Undergraduate Creative Activities and Research Forum

2014 Abstracts

Student Center
Ballrooms A, B, & C
April 7, 2014
“Engaging in research creates new and exciting learning opportunities beyond the classroom for our undergraduate students. Research is about finding answers, and as students are learning, they also are creating new knowledge. These enriched problem-solving experiences will better prepare them to compete in the global society. The enthusiasm and dedication of our students and their faculty mentors inspire the entire campus community.”

—Rita Cheng, Chancellor

“We are extremely proud of our undergraduate research programs at SIU. From first-year students to seniors, students engaged in these programs tend to succeed at a higher rate. The knowledge acquired, collaborations built, and skills developed support a positive supportive learning environment and give students an advantage in pursuit of professional careers and graduate school.”

—John W. Nicklow, Provost and Vice Chancellor for Academic Affairs

“‘Know No Bounds’ represents Southern Illinois University Carbondale without a doubt. Participating in undergraduate creative activities and research is a way for students to Experience the endlessly expanding boundaries available at SIU Carbondale. This Forum is a valuable showcase for the world to see students walking in the path ‘Know No Bounds’.”

—Rodrigo Carramiñana, Director of the Center for Undergraduate Research and Creative Activities
**Poster judges**

Frank Anderson, Zoology  
Pinckney Benedict, English  
Kimberly Booker, Student Health Services  
Michael Brazley, Architectural Studies  
Chad Briggs, Psychology  
Deborah Bruns, Educational Psychology  
Royce Burnett, Accountancy  
George Burruss, Criminology and Criminal Justice  
Qiang Cheng, Computer Science  
Yoginder Chugh, Mining and Mineral Resources Engineering  
Garth Crosby, Technology  
Maureen Doran, Anatomy  
Chad Drake, Psychology  
Linda Drust, Education  
Buffy Ellsworth, Physiology  
Ahmad Fakhoury, Plant, Soil, and Agricultural Systems  
Derek Fisher, Microbiology  
Jane Geisler-Lee, Plant Biology  
Matthew Giblin, Criminology and Criminal Justice  
Jeff Goelz, Recreational Sports and Services  
Sharon Granderson, Library Affairs  
Reza Habib, Psychology  
Thomas Imboden, Information Systems Technologies  
Thushari Jayasekera, Physics  
Karen Jones, Plant, Soil, and Agricultural Systems  
Jyotsna Kapur, Cinema and Photography  
Tammy Kochel, Criminology and Criminal Justice  
Punit Kohli, Chemistry and Biochemistry  
Seung-Hee Lee, Fashion Design and Merchandising  
Liliana Lefticariu, Geology  
James Maclean, Physiology  
Nancy Martin, Information Systems Technologies  
John Massie, Student Health Services  
Walter Metz, Cinema and Photography  
Jeffrey Myers, Technology Transfer Specialist  
Prema Narayan, Physiology  
Jane Nichols, Rehabilitation Institute  
Michael Olson, Kinesiology  
Lisa Peden, Learning Support and Testing Services  
Shawna Pope, Rehabilitation Institute  
Jared Porter, Kinesiology  
Gregory Rose, Center for Integrated Research  
Ami Ruffing, Center for Environmental Health and Safety  
Patricia Saleeby, Social Work  
Andrew Sharp, Anatomy  
Pamela Smoot, History  
Karen Sullivan, Aviation  

**Saluki App competition judges**

John Ahrens - SIU director of enterprise applications  
Lauren Siegert - Online director, The Southern Illinoisan  

**SIU Carbondale Literary and Art Award judges**

Loren Groff, novelist and short story writer  
Jon Charles Tribble, Department of English  
Allison Joseph, Department of English  

Tom Harness - owner, Harness TechED
Undergraduate Creative Activities and Research Forum
April 7, 2014
Southern Illinois University Carbondale

Program
Poster judging sessions: 8:30 a.m. - 12:30 p.m.
Public viewing session: 1:00 p.m. - 3:00 p.m.
Award presentations: 3:00 p.m.
  - Saluki Research Rookies’ poster awards
  - Poster awards by category
  - Saluki App competition awards
  - SIU Carbondale Literary & Art Award awards
  - REACH awards

CURCA Director
Rodrigo Carramiñana

Organizers
Ouadie Akaaboune, CURCA
Mallory Dugger, CURCA

Event Manager
Lori Foster, CURCA

Sponsors
Office of the Provost
Center for Undergraduate Research & Creative Activities (CURCA)
The Sustainability Council

SIU Carbondale Literary & Art Award

Coordinators
Pinckney Benedict, Department of English
Jon Charles Tribble, Department of English

The SIU Carbondale Literary & Art Award recognizes creative excellence in the categories of poetry, fiction, and visual art as published in Grassroots, SIU Carbondale's undergraduate arts magazine. Award winners are chosen, through an identity-blind process, based on the scope and ambition of the project undertaken, the energy and intensity of the project's execution, and the effectiveness of the project's final form in achieving its high artistic aims. From approximately 75 submissions, the Grassroots editors chose for inclusion in the magazine 11 pieces of fiction, 27 pieces of poetry, and 16 pieces of visual art. Of those, one will be named the SIU Carbondale Literary & Art Award winner in each category, with two runners-up in each category.

