solar zenith angle also increases, and vice versa. The surface albedo and the solar zenith angle have a positive exponential relationship. A two-term exponential model equation was also derived from the data for maize, soybean and a crop average.

8. Urban Storm Water Planning Utilizing LiDAR, the WinSLAMM model, and GIS"

Bernard Conrad, Pilot Grove, IA
Major: Geog-GIS and Econ Geog & Bus
Mentor: Ramanathan Sugumaran
University of Northern Iowa

The goal of this project is to successfully integrate detailed and accurate spatial data such as LiDAR-based digital elevation model and remote sensing derived impervious surfaces into the Source Loading and Management Model (WinSLAMM) to detect pollutant loadings at sub-basin level. The data was developed and model was tested for the University of Northern Iowa campus sub-watershed. The resulting outputs include estimates of pollutant loadings for each sub-basin from the UNI campus including phosphorus and nitrates. The resulting data is then used to develop best management practices (BMPs) through different simulation scenarios.

9. Making a Change: Motivational Interviewing in a College Group Setting

Hannah Culbertson, Cedar Falls, IA
Major: Biology
Mentor: Oksana Matvienko
University of Northern Iowa

Motivational interviewing is a client-centered, practitioner-directed counseling method that seeks to help people understand challenges in their lives and find an individualized solution, through the process of reducing ambivalence and considering the consequences of making or not making a change in their lives. This research was completed in order to test this presentation method, based on motivational interviewing strategies, for its effectiveness in evoking a health related behavior change in a group of college students. The group aspect required that the traditional MI techniques be modified to fit the group dynamic and facilitate a similar experience to an individual MI session.

10. Synthesis of Anti-Tuberculosis Diterpenes

Sena Dzakuma, Effingham, IL
Major: Biochemistry
Mentor: Horacio Olivo
University of Iowa

Tuberculosis is an infectious disease killing more than three million people annually. The worldwide spread of *Mycobacterium tuberculosis* (M. tuberculosis) and emergence of multi drug resistant (MDR) strains creates a demand for new anti-tubercular agents with distinct modes of action. Natural product erogorgiaene, found in Mexico, possesses potent inhibitory activity against *Mycobacterium tuberculosis*. By employing synthetic strategies, we are progressing towards the synthesis of this promising and unique natural product.

11. Giving Hope to Cervical Cancer Patients With Multiple-Rotating Shield Brachytherapy (MRS-IMBT)

Drake Edwards, Cedar Falls, IA
Major: Interdepartmental Studies
Mentor: Ryan Flynn
University of Iowa

Bulky (>40 cc) cervical cancer brachytherapy (BT) tumor dose conformity is often poor since symmetric BT dose is limited by the presence of the nearby bladder, rectum, and sigmoid. Rotating shield intensity modulated brachytherapy (RS-IMBT) can theoretically improve tumor dose conformity, but at the cost of significantly increased treatment times. We developed a time efficient method of improving cervical cancer dose distributions with multi-rotating-shield IMBT (MRS-IMBT) that drastically reduces the delivery times relative to RS-IMBT. We developed a shield sequencing method that optimally divides a set of finely sampled IMBT shielding patterns into a combination of coarse and fine shields that delivers the same dose distribution but with a reduced treatment time. The MRS-IMBT method significantly reduced treatment times relative to finely-sampled IMBT without losing tumor coverage. While RS-IMBT causes treatment times to rise exponentially with the number of emission directions when a single shield emission angle is used, treatment times for the MRS-IMBT method increase linearly with the number of emission directions. MRS-IMBT makes IMBT delivery clinically feasible, which could lead to mean better tumor dose conformity and improved outcomes.

12. Key Elements of Poverty Influencing Language Development and Academic Achievement

Joanna Eggert, Ames, IA
Major: Communication Disorders
Mentor: Ken Bleile
University of Northern Iowa

This research project investigates central issues surrounding poverty and how it influences a child's language development and academic achievement. It examines the differences in amounts of language input in the home environments of children from varying socioeconomic statuses and how this shapes their language acquisition. The research also explores key environmental factors relating to poverty that play a role in disparities in development, such as lead exposure, maternal depression, prenatal drug exposure, unequal healthcare access, etc. Ultimately, the purpose of this research is to call attention to the widening achievement gap and the unjust circumstances that impoverished children face, which greatly impede their language skills and performance in school.

13. Decision-Making in Children based on Snack Packages

Whitney Farrell, Chariton, IA
Major: Graphic Design
Alyssa Lauer, Morton, IL
Pre-Graphic Design
Katelyn Oswald, Lakeville, MN
Pre-Graphic Design
Mentor: Sunghyun Kang
Iowa State University

The consumption of unhealthy snack foods contributes to a shortfall in meeting nutritional recommendations and to the high rate of childhood obesity for children and young adults in the United States. One area of research that has managed to be overlooked has been the marketing of healthy snack foods to children. The objective of our research is to examine the visual elements of snack food packaging and the role these elements play when children and young adults participate in the decision making process. Children ages 9-13 were shown digital package designs isolating variables of color, type, image, brand, health message, and visual style in order to determine influencing factors. Participants were then surveyed on why they chose certain elements. The results of this study will contribute to the package design process to encourage healthier snack food selection among children and young adults.

14. Latino Families in Iowa

Angelica Flores, Monroe, IA
Major: Child, Adult, and Family Services
Mentor: Janet Melby
Iowa State University

With an increasing Latino population in Iowa, it is imperative to study and understand Latino family strengths and differences. The purpose of this study was to analyze Latino mother and father parenting. Nineteen families in this study participated in a one-on-one parent-child interaction task. The Parenting Style Observation Rating Scale (PSOS, Rodriguez, 2009) was used to rate parental warmth, autonomy granting, demandingness-support, and demandingness-nonsupport. Findings suggest that Latino mothers and fathers rated low on warmth and autonomy granting and high in demandingness. Latino parents were stricter toward daughters than sons. Latino parents in the U.S. maintain their cultural values; they attempt to be in control of their children's lives. Although the sample size is small, the study is important because it is one of the few and most recent to observe Latino parent-child interactions.

15. Morphological correlation between optical coherence tomography (OCT) and histology in mouse retina

Dan Gratie, Glenview, IL
Major: Health and Human Physiology
Mentor: Arlene Drack
University of Iowa

Optical coherence tomography (OCT) is a technique for obtaining sub-surface images of translucent or opaque materials at a resolution equivalent to a low-power microscope. It is effectively 'optical ultrasound', imaging reflections from within tissue to provide cross-sectional images. The purpose of this work is to characterize the correlation between OCT and histology for mice models of human disease commonly used in the research laboratory. Mice of different ages, from 60 days to 6 months, were used. Biopogen OCT and histology using H and E stain were performed to evaluate and compare the morphology. Two albino mice without retinal degeneration (aged 180 days), and two albino mice (aged 168 days) with PDE6beta mutations and one Bbs1 mouse aged 4 months were studied. Visualization of the retinal layers with OCT was excellent, and correlation between OCT layers and histologic layers of the retina was performed. The image quality of OCT in an albino animal was compared with that of a pigmented mouse of similar age. OCT is a useful method for in vivo evaluation of retinal morphology. It is reproducible and feasible. Correlation between OCT and histology is required. OCT may allow us to follow treated and control mice for long time periods without the need to sacrifice animals at numerous time points.

16. HoxB4 Does Not Abrogate T-Cell Development In-vivo

Maia Griffith, Homewood, IL
Major: Health and Human Physiology
Mentor: Nicholas Zavazava
University of Iowa

Embryonic stem (ES) cells have emerged as a potential alternative source of hematopoietic stem cells to bone marrow due to their abundant availability and low immunogenicity. In the mouse, ES cell-derived hematopoietic progenitor cells have been found not to engraft long-term. To address this problem, ES cells are transduced with a hematopoietic transcription factor called HOXB4. So far, it has not been possible to obtain lymphocytes from HOXB4-transduced ES cells. The goal for this study was to determine whether HOXB4 abrogates T cell development. To address this, immunocompromised and immunocompetent mice were transplanted with GFP positive HOXB4 ES cell derived hematopoietic progenitor cells, together with CD45.1 positive syngeneic bone marrow cells. No T cells were detected in the Rag2^{-/-}/c^{-/-} mice, yet when the same experiment was repeated in the syngeneic 129SvJ wild type mice, ES cell-derived and CD45.1 bone marrow derived T cells were detected in peripheral organs including peripheral blood and the spleen. This result allowed us to conclude that the lack of T cells in this model was due to the poorly developed thymic epithelium in this mouse strain. In contrast, indeed precursor T cells were also detected in the thymus of the wild type mice. Thus, HOXB4 does not abrogate T cell development, but rather the mouse strain the cells are transplanted into. To confirm this further, HOXB4 transduced ES cells were differentiated on OP9 cells and subsequently transferred to OP9-DL1 cells that express the notch-1 ligand. These cells fully developed into mature T cells that rejected allogeneic skin grafts, responded to mitogen expression and expressed the α TcR and CD3, clearly indicating that HOXB4 does not inhibit T cell development. These studies should now allow more detailed experiments on whether ES cell-derived T cells are capable of immunological responses similar to those of adult T cells.

17. Intra- and Interspecific Variation of Carapace Shape in Brazilian Fiddler Crabs (genus *Uca*)

Kelsey Hampton, Muscatine, IA

Major: Biology

Mentor: Carl Thurman

University of Northern Iowa

Isolation by distance across geographic barriers can promote genetic and morphological divergence among populations. The large-scale distribution of fiddler crabs (*Uca*) is determined primarily by the oceanic transport of their planktonic larvae and by available adult habitat. On the Brazilian coast of eastern South America, two major oceanic currents diverge at the Ponta do Calcanhar and appear to separate northern from southern fiddler crab populations, which may promote intraspecific divergence. To test this hypothesis, more than 2500 female specimens of the nine species present were collected from 70 populations located north and south of the Ponta do Calcanhar. Variation in carapace shape for each population was analyzed across 23 surficial landmarks using morphometric geometric techniques. Analysis of *U. mordax* (Smith, 1870) and *U. maracoani* (Latreille, 1802-1803) reveals the hepatic region to be more swollen in the northern compared to the southern populations. Since substantial genetic variability cannot be demonstrated among these populations, such morphological divergence most likely results from habitat pressures. This implies that significant variation occurs in response to ecological modulation of phenotype. To further corroborate this hypothesis, we will extend our morphological and genetic analyses to the remaining species. This research supported by the Fulbright Foundation, the University of Iowa Center for Global Regional Environmental Research Center, the US Fish and Wildlife Service, the Conselho de Desenvolvimento Científico e Tecnológico, the Fundação de Amparo à Pesquisa do Estado de São Paulo, the Coordenadoria de Aperfeiçoamento de Pessoal de Ensino Superior, and the Instituto Brasileiro do Meio Ambiente e de Recursos Naturais Renováveis.

18. Appearance and Perception: The Effects of Hair Color and Weight on Product Perception

Jamie Harthoorn, Lynnville, IA

Major: Marketing and Advertising

Mentor: Dennis Clayson

University of Northern Iowa

This study expands on current research on attractiveness, hair color, and obesity and looks at print advertising and the influence of model appearance on product perception. The variables hair color and weight were used as objective measures in the study. A model's hair color and weight were digitally manipulated to produce several ad variations. These ads were then incorporated into a survey on product perception, purchase intent, and ad appeal and distributed electronically to students on a college campus. Survey results were analyzed for differences in perception between ad variations to determine whether a certain hair color or weight combination produced a more positive perception of the advertised product.

19. Developmental analysis of Ipomoea (morning glory) leaf shape

Bryan Hendrickson, Iowa City, IA

Major: Biology, Ecology & Systematics

Mentor: Julie Kang

University of Northern Iowa

Ipomoea belongs to the Convolvulaceae (morning glory) family that includes approximately 500 species that grow across the United States. While the USDA considers the plant a noxious weed, it is grown in gardens worldwide for its beautiful and colorful flowers. Although morning glories have mostly been bred and cultured for floral traits such as color and shape, cultivation has created a large number of plants with diverse leaf shapes. For this reason, the morning glory family is an ideal group in which to study the development of leaf lobes. We are investigating leaf shape of two morning glory species, the standard type (TKS1065) that has 3 leaf lobes and a classical mutant (ym1018) that has 3, 5 or 7 lobes. The aim of this study is to analyze leaf shape development and vein pattern in these morning glory plants.