Saluki App competition

Coordinator
Amy McMorrow Hunter, SIU Technology Transfer

The Saluki App Competition encourages SIU Carbondale student involvement and the creation of useful and valuable application software (“apps”) for mobile devices. Individual students or teams will compete for prizes by submitting their apps that make the SIU campus and/or the Southern Illinois region better.
<table>
<thead>
<tr>
<th>Student participants</th>
<th>Mentors</th>
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<td>1. Suzanne Abell</td>
<td>Peter Smith</td>
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<td>2. Cheyenne M. Adams</td>
<td>Brian C. Small</td>
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<td>3. Lacey Armit</td>
<td>Rebecca Atkinson</td>
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<td>4. Yara Artis &amp; Vanessa Trotto</td>
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<td>5. Kailyn Baalman</td>
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<td>6. Graham Baker</td>
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<td>7. Dianna Balan</td>
<td>Sandie Bass-Ringdahl</td>
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<td>8. Christopher Barkau</td>
<td>Frank Anderson</td>
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<td>9. John Barron</td>
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<td>10. Kelli Barry</td>
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<td>11. Kara Beer</td>
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<td>12. Shahan Bellamy</td>
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<td>13. Seth Bennett</td>
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<td>15. Ashley Bergman</td>
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<td>20. Sidney Brothers</td>
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<td>22. Mikaela Cantrell</td>
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<td>25. Tariq Collins</td>
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<td>26. Mitchell Connolly</td>
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<td>27. Kacie Conrad</td>
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<td>29. Bryce Corbett</td>
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<td>32. John DeJaynes &amp; Xylina Delrey</td>
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<td>Student participants</td>
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<td>37. Nicholas Flowers</td>
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<td>51. Kara Hunt, Alex Nitto, Justine Gold, &amp;</td>
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<td>Jonathan Cross</td>
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<td>73. Bridget Munoz</td>
<td>Ruth Anne Rehfeldt</td>
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<td>83. Aparajita Rajamhanty</td>
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<td>95. Nisarg Shah</td>
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<td>106. Cody Ward</td>
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<td>107. Amanda Weidhuner</td>
<td>S. Alan Walters</td>
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<tr>
<td>108. Tyler Wells</td>
<td>Michael W. Eichholz</td>
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<td>109. Jessica Whitaker</td>
<td>Andrew A. Sharp</td>
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<td>110. Margaret Widelka</td>
<td>Da Chen</td>
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<td>111. Carlie Willis</td>
<td>Prema Narayan</td>
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What students say about undergraduate research:

“It’s not somebody else’s research, it’s my own, which is really nice. You don’t have to have somebody tell you what to focus on or what to do. It’s a great opportunity to be able to put yourself in your field and get started. It’s really helped me starting my career.” -- Misty McElyea

“I view this project as part of a bigger effort of trying to find out how all of life is created. There may not necessarily be an immediate or obvious benefit; it’s not going to cure a disease or it’s not going to make anyone money. It’s just one of those questions that I think people are curious about, like how does life all tie together in the end. I feel like this project will contribute to that. And, this has given me a really good opportunity to figure out if this is the major I really want to do, instead of going through four years and not getting any real lab experience and hoping that I would like it. That’s really been the main benefit for me - experience and exposure to my field." -- Nicholas Defreitas

“This opportunity to do real research as an undergraduate has enforced in me that this is indeed what I want to do with my life." -- Sara Reardon

"I have learned more from doing research than in any class I've taken. Hands-on learning stays with you much better than learning from lectures and books. Research is slow and frustrating but the rewards and excitement of discovering new scientific information are beyond anything I could have imagined. No matter what I do in life, I will always be able to use the tools of research, especially the critical-thinking and problem-solving skills that are essential for success." -- Renee Lopez-Smith

“This experience confirmed my ability to tackle a large project and to meet a deadline, but more importantly I was able to participate in something I enjoyed and also educate the public about a growing problem in our waterways.” -- Matt Wegener
Suzanne Abell
School of Architecture

Advanced digital design and fabrication: Transforming the practice of architecture and design

As one of the most rapidly developing technologies for architects, doctors, artists and engineers, digital fabrication and design is a topic that holds an incredible valuable and relevant learning experience for students and professionals alike. Methods of digital fabrication include laser cutters, CNC machines, and 3D printers. Universities, labs, and design firms all over are using them to enrich their work. They provide an essential role in the design process and act as not only as a bridge between the physical and digital worlds but also as a revolutionary instrument of communication and creative collaboration. They have also helped build a network for in-person and online community exchange and education, providing architects and students with guidance related to new construction techniques, prototyping methods, and new material applications. As improvements in the technology rapidly advance, exploration of potential future uses of these technologies, especially 3D printers, suggests a very real possibility of these machines quickly becoming a common household object. In addition to household use, digital fabrication is changing future of architectural design and the ways architects think about their tasks and visions. Through the equipment available on campus, I have carried out my own personal projects with each of the machines to produce example study models and to explore how the use of these resources can improve the quality of my own design process.
Cheyenne Adams

Center for Fisheries, Aquaculture, and Aquatic Sciences
Department of Zoology

Effects and source of an unknown contaminant in a recirculating coral propagation aquaria system

The world’s coral reef populations are quickly diminishing in the face of pollution, exploitation, and global climate change. Current propagation techniques either diminish the genetic variability of populations through asexual propagation or harm and rely on existing populations for a source of larvae. The original proposal was to induce a sexual spawning event in captive conditions from an asexually fragmented coral as a solution to current coral reef restoration efforts. However, the livestock of coral fragments died within one week of exposure to the system. Interestingly, the fish species that were introduced to the system simultaneously with the original coral fragments showed no symptoms or mortality throughout the duration of the study. A series of problem solving tests were conducted to assess the system in a structural, toxicological, and analytical framework. The results of these tests supported the conclusions that a toxic contaminant in the recirculating water was the source of coral mortality. Whole Effluent Toxicity (WET) tests were conducted to isolate components of the aquaria system and identify the source of the toxic leachate. The silicone sealant used on bulkheads was found to be a source of mortality in coral, likely caused by the fungicidal compound copper hydroxide used in the sealant. Although aquatic invertebrates are highly susceptible to copper poisoning, aquatic vertebrates are not susceptible to copper poisoning, which is supported by the survival of the fish species. This information could prove significant because it provides toxicological data, including symptoms and mortality rate, for four species of coral, ranging from small stony polyp to soft coral. These results emphasize the importance of system components and construction in captive breeding programs for coral propagation. Future studies could establish LC50 for copper exposure and other toxicological benchmarks for commonly propagated coral species to improve the success rate of captive propagation.
Lacey Armit and Rebecca Atkinson

Department of Animal Science, Food and Nutrition

Apparent ruminal digestibility of commonly grazed forage cereal grains

Nine varieties of forage cereal grains, originally developed for deer food plots, were used to determine cattle and deer acceptance, and interaction. Grazing offers numerous benefits to the environment as well as reduces cost of cattle production, however, as land mass decreases it is of utmost importance to maintain or enhance wildlife habitats. Planting dual-purpose crops that can be utilized by both domesticated and wildlife species will allow for more efficient landmass usage. Using the concepts from this experiment looking at acceptance from cattle, forages were tested for digestibility. Efficiency of cattle production will increase as the acceptance and digestibility of forages in a diet increases. With an increased efficiency in feed the cost of production that the farmer has to supply goes significantly down. The forages used were Buck Forage Oat, Buck Maser Wheat, and Rye Grass. Grass hay was used as a control diet in this experiment. The experiment was conducted through a fermenter trial in the lab. Four ten day trials were conducted in this experiment. Rumen content was collected from the cattle on day 1 and taken and processed back in the lab. The forages were put into diets and fed to the content in the fermenters three times a day throughout these trials. Samples from the output and each fermenter were collected for the last three days of each trial. Analyses of the samples collected from the trials are currently being conducted.
Previous research has established that a relationship exists between the personality trait of conscientiousness and academic achievement (Poropat, 2009). Conscientiousness reflects being organized, disciplined, responsible and striving to achieve (John, 2008). Academic self-concept reflects how students view themselves academically in relationship to others (Poropat, 2009). Both conscientiousness and academic self-concept are expected to affect academic performance. The current study consisted of 336 undergraduate students who provided information that included current GPA, high school GPA, weekly hours studied, weekly hours worked, and whether classes were missed. Findings suggest that academic self-concept was significantly positively correlated with current GPA, $r(215) = .293, p < .001$; high school GPA, $r(265) = .214, p < .001$; weekly hours worked, $r(328) = .119, p = .031$; and weekly hours studied, $r(328) = .202, p < .001$. Conscientiousness was significantly positively correlated with high school GPA, $r(264) = .263, p < .001$; current GPA, $r(214) = .257, p < .001$; weekly hours worked, $r(327) = .116, p = .036$; and weekly hours studied, $r(327) = .214, p < .001$. Both academic self-concept, $r(313) = -.157, p = .005$; and conscientiousness, $r(312) = -.194, p = .001$; were significantly negatively correlated with whether classes were missed. This research provides insights into the traits that are associated with academic outcomes and establishes the relationship between academic self-concept, conscientiousness and academic performance. In the future, educators could work towards improving student self-concept to enhance their academic performance. Professionals can encourage students confidence by making all learning goal-oriented, so that students can establish a sense of accomplishment. Creating workshops to educate academic professionals, could also lead to fostering an environment for students that encourages a stimulating relationship between teacher and student to positively impact their achievements.
Despite its many functions, the liver is a very efficient energy storage organ. When we eat, nutrients are taken to the liver for processing, where the liver cells will either release the nutrients or store them for when the body is running low. When this happens, cells utilize glucose and oxygen through aerobic respiration to make adenosine triphosphate (ATP), or energy, to function and grow. While this is a normal process in daily life, it also means that the liver is the ultimate energy bank for proliferating cancer cells. Cancer cells, like any other cell, utilize aerobic respiration to produce ATP, but, when dividing rapidly, they utilize aerobic glycolysis to produce ATP very quickly. In addition to this, when glucose supply is low, the liver can convert stored lipids into usable energy for the cells as well. Thus, liver energy storage may be an important target for cancer prevention.

Flaxseed, an omega-3 fatty acid, has many health benefits and is commonly used to reduce inflammation and triglyceride levels in the body; many recent studies have also linked omega-3 fatty acids to a decrease in blood glucose. This experiment was designed to histologically study the effects of flaxseed by analyzing livers from four test groups of hens that were fed a 0 percent, 5 percent, 10 percent, and 15 percent flaxseed diet for six months to see if flaxseed had any effects on the number of lipid and glycogen (stored glucose) vacuoles in the liver. This, in turn, will decrease proliferating cancer cells' availability of energy. Three liver samples from each test group were analyzed and the results showed that the number of lipid and glycogen vacuoles decreased as the percentage of flaxseed increased. This suggests that flaxseed caused a dose-dependent decrease in liver energy storage. However, further study will have to be done to determine significant results.
Southern Illinois’s Cache River nurtures internationally important wetlands but has suffered dramatic hydrologic changes due to agricultural development. Since the 1915 completion of the Post Creek Cutoff, the Upper Cache River floods less frequently while the Lower Cache floods more often. The objective of this study was to assess the effect of river modification on dominant floodplain tree species by comparing radial growth rates of baldcypress (*Taxodium distichum*) and cherrybark oak (*Quercus pagoda*), two species at opposite ends of the flood tolerance spectrum. We hypothesized that radial growth rate for baldcypress would be high at the Upper Cache site due to less flood stress, and low at the Lower Cache site because of higher stress levels from increased flooding. On the contrary, we expected radial growth rate of cherrybark oak on ridges to be low at the Upper Cache site because of low water availability, and high at the Lower Cache site due to increased access to water. Preliminary results suggest that *Quercus pagoda* has higher radial growth rates in the Lower Cache than in the Upper Cache, while *Taxodium distichum* growth rates did not differ between the Lower and Upper Cache. These results regarding *Quercus pagoda* partially support our hypothesis. These differences indicate variation in productivity that may govern responses of floodplain community composition and dynamics to altered hydrology.
Dianna S. Balan and Sandie M. Bass-Ringdahl, Ph.D.