20. UI Entomology Collection - Its Collectors and Scientific Value

Lawrence Houston, Coralville, IA

Major: Classical Languages

Mentor: Cindy Opitz

University of Iowa

The goal of this project was to undertake scholarly investigation of principal entomologists associated with the University of Iowa Museum of Natural History (UIMNH) and their collections, identifying their involvement with collections and UI expeditions, reconstructing a picture of their scholarly careers at the UI, and enhancing the utility of the collection via documentation of the holdings. The project's secondary goals were to attempt identification of specimens of historical interest in the collections and enhance the collections' scientific value. The project tied into an ongoing comprehensive inventory and assessment project at the Museum, during which it was discovered that UIMNH entomology holdings include over 26,000 insect specimens. The project also coordinated with efforts to make UIMNH biological collections available through various electronic research portals. Working with the collection, the researcher identified 14,000 additional specimens belonging to the collection, located 250,000 former UI specimens, located specimens from the UI expeditions, and was able to identify valuable holotype specimens. The entomology work from this project has opened new avenues of research in areas ranging from biology to art, has highlighted certain needs of the collections, and has garnered a greater interest in the scholarly asset which the UIMNH collection presents.

21. Using the RTOP to Gauge IPTIR (a Physics Teaching Program) Goals

Jeremy Hulshizer, Grafton, IA

Major: Physics

Mentor: Jeff Morgan

University of Northern Iowa

The Iowa Physics Teacher Instruction and Resources (IPTIR) program at the University of Northern Iowa trains physics teachers in research-based inquiry strategies; many out-of-field teachers also use the program to gain certification to teach physics. As part of their program activities, participants submit two video lessons each academic year, which the staff uses to evaluate the degree to which participants are employing methods emphasized by the program. The Reformed Teaching Observation Protocol (1) is used to rate each submission. We discuss trends observed in examining the RTOP scores of program participants, as well as correlations between RTOP scores and student performance on various standardized conceptual assessments and other measures.

22. Intracellular Communication in Bacteria Regulates Biofilm Predation

Katherine Hummels, Adel, IA

Majors: Microbiology and Studio Art

Mentor: John Kirby

University of Iowa

Over the last decade, research has demonstrated that the vast majority of bacteria found in nature live within multicellular units known as biofilms. Bacterial biofilms play important roles ranging from remediation of toxic waste sites to promoting healthy digestion. Some biofilms are the source of human diseases including chronic infections on artificial implants, gingivitis, and infectious endocarditis. The biofilm structure renders bacteria highly resistant to antimicrobial agents, making them extremely difficult to eradicate. We have shown that *Myxococcus xanthus*, a common soil bacterium, destroys biofilms through a process known as predation.

23. Automated Tracking of Locomotion, Social Interaction, and Choice in *Drosophila Melanogaster*

Jordan Imoehl, Oelwein, IA
Major: Biomedical Engineering
Mentor: Chun-Fang Wu
University of Iowa

The fruit fly *Drosophila melanogaster* is a model organism for studying the genetic and physiological processes which constitute higher-order behavior. Automated analysis of fly locomotion and behavior based on machine-vision algorithms have been developed for over 20 years. Our algorithm, AutoFLI Tracker, allows for the quantification of both motion and social interaction patterns which had previously relied upon more qualitative methods. It accomplishes this through the individual segmentation of video frames, yielding position and kinematic information. AutoFLI Tracker allows us to characterize different genotypes based upon their motion "profile". Given these profiles we were able to determine the effect of population density on locomotion. Our system also addresses the much more complicated issue of social interaction, allowing us to quantify which genotypes interact more frequently. Finally, we are able to use our system to track the active choice of one stimulus over another, be that stimulus a potential mate or a pheromone. Through the development of AutoFLI Tracker we now possess the ability to determine how genetics and environment influence adult-life behavior.

24. Alcohol Affects Microglial Morphology In Vitro: The Brain's Immune System in Fetal Alcohol Syndrome

Senuri Jayatileka, Johnston, IA
Major: Biology
Mentor: Michael Dailey
University of Iowa

Fetal Alcohol Syndrome devastates the lives of 1/1000 newborn children, and costs the economy about \$860,000 during a child's lifetime. It is important to learn as much as possible about the effects of alcohol on fetal health, including neural development. We study the effects of physiological levels of alcohol on a microglial cell line (BV-2 cells). These cells are the immune system in the brain, and it is important to know how they react to alcohol, so as to better understand how they affect the neurons' reactions to alcohol. We have hypothesized that the BV-2 cell morphology will significantly change at blood alcohol levels at and below 0.05%, which is the lethal dose. BV-2 cell morphology does significantly change at 0.05% alcohol, and it seems likely that there is an effect at 0.025% alcohol as well.

25. Extinguishing Flames to Rekindle a Population

Allison Kindig, Cedar Rapids, IA
Major: Industrial Engineering
Mentor: H. S. Udaykumar
University of Iowa

A solar cooker is a device which captures the energy of the sun in the form of heat to boil water and cook food. Unlike the traditional cook stoves currently used in rural India, solar cookers do not burn wood. Thus, this technology has the potential to save forests from being cut down, save lives by eliminating toxic cook smoke, and save time for the empowerment of women. In order to maximize these benefits, I studied the implications of implementing solar cookers in rural villages of Rajasthan, India, a region with high solar cooker potential. The study identified certain criteria and constraints for engineering a responsible solution to the domestic energy crisis (burning wood for cooking in deforested regions of the developing world). Through case studies and ethnographic assessments, local trading patterns were mapped to project possible unintended consequences of implementing solar cooker technology into rural Indian villages. The data collected from the study conducted this winter in Udaipur, India is now being used by the iHawk and MEDP engineering teams of The College of Engineering to engineer a more adoptable and sustainable solar cooker and provide alternative implementation models for areas less suitable to the technology.

26. Use of Recycled Asphalt Shingles in Asphalt Pavements

Matthew Kirby, Keokuk, IA
Major: Civil Engineering
Mentor: Chris Williams and Andrew Cascione
Iowa State University

Millions of tons of asphalt shingles are dumped into landfills each year at an added expense to home owners and/or insurance agencies. These shingles are made up of asphalt, fibers, lime dust and granules. When ground up and appropriately proportioned, they can be used in asphalt mixtures for roadways. As the cost of construction materials continue to rise and place financial constraints on transportation agencies, engineers are looking for sustainable methods that minimize construction costs and optimize the selection of materials used in asphalt pavements. The effects of the use of Recycled Asphalt Shingles has been studied and found to improve the fatigue performance of asphalt pavements when processed and proportioned correctly in typical asphalt mixtures. Fatigue life is one of the critical components of pavement performance particularly for medium and high volume roadways.