Rehabilitation Institute, Communication Disorders and Sciences

Hearing impairment and access to intervention across the life span

Approximately 17 percent, or 36 million, American adults report some degree of hearing impairment (National Institute on Deafness and Other Communication Disorders [NIDC]. The incidence of hearing impairment increases with age, with nearly one-third of people older than 65 and nearly half of those older than 75 reporting some degree of loss (NIDCD). Yet, adults often suspect the presence of hearing impairment for many years before seeking identification and intervention. Hearing impairment also affects children. Approximately 56,000 children in the United States under the age of six years have hearing impairment in both ears at a level that will impact the understanding of speech (Humes & Bess, 2014). Congenital hearing impairment or hearing loss present at birth is estimated to occur in 2-3 per 1000 infants in the United States (NIDCD). Severity of hearing impairment can range from mild to profound, with the resulting degree of disability varying as well. For children, early intervention of hearing impairment is essential to support successful outcomes. As of 2013, 46 states passed legislation requiring newborn hearing screening and 37 states required intervention for newborns with hearing impairments (ASHA). With the widespread implementation of newborn hearing screening, the average age of identification has significantly lowered. However, intervention is often delayed for children with multiple impairments. The presence of hearing impairment may mask the identification of additional impairments (Moeller, 1985). Challenges to the identification and intervention of hearing impairment will be examined across multiple populations.
Chris Barkau¹, Bronwyn Williams¹, Christer Erséus², and Frank Anderson¹

¹Department of Zoology, Southern Illinois University Carbondale
²Department of Biological and Environmental Sciences, University of Gothenburg

Phylogenetics and species delimitation in the Naidid species
Slavina appendiculata and Stylaria lacustris

Naididae is a clade of typically benthic worms found in most freshwater systems. Recent molecular research has revealed cryptic variation within multiple naidid species, which have traditionally been delimited by morphology alone. Cryptic lineages within the naidid Tubifex tubifex have been shown to respond differently to toxins and infection, suggesting that taking this unseen diversity into account may be important when naidids are used in physiological research or as environmental indicators. Slavina appendiculata and Stylaria lacustris are broadly distributed naidids commonly found among vegetation and sediments in still or nearly still waters. They have been used in toxicological research and many studies investigating ecosystem dynamics. Preliminary phylogenetic analyses of Stylaria lacustris suggest that this species may actually comprise three distinct genetic lineages, at least two of which occur sympatrically. Slavina appendiculata, on the other hand, appears to comprise at least two distinct lineages, one found in Europe, and the other throughout North America. In order to understand the extent of this cryptic diversity, we obtained a suite of mitochondrial and nuclear genes sampled from worms collected from several broadly distributed sites using PCR. Amplified DNA sequences were tagged with BigDye® terminator and read on an ABI sequencing machine. From these data, we infer the phylogenies of Slavina appendiculata and Stylaria lacustris and discuss their importance to future taxonomic and ecological study.
A recent spike in research into supercapacitors stems from the need for energy storage in alternative energy sources. Supercapacitors, also known as electrochemical double layer capacitors, are a bridge between batteries, which store a lot of energy, and capacitors, which charge and discharge at a fast rate. Supercapacitors are able to store more energy than regular capacitors while still charging and discharging at a quick rate. This quick ability of supercapacitors to charge and store energy makes it more useful than a battery or capacitor. Graphene is a widely studied tool for making supercapacitors due to its ability to form single layer nanoflake dispersion with a high specific surface area. The purpose of this experiment was to synthesis graphene nanoflake dispersions using liquid phase exfoliation and to electrochemically characterize the sample. The sample was confirmed to be graphene nanosheets using UV-Vis and TEM imaging. The sample was tested through CV, galvanostatic charge-discharge, Electrochemical Impedance Spectroscopy, and Ragone charts in order to analyze and calculate electrochemical properties (i.e. capacitance, stability, life cycle, power density, energy density, faradaic behavior). Aside from room temperature, the sample was also tested at low temperatures down to 240 Kelvin.
Kelli Barry

Center for Fisheries, Aquaculture, and Aquatic Sciences
Department of Zoology

Comparing transport vigor of pond- & cage-reared hybrid striped bass

The objective of this experiment was to compare transport vigor of pond- and cage-reared hybrid striped bass, a popular food fish. Typical transport procedures, including harvest and handling, create high amounts of stress for fish. Therefore, this project has the potential to help aquaculture facilities determine which rearing process will yield the most transport-tolerant product, in order to increase the profit of producing these fish for live markets. Subjects were harvested from earthen ponds using a seine and from floating mesh cages using a dip net. The experiment included four simulated transport trials of the hybrids for a period of eight hours in a live hauler. Salt and supplemental oxygen were added to each side of the aluminum hauler (pond and cage). In each trial, blood samples were collected from three fish after five minutes of stocking and at intervals of one, two, four and eight hours of transport to assess physiological stress in the fish. Water quality samples were also collected at the beginning of each trial as well as at the intervals formerly mentioned. In this study, cage-reared fish were expected to exhibit lower stress and mortality than pond-reared fish. This hypothesis was supported by the experiment. Further research will be conducted with the use of agitators and buffers in order to alleviate stress and poor water quality during the transport of hybrid striped bass.
Bobcat diet analysis

The goal of this analysis is to account for any changes in the food habits of bobcats (*Lynx rufus*) in Southern Illinois. A similar analysis was conducted with bobcat stomachs collected from 1994-2000. The results showed prey including murid rodents, lagomorphs, squirrels, white tailed deer, and birds, the majority being murid rodents and lagomorphs. These animals are associated with open habitats such as orchards and grasslands, which are abundant in the Southern Illinois area. My experiment will compare any trends found in the variety and abundance of animals found in bobcat stomachs collected from 2011-2013 to the previous sample. Most of these bobcats were found as road kill and delivered to SIU by Illinois Department of Natural Resources personnel. Some bobcats were provided as mortalities of radio-collared individuals from a previous study (Woolf and Nielsen 1999). Expected changes in trends could include increased quantities of murid rodents and lagomorphs due to increased crop land areas, a typical habitat for these types of animals. Studying the timeline in change of habitat alongside frequency of the bobcats’ prey can help local biologists and farmers maintain a sustainable and healthy population of bobcats in the Southern Illinois area.
Throughout the last 25 years the visibility of transgendered individuals has become more prominent in documentary film. Traditionally these films have concentrated on the definition of gender as it pertains to biological sex. Characters are marginalized as beings only concerned with ‘correcting’ their outer bodies to match societal definitions of their gender. The lack of representation of transgender individuals who do not participate in hormone replacement therapy or seek surgery promotes the notion that in order to be transgender one must alter their body. Based off of this concept being transgender does not go against the gender binary system but instead reinforces it. This paper contextualizes several documentary films’ attempt to define what gender looks like and examine gender fluidity and its implications on the traditional gender binary and patriarchal systems. Films will be contextualized on how the characters defy the gender binary system.
Seth Bennett, Brandy Elmore, and Michael Hoane, Ph.D.

Department of Psychology

The effects of nicotinamide treatment on learning in rats in a traumatic brain injury model

In the United States 1.7 million people experience a traumatic brain injury (TBI) annually, and cognitive impairments are the leading cause of TBI-related disability. Despite the frequency of this major public health issue, there are currently no FDA approved pharmacological treatments available. Previous research has shown that a derivative of the B3 vitamin, nicotinamide (NAM), has therapeutic potential as neuroprotectant in various TBI models. The purpose of this study was to evaluate cognitive functioning and learning following NAM treatment in a bilateral frontal controlled cortical impact (CCI) model in male Sprague-Dawley rats. It was hypothesized that NAM would improve recovery of function in a retrograde amnesia Morris water maze (MWM) paradigm and a passive avoidance assessment. Four days prior to surgery animals were tested in the MWM paradigm for four trials per day to assess baseline learning. On the day of surgery animals were assigned to a sham (uninjured), vehicle (0.9% saline), or NAM treatment condition (150 mg/kg), $n = 3$ in each group. Injections were administered intraperitoneally at four hours post injury, and every 12 hours for 72 hours. The animals were tested for retention in the MWM on day 11 and tested in the passive avoidance task on days 12 and 13. Animals were perfused on day 13 and standard histological procedures were conducted to assess lesion volume. The results of this study will determine whether these behavioral assessments are sensitive to the therapeutic effects of NAM in the current injury model. These findings could contribute to the repertoire of behavioral assessments used in TBI pharmaceutical evaluations and provide further evidence of the efficacy of NAM treatments.
Minka E. Bentley\textsuperscript{1}, Kerry E McLeran\textsuperscript{2,3}, Mihai Lefticariu\textsuperscript{4}, and Liliana Lefticariu\textsuperscript{1,3}

\textsuperscript{1}Department of Geology, \textsuperscript{2}NSF IGERT Fellow, Watershed Science and Policy, \textsuperscript{3}Environmental Resources and Policy, and \textsuperscript{4}Mass Spectrometry Facility

\textit{Hydrogen and oxygen stable isotope characterization of precipitation in Southern Illinois}

We present data for the first study on the hydrogen (d\textsuperscript{2}H\textsubscript{p}) and oxygen (d\textsuperscript{18}O\textsubscript{p}) isotope values in precipitation from Southern Illinois. Data collection began in the fall of 2012 and continued through the beginning of March 2014. We report large variation in d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} values, with d\textsuperscript{2}H\textsubscript{p} ranging from -158.2 to - 1.6‰ and d\textsuperscript{18}O\textsubscript{p} from -22.4 to - 0.3‰. The average relationship between d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} values for locations around the globe is defined by d\textsuperscript{2}H = 8.0*d\textsuperscript{18}O + 10‰, known as the Global Meteoric Water Line (GMWL).

The average relationship between d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} in precipitation from Southern Illinois can be expressed as d\textsuperscript{2}H = 7.8*d\textsuperscript{18}O + 15‰, which represent the equation for the Carbondale Meteoric Water Line (CMWL). The difference between the GMWL and CMWL is due to local factors, such as the exchange of water between the atmosphere and lakes, rivers, and soils, which play a dominant role in influencing the isotopic values of precipitation in Carbondale. The d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} values were correlated with average and maximum temperature, relative humidity, and precipitation amount. The strongest correlations were observed between average temperature and the d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} values (r = 0.60, p<0.002 and r = 0.832, p<0.0001 respectively). These relationships are consistent with d\textsuperscript{2}H\textsubscript{p}-enriched and d\textsuperscript{18}O\textsubscript{p}-enriched values measured during periods of increasing temperature, indicating a temperature effect for d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} in southern Illinois. Weak correlations were identified between d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} values and both relative humidity and precipitation amount, suggesting that temperature is the dominant control on d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p}. To date, there are no stable isotope studies of precipitation in Southern Illinois and our results suggest that d\textsuperscript{2}H\textsubscript{p} and d\textsuperscript{18}O\textsubscript{p} values can be used as natural indicators for environmental and ecological studies involving the hydrologic cycle in the Midwest.
Ashley Bergman, Stephen Ebbs, and David Gibson, Ph.D.

Department of Plant Biology

Does the exotic invasive Japanese Chaff flower have root mycorrhizae?