27. Chemical Investigations on a Scarce but Promising Anticancer Agent

Shane Kirkegaard, Pocahontas, IA
Majors: Biology and Business
Mentor: Jason Chen
Iowa State University

Nigriganoside A is a scarce but promising anticancer agent from the ocean. Unfortunately, despite exciting preliminary data, the limited availability of nigriganoside A precludes further chemical and biological investigations. Therefore, we are working toward the laboratory preparation of nigriganoside A and bioactive fragments of nigriganoside. Access to synthetic nigriganosides will allow the structure to be fully defined and enable biological evaluations that may lead to a starting point for anticancer drug development. Research toward the synthesis of a key nigriganoside fragment will be presented.

28. Determinants of Youth Employment in the United States

Nathan Klyn, Pella, IA
Major: Economics and Business Analysis
Mentor: Shahina Amin
University of Northern Iowa

Youth employment is important for both economic and social reasons. The youth of today are the future of the United States and will have an immense impact on our society and economy. I am interested in the study of youth employment because of the diverse backgrounds of people I have met. Some decided to be employed as a youth while others did not, and I wanted to research why this is. In this study I look into the determinants of youth employment in the United States. I use 2009 American Community Survey data and a logistic regression technique. My results show that income, geography, parental, race, age and gender factors play a role in determining youth employment.

29. Analysis of On-farm Decision Support Tools (DSTs) for Ecosystem Service Management

Robert Manatt, Ames, IA
Major: Forestry
Mentor: John Tyndall
Iowa State University

Scientists are interested in multifunctional landscapes to address the growing demand for provision of a broad suite of ecosystem services (e.g., clean water, biodiversity, commodity production) from agricultural landscapes. Farmers are also becoming more interested in managing for beneficial ecosystem services. However, such management decisions require the evaluation of important land use trade-offs. Farm-level decision support tools (DSTs) have been developed to assist with decision-making complexities. We conducted an analysis of four DSTs that are particularly suited to assisting with management for ecosystem services on agricultural lands in Iowa: I-FARM, Healthy Farm Index (HFI), CarbOn Management Evaluation Tool (COMET-VR 2.0), and the Fieldprint Calculator. These DSTs provide a diverse sampling of the types of models that are currently available. We analyzed the models based on required inputs and outputs produced, which directly influence their applicability to informing multi-level decision making (e.g., from the farm scale to regional policy initiatives).

30. Pay expectations: How do they influence selection of college degrees and motivational effort towards college?

Ben McCarty, Marion, IA
Major: Psychology
Mentor: Mike Gasser
University of Northern Iowa

The purpose of the study is to examine the effects of expected monetary compensation on selection of degree type and motivation to succeed in college. These pay expectations are created based on factors such as educational background required for position and knowledge of personal capabilities and competence. Fifty college students, ages 18 and over, took a survey including questions about their major, their salary expectation for a career after graduation, and motivation towards college. Levels of extrinsic and intrinsic motivation are measured and compared with pay expectations to determine the motivational influence towards selecting a college major. College students in the College of Business Administration and the former College of Natural Sciences are predicted to have higher pay expectations as well as higher levels of extrinsic motivation.

31. Comparison of Ergonomic Risk Ratings by Three Different Assessment Tools

Elease McLaurin, Clinton, MS
Major: Industrial Engineering
Mentor: Richard Stone
Iowa State University

For this project, we visited a plant in Iowa and evaluated the ergonomic risk imposed by the movements made by the employees. To conduct this evaluation, we used three different assessments: the Rapid Entire Body Assessment (REBA), a Lumbar Motion Monitor (LMM), and the National Institute for Occupational Safety and Health (NIOSH) lifting equation. We then compared the level of detail, comprehensiveness, and the consistency of the results from the three different assessment methods. Finally, we identified the strengths and limitations of each method and made recommendations for how they can be used in combination to better understand the source and severity of ergonomic risk for a given situation.

32. Taimyr Wild Reindeer Spatial Fidelity and Calving Grounds Dynamics in a Changing Climate

Susan Meerdink, Hawarden, IA
Major: Biology, Ecology & Systematics and Geog-GIS: Env Sci & Policy
Mentor: Andrey Petrov
University of Northern Iowa

The Taimyr wild reindeer herd (TRH) is the largest herd of Rangifer tarandus in Eurasia. Historical evidence shows that reindeer demonstrate spatial fidelity to specific locations, particularly during calving. However, calving locations exhibit periodic and abrupt changes that create a dramatic impact on ecosystems, population densities, and can cause conflict with other ungulates. The purpose of this study is to investigate the phenomenon of spatial fidelity and identify possible climatic factors that influence the geographic shift of calving grounds. Calving concentrations were derived from ten aerial surveys between 1980 and 2003. Climatic parameters were interpolated from meteorological data. The spatial analysis of calving grounds dynamics confirmed considerable spatial fidelity of the Taimyr reindeer. On average there was a 28.5% overlap between calving surveys, ranging between 10.3% in 1982-1984 and 38.5% in 2000-2003. The locations of the geographic mean center for reindeer concentrations remained stable varying 74 km between the surveys.

33. Tracing Iowa Runoff to Gulf Hypoxia

Lauren Mills, Leawood, KS
Major: Journalism, English, and Spanish
Mentor: Steve Berry
University of Iowa

For the past few semesters, I've traced fertilizer runoff from farms, into Iowa waters, the Mississippi River, and the Gulf of Mexico where a hypoxic dead zone is spreading, threatening marine life and the fishing industry.

34. Experiences of Students Suffering from Food Allergies with College and University Dining: What can College and University Dining Services Learn?

Matthew Monaco, Panora, IA
Major: Hotel, Restaurant, and Institution Management
Mentor: Lakshman Rajagopal
Iowa State University

The prevalence of food allergies among children and teens has been increasing. As this demographic enters college and university settings, it is critical to determine if college and university dining establishments are meeting the needs of food allergy sufferers and identify areas of improvement to provide a safe environment for food allergy sufferers. The purpose of this study was to explore the experiences and needs of food allergy sufferers in college and university dining establishments. A 47-question, electronic survey was distributed to students at two Midwestern universities and on the Food Allergy & Anaphylaxis Network Facebook page. Results showed that respondents suffered food allergy reactions, ranging from mild to severe after accidentally consuming allergen containing foods at university or college dining facilities. Respondents stressed the need for easy-to-read/view food allergen labels, for training food handlers about food allergies and allergen handling, and for better communication between food handlers and allergen sufferers.

35. Dangerous Toys: Adult-size ATVs Can Eject Children Resulting in Deaths and Injuries

John Pienta, Iowa City, IA
Major: Mathematics
Mentor: Gerene Denning
University of Iowa

One in four all-terrain vehicle (ATV)-related deaths and one in three injuries are among children and teens under the age of sixteen. A major risk factor for these deaths and injuries are adult-sized vehicles too large for a youth to handle safely. The goal of this project is to understand the factors that can contribute to ejecting a youth from an ATV. To address this issue, we performed kinematic and dynamic mathematical modeling to determine thresholds and conditions that could lead to vehicle-dependent operator ejection. Variables tested included operator and vehicle weight, as well as the amplitude and frequency of vertical vehicle movement (simulating bumpiness of terrain). We found that the risk of ejection increased as the operator to vehicle weight ratio decreased. We also found increasing risk with large frequency and amplitude. Dangerous conditions were easily within the range of the normal riding environment. Modeling provides a safe way to study the mechanisms of ATV crashes, in order to develop educational and engineering approaches to prevent ATV crashes and injuries. Future studies will include adding to the complexity of the model to examine other risk factors for ATV injuries, including abrupt changes in vehicle velocity and direction.

36. Size and Shape Trends in Fusulinids at Different Habitat Depths

Maddie Pike, Cresco, IA
Major: Geology
Mentor: John Groves
University of Northern Iowa

The Principle of Uniformitarianism states that "the present is the key to the past." i.e., prehistoric processes can be understood by analogy with modern processes. The purpose of this project was to evaluate the possibility of photosymbiosis in extinct, marine protists by comparing their shells with shells of modern counterparts. Modern protists with photosymbionts exhibit different shapes depending on light intensity in their habitat. They have large surface area-to-volume ratios in deeper habitats and smaller ratios in shallower habitats. This trend ought to be found in fossils if extinct forms hosted photosymbionts. Surface area-to-volume ratios were determined for hundreds of fossil shells from various habitats. Shallower-dwelling specimens exhibited smaller ratios than deeper-dwelling ones, mirroring the trend in modern counterparts. Shape trends in fossils, however, differ from those in modern counterparts. The fossils altered surface area-to-volume ratios by changing size, not shape. Results of this study support the possibility of photosymbiosis in fossils.

37. Understanding Gene Expression Networks in Mouse Retinal Ganglion Cells (RGCs)

Brock Pope, Pella, IA
Major: Genetics
Mentor: Jeff Trimarchi
Iowa State University

One key question in developmental neuroscience is how stem cells decide upon a final cell fate and how they are programmed to generate the very diverse set of neurons that populate the central nervous system. This research is important for understanding the factors needed to drive stem cells to produce ganglion cells that can be used as a potential therapy for glaucoma, the second leading cause of blindness. Our lab is comparing the gene expression profiles from single immature retinal ganglion cells isolated from the mouse and chicken. The goal of my project is to examine sets of genes that correlate with early steps in retinal ganglion cell development and test, by in situ hybridization, whether their expression occurs at the right time and place to play a role in generating ganglion cells to replace these lost cells in a glaucoma patient.

38. Genes from Epstein Barr Virus Cause Cellular Changes which Are Associated with the Development of Cancer

Xin Qi, Wuhan, Hubei, CHN
Major: Chemical Engineering
Mentor: Aloysius Klingelhutz
University of Iowa

Epstein Barr Virus (EBV) is a causative agent in a number of malignancies, including B cell lymphomas and nasopharyngeal carcinomas. EBV expresses oncogenes called latent membrane proteins (LMPs) that are thought to be involved in the development of cancer. To develop a model system to study how EBV LMPs cause cellular transformation, we used recombinant DNA methodology to construct replication defective retroviral vectors that express one of two different LMPs (LMP1 or LMP2a). We infected human epithelial cells with the vectors and selected for a drug resistance marker that was in the construct. Using molecular biology techniques, we demonstrated that the infected cells expressed high levels of the LMPs (both RNA and protein). To assess transformation, we tested the cells for their ability to form colonies in culture. We found that expression of either LMP1 or LMP2a greatly increased colony size, indicating that the viral proteins provide a growth advantage to the cells. We further demonstrated that the LMP1 expressing cells had activated transcription factor and signaling pathways that are associated with malignant transformation. Our long-term goal is to develop small molecules that can bind to and/or inhibit the LMPs. These could potentially be used in therapy for EBV-associated cancers.

39. Jane Austen's Pride and Prejudice: A Theatrical Design and Construction Piece

Rachel Rathe, Dunkerton, IA
Major: Theatre: Performance-Acting
Mentor: Jay Edelnant
University of Northern Iowa

Pride and Prejudice, a Jane Austen novel set at the turn of the 19th century, follows the journey of a young female, Elizabeth Bennet, as she deals with the pressures of growing up and securing a husband and promising future but struggles with tendencies of passing quick judgment towards potential suitors. This novel appeals to my tastes because I can relate to Miss Bennet's characteristics and independent qualities throughout the story. Another engaging aspect are the fashions of the time and the romantic simplicity incorporated in the designs which, henceforth, have prompted me to devise my senior project based around the notion of creating two original designs of my own, one for Miss Bennet and one for her suitor, Mr. Darcy. The research, attention to detail, and period accuracy will prove challenging but undoubtedly beneficial towards my career aspirations.

40. Mentoring in the Non-profit Leadership Alliance

Dakotah Reed, Ottumwa, IA
Major: Management: Business Administration
Mentor: Julianne Gassman
University of Northern Iowa

This project focuses on informal mentoring relationships within the Non-profit Leadership Alliance, a nationwide organization that brings together students and the non-profit world, training them to be the non-profit leaders of tomorrow. The research, funded by a grant from the national office of the Non-profit Leadership Alliance, consisted of surveying nearly 2000 current students and alumni of the program to get an accurate picture of their mentor-mentoring relationship as well as the benefits they felt that they gained from having a mentor. The results of this research will be incredibly useful to student organizations across the board, as they work to provide the best opportunities and most benefits to the students involved in their organizations.