Over 90 percent of plants that have been examined have symbiotic fungal mycorrhizal associations. Little is known about the newly invasive exotic plant *Achyranthes japonica* (Japanese Chaff flower) and its fungal associations have not been investigated. This research was conducted to see if Japanese Chaff flower has mycorrhizae in its roots. To check for this association, 1cm long root segments collected from naturally established plants growing at Chestnut Hills Nature Preserve in southern Illinois were cut and stained with trypan blue. The procedure was first tested on White Clover (*Trifolium repens*) known to possess mycorrhizae. To stain the roots they were first soaked in 10 percent KOH overnight to breakdown the living parts of the plant. Then the roots were cleared in HCl so the stain would bind to fungal tissues in the roots. The roots were left in HCl for 15 minutes before placing the roots in a dish with trypan blue stain for four hours. After staining, the roots were distained in lactophenol for 15 to 20 minutes. Then they were placed on a slide with a cover slip and observed under a microscope. As expected, the white clover had mycorrhizae in its roots confirming the efficacy of the staining procedure. Given the widespread presence of mycorrhizal associations in plants, the Japanese Chaff flower samples are expected to demonstrate this association as well.
Corporations are able to make large profits by exploiting foreign workers for their own gain. The purpose of this study was to investigate how major corporations on the Fortune 500 list were taking advantage of the foreign work force. In order to determine this I examined the annual reports and social responsibility reports of major corporations. I then constructed a chart showing a company’s rank on the Fortune 500 list, the amount of money they make and whether or not they provide certain benefits to their workers. By analyzing this data in chart format I was able to determine which companies treated their workers the best and which companies did not treat their workers as well. I was also able to see which companies made the most money and whether or not those companies treated their employees well. This research has demonstrated that in order to make large sums of money, some companies are willing to compromise their morals and take advantage of workers in foreign countries.
Kevin S. Bradley and Amber L. Pond

Department of Anatomy

Effect of Merg1a K\(^+\) channel expression on skeletal muscle calpain activity over time

Skeletal muscle atrophy is the loss of muscle size and strength that often occurs with injury, disease states and normal aging. Numerous proteolytic systems contribute to atrophy, including the ubiquitin proteolytic pathway (UPP) and calcium activated proteolytic calpain enzymes. We have shown that the MERG1a K\(^+\) channel induces atrophy by up-regulating UPP activity, but this may not account for all proteolysis induced by MERG1a. Recently, we showed that MERG1a significantly increases intracellular calcium levels. Therefore, we hypothesized that the augmented calcium concentration may increase calpain activity. Here, we have explored the potential effect of MERG1a on calpain activity over time. To determine the time course of the effect of MERG1a on calpain activity, the right gastrocnemius muscles of 40 mice were injected with a control expression plasmid (30 ug) while the gastrocnemius muscles of the left legs received a plasmid encoding Merg1a (30 ug). A Renilla luciferase reporter was also injected into each muscle to monitor transfection efficiency. Injected legs were electro-transferred to ensure uptake of plasmid. Five mice were euthanized ~3 hours post procedure to produce Day 0 samples. Five animals were then killed every 24 hours thereafter to yield Day 1-7 samples. Gastrocnemius muscles were harvested and frozen at minus 80\(^\circ\)C. After homogenization, each muscle was assayed for both protein content and calpain activity. Preliminary data analysis suggests that the calpain activity increased in response to MERG1a expression, starting at day 3 and peaking at day 4. The activity returned to baseline by days 6 and 7. These days correlate well with time course studies of MERG1a expression in response to electro-transfer. We conclude that calpain proteolytic activity appears to be affected by Merg1a K\(^+\) channel expression over the course of a week. This suggests that MERG1a may contribute to atrophy by increasing calpain activity.
In past years, grazing muzzles have become a popular solution to decreasing the forage intake of horses. Grazing muzzles could also have ramifications on both the horse’s digestive process and the recommended pasture stocking rate. While the decrease in roughage has been estimated, the grazing muzzle’s effect on hay consumption is less documented. The purpose of this experiment was to determine the effect of grazing muzzles on the hay intake of horses. Two different types of muzzles were used to determine if there were any differences in the effectiveness of muzzles. Ten horses were randomly with an average starting weight (in lbs), body condition score, and age of 1147.40 ± 76.69, 5.50 ± 1.18, and 8.80 ± 1.75 respectively. The horses were stalled overnight before being fed hay ad libitum for thirty minutes. After seven days, the horses were randomly selected to wear one of two types of grazing muzzles. The same procedure was then repeated with the addition of a grazing muzzle. Both muzzles reduced the intake of the horses from their week of adjustment average of 2.9 lbs of hay when fed ad libitum for thirty minutes. The first grazing muzzle treatment reduced the average intake to 2.45 lbs, a change of 15%. The second grazing muzzle treatment group reduced the average intake to 0.81 lbs, a change of 72% (P < .0001). The results show that there is a difference between the types of grazing muzzles utilized.
Gabriela Brito, Kristin Rosche, and Vjolca Konjufca

Department of Microbiology

Changes in liver tissue architecture and cell population profiles during Salmonella infection

Salmonella spp. (Salmonella) is a food-borne pathogen that can cause typhoid fever, self-limiting gastroenteritis, and bacterimia. Following infection, Salmonella primarily colonizes the spleen and liver. The spleen is an important immune organ responsible for the clearance of blood-borne pathogens, while the liver is vital for the maintenance of metabolic homeostasis and may also play a central role in persistent Salmonella infections. In the spleen, Salmonella causes drastic changes in the proportions of immune cells. Most notably, macrophages responsible for the recycling of old and damaged red blood cells expand considerably in numbers. Additionally, the proportion of immature red blood cells expand dramatically with infection, as due to extramedullary erythropoiesis. In contrast, B and T lymphocytes, which are important for the induction of immunity, decrease substantially. Salmonella is found predominantly to reside in macrophages throughout the course of infection, especially in conjunction with red blood cells. The colonization of the liver leads to tissue ischemia, indicative of its pale pink color, and the appearance of abscesses. These outward changes in tissue morphology are suggestive of alterations occurring at the cellular level, possibly in a similar manner as is seen in the spleen. Yet it is not known how Salmonella affects the liver tissue architecture and which cell populations harbor the bacteria throughout the course of infection. We used immunofluorescence microscopy to characterize the in situ changes in liver architecture and cell population profiles of C57BL/6 mice infected with Salmonella.
Sidney Brothers

Rehabilitation Institute, Communication Disorders and Sciences

*Application of invented rule with preschool children*

Speech-language pathologists are challenged with providing efficient, time-sensitive, and accurate clinical assessments to children who are learning English as a second language, English Language Learners (ELLs). One potential tool is a form of dynamic assessment known as the invented rule procedure that teaches a child a novel but nonsense rule and asks the child to apply this novel rule following a training protocol. Dynamic assessment offers the advantage of measuring how a child learns a novel linguistic element rather than what the child knows prior to testing. The invented rule offers the advantage of time and language efficiency in administration, but there is still a need for more guidance on how this rule can be utilized with ELLs. This study taught the invented rule with a modeling protocol to compare performance between children who are ELL and children who are monolingual. In addition, task performance was also compared with individual participant’s task scores on the Peabody Picture Vocabulary Test-III (PPVT-III), and the Phonological Awareness Literacy Screening (PALS). This project’s objectives were to discover whether or not history of exposure to multiple languages impacts a child’s ability to pass the invented rule and whether performance on an invented rule task correlates to performance on the PPVT-III and PALS assessments. We predict that these findings may be able to indicate if the assessments are assessing different areas of language. I anticipate that the results will play a critical role in language assessment, especially among the ELL population by providing guidance on relationship of language experience to performance on the invented rule. Currently, this project’s data is still being collected and analyzed; however, our data will be finalized and ready for presentation at the Undergraduate Creative Activities and Research Forum.
Shailey Brumley and Jared M. Porter

Department of Kinesiology

Honesty may not be the best policy: Focus of attention and positive bias effects on the mechanics of long jump performance

For several years research findings have demonstrated that instructing an individual to direct one’s attention externally rather than internally results in superior motor behavior. However, recent findings have revealed that biasing the expectations of the performer can negate the positive effects of adopting an external focus of attention (Porter et al., 2012). The purpose of the present study was to investigate potential mechanisms for this effect. Sixty-eight (male and female) university students participated in the study. Using a counterbalanced mixed method design, participants completed two standing long jumps within four experimental conditions (i.e., control, internal, external proximal, external distal). To bias expectancy, participants were told that one of the conditions should result in their “best jump.” The assigned bias was counterbalanced across all conditions to control for possible order effects. Jump distance, projection angle, knee flexion, and jump velocity served as the dependent variables. Consistent with previous findings (Porter et al., 2012), jumps performed in the non-biased conditions resulted in greater jumping distance as the participants’ focus of attention was directed more distally. Also consistent with previous findings, an analysis of the biased trials indicated that only the external distal condition had a reduced jump distance after having their expectancy biased. An evaluation of jump projection angle and knee kinematics revealed that movements were similar across all experimental conditions. The results of the present study suggest that positively biasing performance expectancy has a contradictory effect on motor behavior. Specifically, when participants were biased in the theoretically superior condition (i.e., external distal), they had their worst jumping performance. Our findings also suggest that changes in lower body kinematics are not likely the primary reason for this effect.
Mikaela Cantrell, Chelsea Griffith and Peter R. Patrylo, Ph.D.

Department of Physiology

_AKT activation is reduced early in the 3xTg mouse model of Alzheimer’s disease_

Alzheimer’s disease (AD) is a neurological disorder associated with beta-amyloid plaques, neurofibrillary tangles, and cognitive decline. AD is the third leading cause of death and the incidence/prevalence of AD is expected to increase in the next two decades. There are no cures for AD. Thus identifying novel AD-related changes is crucial. Clinical trials suggest that intranasal insulin can improve cognitive function possibly by restoring insulin signaling. Dr. Peter R. Patrylo’s lab has investigated insulin signaling in a genetic mouse model of AD (3xTg). AD neuropathology and cognitive decline occurs in these 3xTg mice at 14-21 months of age. Further, activated AKT (pAKT) levels are decreased at 20-24 months. This is likely due to impaired insulin signaling via the PI3K/AKT pathway. Our hypothesis is that alterations in PI3K/AKT signaling occurs early in AD and thus could contribute to pathogenesis. Immunoblotting was used to examine AKT and pAKT levels in brain samples collected from 3xTg and control mice prior to plaques, tangles and cognitive decline (6-10 mo). Samples were loaded on 10 percent SDS-Page gels transferred to PVDF membranes and then probed for AKT (1:2,500 Rockland) or pAKT (1:2,000 Cell Signaling Technology). Appropriate secondary antibodies were used for densitometric quantification using the Odyssey licor system and normalized to β-actin (Normalized optical density = NOD). 3xTg mice, vs. control, showed comparable levels of AKT (WT NOD = 1 ± 0.05, 3xTg NOD = 0.85 ± 0.08; p > 0.05; t-test), but a decrease in pAKT (WT NOD = 1 ± 0.15, 3xTg NOD = 0.58 ± 0.11; p < 0.05). These results suggest that insulin signaling via the PI3K/AKT pathway may be altered early on in 3xTg mice and thus could contribute to pathogenesis. Future experiments will examine the levels of upstream proteins in the PI3K/AKT pathway in 3xTg mice.
Frank Cavender\textsuperscript{1} and Andrew Wood, Ph.D.\textsuperscript{2}

\textsuperscript{1}Department of Physiology and \textsuperscript{2}Department of Plant Biology