41. ViriChip™: a Sensitive Solid Phase Immunoassay for the Specific Capture and Identification of Viruses by Atomic Force Microscopy

Nathan Sage, Mason City, IA
Major: Agronomy
Mentor: Eric Henderson, James C. Johnson, Asrun Kristmundsdottir, and Curtis Mosher
Iowa State University

"ViriChip™ is an atomic force microscopy-immunosensor assay developed for the capture, identification, and quantification of virus particles rather than antigens or nucleic acid. The capture substrate is a silicon-chromium-gold indexed chip coated in recombinant protein A/G for binding of antibodies directed at virus surfaces. Miniaturization permits formation of multiplexed antibody arrays. Viruses cognate to a capture antibody were added to the chip and bound antibody domains assessed for their ability to immobilize those viruses. Viruses were identified by site of localization and morphology through atomic force microscopy. Capture antibodies were identified for the B group coxsackieviruses, MS2, FD/M13, T7, and Vaccinia. Static capture was found to have sensitivities of 1.4×10^4 pfu/mL. Microfluidic dynamic capture further increased capture sensitivity. Our results show that ViriChip™ may be useful as a non-destructive, diagnostic platform for field/clinic identification of viruses with potential applications in point-of-care health diagnostics, drug discovery, and bioterrorism concerns.

42. Differences in State Unemployment Rates during the Great Recession

Joslyn Sailer, Manchester, IA

Major: Economics: General Economics

Mentor: Bryce Kanago

University of Northern Iowa

During the Great Recession, unemployment rates peaked in October 2009 at 10%. Although it is now somewhat lower, continuing high unemployment has contributed to diminished consumer and business confidence. The change in unemployment rates between June 2006 and June 2008 varied widely from state to state. Between 2006 and 2008, Florida experienced nearly an 88 percent increase in its unemployment rate. On the other hand, Oklahoma had a 10 percent decrease in its unemployment rate. Some of this variation is likely explained by variation in variables across states after June 2006. However, it is likely that changes in the unemployment rate depended on differences in the magnitude of the housing boom and perhaps differences in the composition of industry and the labor force across states in 2006, prior to the crisis. I collected data by state on housing, banking, industry, demographics, government finances, and education to examine if any of the variables made states more or less prone to a large rise in their unemployment rates. The regression analysis investigates if differences in these variables across states in June 2006 can explain differences in the percentage change in unemployment rates across states over the period June 2006-June 2008.

43. Validation of Hail Detection in the 26 May 2010 Denver, Colorado Hailstorm Using Dual-Polarization Radar

Samantha Santeiu, Dearborn Heights, MI

Major: Meteorology

Mentor: Patrick Kennedy

Iowa State University

On 26 May 2010, a severe, long-lasting hailstorm in the Denver, CO, metro area produced up to 2.75" diameter hail, according to the Storm Prediction Center (SPC), and a few small tornadoes. The environmental profile that day was favorable for thunderstorm development. Both the Colorado State University-CHILL (CSU-CHILL) radar and the National Weather Service Weather Surveillance Radar-1988 Doppler (WSR-88D) in Denver (KFTG) captured the storm on radar as it passed. In this study, polarimetric variables from the CSU-CHILL radar are paired with hail reports from the SPC in order to validate CSU-CHILL's ability to verify ground reports of hail, and to demonstrate improved hail detection due to polarimetric capabilities. Overall, the CSU-CHILL polarimetric variables consistently coincide with hail report locations. In addition, the CSU-CHILL polarimetric variables indicated hail within a kilometer of spotter hail reports. This study helps confirm that dual-polarization capabilities will be an excellent addition to operational radar.

44. Cost Savings of Parallelizing Tasks and using Graphics Processing Units in Computation

Michael Seedorff, Hiawatha, IA

Major: Statistics

Mentor, Kate Cowles

University of Iowa

Everyday computer graphics cards can be used to save money and speed up computing in both scientific and business environments. Using graphics cards in this way is called "general programming for graphical processing units" or GPGPU. The role of GPGPU is growing rapidly because of the savings it provides not only in computation time but also in equipment and electricity costs. Through massive parallelization companies, such as JP Morgan, have used GPGPU computing to reduce the costs of running computationally intensive processes. GPGPU computing splits the tasks of a computation into many parts and sends them in parallel to the graphics unit for processing. Because graphics processors have several hundred cores, as compared to the typical two or four on a CPU, many more tasks can run simultaneously. As an example, I implemented a geographic analysis method that analyzes vegetation data across Iowa and uses GPGPU computing to decrease run time by 10 to 100 times. The method used is part of the CARramps package, which I helped develop, in the R programming language. This analysis looks at satellite images of Iowa and estimates a smoother map over space and time.

45. Targeted Nanovaccines against the Influenza A H5N1 Respiratory Pathogen

Nikhil Shah, Cedar Rapids, IA

Major: Chemical Engineering

Mentor: Surya Mallapragada

Iowa State University

The influenza A H5N1 respiratory pathogen, with a mortality rate of nearly 50%, has been tabbed by the U.S. Food and Drug Administration as a candidate for the next global pandemic. Current vaccination delivery options against the H5N1 strain are limited, and development of a new vaccine to prevent an outbreak is critical. Progress is being made on a delivery system capable of eliciting both a humoral and cell-mediated immune response by using pentablock copolymers. These nanoparticles, capable of being tailored to a specific target recognition receptor, are fitted with H5N1 DNA, which they transport to antigen presenting cells (APCs). Laboratory tests have been performed using dendritic cells (DCs) harvested from the bone marrow of C57BL/6 mice. Initial studies, using flow cytometry and fluorescence microscopy, show that pentablock copolymers may transfect marrow derived DCs with a higher efficiency than commercially available reagents, which is vital for an adaptive immune response.

46. Exercise improves host response to Influenza in obese and non-obese mice

Molly Slattery, Calamus, IA

Major: Kinesiology

Mentor: Marian Kohut, K.J. Yoon and Kristi Warren, Iowa State University and Todd Wyatt,

University of Nebraska Medical Center, Omaha, NE

Iowa State University

Obesity may impair host response to influenza infection. In order to determine whether exercise may improve resistance to infection in an obese host, mice were fed either a normal or high fat diet for 8 weeks, then assigned to either exercise or no-exercise treatment. Twenty-four hours after the last exercise session, mice were infected with Influenza-H1N1. At day 3-post-infection, a significant effect of exercise was found such that exercise reduced lung inflammatory factors in non-obese mice only. At day-8 post-infection exercise treatment had reduced lung viral load in both obese and non-obese mice, and exercise also reduced lung concentrations of several inflammatory factors. To assess mucociliary clearance from the respiratory tract, ciliary beat frequency (CBF) in the trachea was measured. Infection with virus reduced CBF, and the obese non-exercised mice showed the greatest impairment in CBF. In summary, exercise improved host resistance to Influenza infection in obese and non-obese mice.

47. Application of Physiology Based Metrics for Evaluation of Physical Aptitude of Warfighters in a Digital Environment

Kristen Spurrier, Quincy, IL

Major: Mechanical Engineering

Mentor: Anith Mathai

University of Iowa

Military decision makers need a way to evaluate the physical aptitude and the level of physical stress experienced by warfighters while performing tasks. The Santos software developed at VSR can simulate common military tasks with a digital human in a virtual environment, which makes task analysis quicker and easier. In order to evaluate human performance in this digital setting, key physiology parameters have been identified, studied, and then developed into physiology metrics. The metrics that have been addressed in this project include overall fitness, energy expenditure, whole-body fatigue, and heart rate. In the past, these metrics were determined experimentally on live subjects. Current physiology models were analyzed in order to determine the most accurate procedure to calculate these metrics from available data assigned to Santos, eliminating human experimentation. The chosen models were validated in comparison with other existing models reported in literature and then implemented in Santos.

48. Louis Falco: A Leader in Modern Dance

Kim Staniforth, Ames, IA
Major: Dance
Mentor: Alan Sener
University of Iowa

Louis Falco emerged from an era of the modern dance foundationalists, brought up within the Jose Limon Dance Company. Breaking away from his upbringing, Falco moved on to develop a radical new approach to dancing, embracing pop-culture and societal trends while maintaining a respect for the established foundations of modern and ballet technique. The result was a dance company that was relevant to society, and accessible to the greater population. I am focusing on a particular work, Escargot, and investigating what about the process, technique, and development of that work made it so successful in it's own time, and also, has allowed it to be successful in its many re-creations in the last 35 years.

49. Increasing Heat Waves and Mortality in St. Louis, Missouri and Future Modeling

Claire Steinweg, Plymouth, MN
Major: Environmental Science and International Studies
Mentor: William Gutowski
Iowa State University

St. Louis, Missouri has experienced numerous heat stress events and implemented response measures that involve expending funds and human resources. The city historically has had a large number of heat stress events. Future climate change may increase the number of heat stress events, which could increase the resources required to respond. In this research project I compared temperature and humidity data from a regional climate model to compute apparent temperature, a measure of human comfort. I also computed the apparent temperature from an observation-based data set, and adjusted the model's apparent temperatures to account for model bias versus the real world. Then I computed the apparent temperature, also adjusted for bias, for a future climate simulated by the same regional model. Preliminary indications show that this region will experience more and longer heat stress events, at a cost to resources and possibly human life.

50. Horseshoe Bend, Port Louisa National Wildlife Refuge

Asa Strong, Hinsdale, IL
Major: Geography
Mentor: Marc Linderman
University of Iowa

My research project was to use remote sensing programs and multiple aerial photographs of Louisa County, Iowa to complete a classification of the types of vegetation found in the Horseshoe Bend Wetland Division of the Port Louisa National Wildlife Refuge. The final result is raster file of the Horseshoe Bend Wetland broken into 13 different vegetation classes. This image will be blown up to fit a poster size. The vegetation was separated into different classes based on their spectral values, and vegetation classes were verified by ground truthing the study area with a GPS. The output of this project will aid the U.S. Fish and Wildlife Employees at Port Louisa National Wildlife in making management decisions and in preparation for future climate change.

51. Pulling Back the Veil on Stem Cell Research: The Generation of Induced Pluripotent Stem Cells as an Ethical Alternative to the Controversy Surrounding Embryonic Stem Cell Research

Sara Ternes, Marion, IA
Major: Biology and Biochemistry
Mentor: Kavita Dhanwada
University of Northern Iowa

Stem cell research has captured the imagination of many in society, and although it holds hope for curing disease, and alleviating human suffering, the effects of this pioneering technology present profound ethical implications. While a consensus exists that the use of adult stem cells is ethically just, embryonic stem cell research (ESCR) has generated significant debate in the scientific community. The moral quandaries and opposition to this research should not be confused with opposition to all stem cell research. The research of CET focuses on the generation of induced pluripotent stem (iPS) cells, an alternative avenue to ESCR. iPS cells are adult cells that have been reprogrammed to an embryonic-cell like state but are void of ethical considerations posed by ESCR. These cells will be used to create disease models, drug screening, and ultimately be used as cures for a number of disorders, therefore representing the future of regenerative medicine.

52. From Strangers to Siblings: An Ethnography of the Appalachia Service Project Summer Staffers

Rachel Tish, Carlisle, IA
Major: Organizational Communication
Mentor: Tom Hall
University of Northern Iowa

Communication research has typically focused on relationship development in fairly regular, true-to-life settings; there is a lack of focus on friendships that grow out of situations in which people have no relational alternatives. This ethnographic study of the Appalachia Service Project (ASP) offers a contrast: observations, interviews, cultural artifacts, and researcher memories shed light on the friendship processes within various groups of four college-aged individuals who are assigned as work teams for 12 weeks. Together the members of these teams repair homes, oversee volunteers, and typically form relationships that reach a deeper level than most friendships. The study of how these relationships form is unique to ASP but also provides a basis of knowledge for future studies of similar situations, such as military units, in which dependent coworkers co-create a cultural unit through self-disclosure, rituals, and co-habitation.

53. Synthesis of a Novel Photopolymerized Nanocomposite Hydrogel for Treatment of Acute Mechanical Damage to Cartilage

Christian Tormos, Guaynabo, PRI
Major: Chemical Engineering
Mentor: Surya Mallapragada
Iowa State University

Intraarticular fractures leads to the destruction of the cartilage matrix, loss of chondrocytes and acute mechanical damage (AMD), this combination of events is known as posttraumatic osteoarthritis (PTOA). Current treatment of PTOA is completely focused on restoration of the macroanatomy of the joint and ignores AMD. Previous studies developed a hydrogel to treat AMD. This study consists of optimizing the properties of a synthetic hydrogel and its ability to sustain and promote cell growth. The mechanical properties of the hydrogel must be similar to that of native cartilage in order to mechanically stabilize and restore local structural integrity to acutely injured cartilage. This was accomplished by changing the relative amounts of constituents used to make the hydrogel. In order to sustain and promote cell growth, peptides to promote cell attachment have been integrated to the hydrogel. This material has the potential to stabilize injured cartilage and prevent PTOA.

54. Recommendations for Increasing the Energy Efficiency of Rod Library

Spencer Walrath, Cedar Rapids, IA
Major: Psychology and Music
Mentor: Bill Stigliani
University of Northern Iowa

With continued cuts from the state government of Iowa, the University of Northern Iowa (UNI) needs to identify all potential savings in its operations budget. All of the newly renovated buildings on campus have been remodeled to increase their energy efficiency and thereby reduce their utility costs. The Rod Library has not been renovated since 1995 and no attention was paid at that time to increasing its energy efficiency. This study analyzes the energy inefficiencies of the Rod Library and calculates the cost effectiveness of various upgrades. The author then makes several recommendations of how to achieve savings through the implementation of various structural and behavioral improvements while minimizing the up-front cost to the University.

55. Damage to the Ventromedial Prefrontal Cortex Increases Credulity to Explicitly-Labeled False Information

Kelsey Warner, Bettendorf, IA
Majors: Communication Sciences and Disorders and Psychology
Mentor: Dan Tranel
University of Iowa

The False Tagging Theory (FTT), a neuroanatomical model of belief and doubt, was tested using the lesion method. Tenets of the FTT include: 1) the process of belief involves mental representation and assessment 2) represented ideas are initially believed, and a secondary psychological process of assessment produces disbelief 3) the prefrontal cortex is necessary for “false tagging” the initial belief. A central prediction of the theory asserts that damage to the prefrontal cortex induces a “doubt deficit”, accompanied by credulity to information. To test this, patients with ventromedial prefrontal cortex (vmPFC) damage and normal comparison participants were given stories that contained explicitly-labeled false statements. Our results show that patients with vmPFC damage were significantly more likely than normal comparisons to misidentify false statements as true. These errors influenced the social judgments made on the protagonists of each story, suggesting true cognitive belief. Thus, patients with vmPFC damage have a specific deficit in the ability to “false tag” explicitly-labeled false information. These findings support the FTT, which asserts that vmPFC damage decreases doubt, thereby increasing credulity.

56. A Tale of Two Breadbaskets: Agriculture and nitrogen pollution in the Des Moines River, Iowa, and the Shaying River, China

Mary Weber, Independence, IA
Major: Geoscience
Mentors: You-Kuan Zhang and Keith Schilling
University of Iowa

Nonpoint source agricultural nitrogen pollution is a well-documented problem in the Des Moines River basin. In the Shaying River basin, it's known that the water quality is impaired, however the extent and causes of nitrogen pollution are unclear, due to lack of data and lack of governmental controls on point-source pollution. This project analyzes the results of data collected in the Shaying River basin in the fall of 2011, examines the agricultural aspects of this highly agricultural region, and compares these components to the Des Moines River basin, a highly agricultural watershed in Iowa. This research was conducted under the umbrella of Dr. Zhang's research of pollution in the Huai River basin.

57. Electrical transport anomalies in nanometer scale manganese films

Erik Wolter, Van Horne, IA
Major: Physics
Mentor: Tim Kidd
University of Northern Iowa

Nanoscience and nanotechnology have been at the forefront of scientific research in 21st century technology. Current uses include applications in solar cells, cancer treatment, and almost all electronics we utilize today. In our work, nanoscale thick Manganese films were grown in a vacuum deposition chamber. The electronic properties of these films are monitored while they grow, so we can determine important fundamental properties as the system transitions between atomic and nanometer length scales. By controlling the speed at which these films grow, we can control when this transition occurs. Using these results we can, for the first time, demonstrate how to grow truly nanometer scale manganese films that are continuous. Continuity is important, as only continuous films have metallic properties that can be used in applications. In each application, nanoscale films are advantageous as they give rise to cheap, high sensitivity devices unmatched by current technologies.

58. Surveillance for Blacklegged Ticks (*Ixodes scapularis*) and the Bacterium That Causes Lyme Disease (*Borrelia burgdorferi*) in two Ames, Iowa neighborhoods

Brandon Woods, Urbandale, IA
Major: Biology
Mentor: Julie Blanchong
Iowa State University

A study was conducted in two neighborhoods adjacent to city parks in Ames, Iowa to survey for blacklegged ticks (*Ixodes scapularis*), rodent vectors, and the bacterium *Borrelia burgdorferi* responsible for Lyme disease. Small mammal live-trapping occurred in each neighborhood in alternating weeks from May-August 2011. Eleven backyards near Inis Grove Park were trapped where residents have reported Lyme disease. Ten backyards near Emma McCarthy Lee Park were trapped where Lyme disease has not been reported. Primarily rodents of genus *Peromyscus*, such as deer mice and white-footed mice, and Eastern chipmunks (*Tamias striatus*) were captured. No ticks and twenty unique animals were captured in the Inis Grove neighborhood, whereas fourteen dog ticks (*Dermacentor variabilis*), four blacklegged ticks and 87 unique animals were captured in the Emma McCarthy Lee neighborhood. Ticks and ear tissues were collected from rodents and tested for the bacterium *B. burgdorferi*; all tissue samples and ticks tested negative.

59. Structure in the m-ary Partition Function

Duncan Wright, Altoona, IA
Major: Mathematics
Mentor: Theron Hitchman
University of Northern Iowa

Similar to partitions of the integers, m-ary partitions is another way of studying the properties of integers in a very exciting way. Throughout this presentation, you should learn what an m-ary partition of an integer is and will be introduced to a clever function that comes out of studying these m-ary partitions. The structure of this function is quite amazing and there are many amazing properties that have been noticed. I will show how this function is built and many of the properties that have been discovered, as well as some explanation as to why some them happen.

60. Determining the virulence of corn pathogen *Fusarium verticillioides* using deletion mutants lacking genes Fv_00027 or Fv_NPS6

Abby Zieman, Newton, IA

Major: Biochemistry

Mentor: Nalin Goonesekere

University of Northern Iowa

Fusarium verticillioides is the most reported fungal pathogen of corn. Many pathogens have virulent genes which are genes that increase infectivity of the pathogen. After a bioinformatics study, it was determined that genes Fv_00027 and Fv_NPS6 are potential virulent genes in *F. verticillioides*. To determine if either gene contributes to the virulence of the fungus, deletion mutants of *F. verticillioides* were created lacking either Fv_00027 or Fv_NPS6 genes. These deletion mutants are being utilized in an optimized corn assay to determine the effect of infectivity on corn. To test these deletion mutants, corn seeds infected with *F. verticillioides* are grown on germination paper and harvested. The assay includes both negative (no fungus) and positive (wild type *F. verticillioides*) controls. The seedling weight and shoot length is collected for each treatment and a computer program is used for the statistical analysis.

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