Crowding effect in Arabidopsis strains

Plant growth and productivity are controlled by a large variety of factors and are often limited by access to sunlight, water or nutrients. An increase in plant productivity is directly correlated with an increase in crop growth. One often overlooked aspect of plant growth and regulation is the crowding effect. Plants of the same species, when grown in close proximity, are smaller than those grown separately. This effect can be seen by comparing plants grown individually and those grown in groups. The isolated plants show trends of larger growth and producing more seeds than those grown in large groups, which tend to be smaller and produce fewer seeds. Previous studies have also shown that gene expression is also heavily influenced by the amount of crowding. However few studies have focused on the implications of crowding conditions, and fewer researchers establish protocols to accommodate for crowding changes. To better understand the phenomena, two strains of \textit{Arabidopsis thaliana} were grown, comparing the responses to crowding in each. Analysis of seed count and overall plant growth were used to determine the magnitude of the crowding response in the different varieties of \textit{Arabidopsis} plants. These growth characteristics are commonly used as plant productivity and vitality markers. Further investigations could expand the study to include more varieties of \textit{Arabidopsis} or more molecular assays to determine the cellular changes that occur due to crowding.
Coal sensitized solar cells: A cleaner way to generate power

Dye sensitized solar cells (DSSC) are a new generation of solar cells that can compete with traditional silicon based solar cells. Although DSSCs are currently not as efficient as crystalline solar cells, they are cheaper to construct. DSSCs are composed of a dye stained metal oxide layer and an electrolyte redox couple that are sandwiched between two conductive glass plates. The dye absorbs a photon of light and becomes oxidized. Then, it injects an electron into the conduction band of the metal oxide layer. The electron is passed through an external circuit to the other conductive glass plate. The electron is then transferred to the electrolyte redox couple, which reduces the dye back to its original state.

The goal of this project is to develop new dyes for use in DSSCs while maintaining a relatively low production cost. Dyes were produced by using a variety of solvents to partially dissolve solid coal. Coal was used because it is inexpensive compared to ruthenium dyes that are widely used in DSSCs. The liquid from dissolving coal was separated from the remaining solid coal. UV-vis and FT-IR spectroscopy were used to characterize the absorbance spectra and functional groups of the dye. Ten DSSCs were constructed using different coal dyes. The open circuit voltage and short circuit current was tested for each solar cell using a digital millimeter. These points, along with the max power point, were plotted to generate an IV-curve. From the results, it can be deduced that coal dyes can be used to create functioning DSSCs. However, further research will be conducted in order to improve efficiency.
Tariq Collins¹ and Philip C. Howze²

¹Department of Philosophy and ²Department of Africana Studies

Causes of violence in Chicago, Illinois: Using citation analysis as a research method

In this study, the researchers attempted to discover who the prominent researchers are before searching for published materials in the public domain (e.g. libraries) on the etiology of violence in large urban areas, such as Chicago, Illinois. This “preparatory stage” work was very important, particularly when researching the impact causal agents may have on any given phenomenon that involves social interaction. The research method used was citation analysis. According to Cohn (2009) “citation and content analyses are two methodological techniques used by criminologists for a variety of purposes. Citation analysis is a way of evaluating the scholarly impact of a scholar, scholarly work, journal, book, or academic department within a discipline” and “both are quantitative methods that are less likely to be affected by personal bias than other techniques.” The objectives were to (1) develop search histories using prominent databases such as SSCI, SIUC’s Open Access, JSTOR and Google Scholar to identify author prominence; and (2) to “browse” for causes of violence as noted in the work of these authors. Methodology involved choosing data groups and then isolating the top 5-10 causes listed in each group. Protocol involved searching (a) the Morris Library website at lib.siu.edu; (b) OneSearch beta link to Web of Knowledge (click on letter W); (c) Social Sciences Citation Index (online) and other databases; and (d) charting Search Terms and Mapping, after two trials. Preliminary results indicate that while author prominence can be easily discovered, agreement on the top causal agents of urban violence among those prominent authors is low. The research is ongoing, to further refine search terms and concept mapping.
Mitchell Connolly\textsuperscript{1,2}, Andrew Winchester\textsuperscript{1}, Peter Hale\textsuperscript{2}, Keshav M. Dani\textsuperscript{2}, and Saikat Talapatra\textsuperscript{1}

\textsuperscript{1}Department of Physics, Southern Illinois University-Carbondale, Illinois, USA
\textsuperscript{2}Femtosecond Spectroscopy Unit, Okinawa Institute of Science and Technology, Okinawa, Japan

Temperature Dependent Raman Studies of Liquid-Phase Exfoliated MoS\textsubscript{2}

We investigate the temperature dependence of in-plane E\textsubscript{1g} and out-of-plane A\textsubscript{1g} Raman modes of few-layer MoS\textsubscript{2} prepared using the Coleman liquid-phase exfoliation method. After exfoliation, the resultant material was viewed under the transmission electron microscope (TEM) for determining the quality, which showed small, few layer flakes of approximately 100 nm diameter ranging between 3-8 layers. The resultant material was drop cast into a thin film on silicon substrate for phonon mode measurement. We supported our TEM observations using Raman peak measurements which displayed characteristics of <6 layer thickness at room temperature (E\textsubscript{1g} =381.4 cm\textsuperscript{-1} and A\textsubscript{1g} =405.8 cm\textsuperscript{-1}). The Raman shift peaks indicate a linear dependence on temperature within the range of 293 K to 77 K. We will discuss the measured temperature coefficients of E\textsubscript{1g} and A\textsubscript{1g} modes.
Kacie Conrad and Yu-Wei Wang, Ph.D.

Department of Psychology

*Effects of video intervention on ethnocultural empathy and attitudes towards diversity*

Ethnocultural empathy is a relatively new focus of study within the realm of psychology. Conceptualized by Wang and colleagues (2003) to be different from general empathy, ethnocultural empathy describes a person’s ability to understand the oppression felt by someone of a different racial/ethnic background. In this current study with a between-group experimental research design, we examine the impact of diversity videos on White-American students’ ethnocultural empathy, color-blind racial attitudes, and psychosocial cost of racism. The effects of the intervention videos on ethnocultural empathy and diversity attitudes will be compared to the effects of a control group video on self-discovery, which does not explore racial inequality issues. The first hypothesis of this study is that the diversity video intervention should increase White participants’ ethnocultural empathy, White empathy, and White guilt, and such intervention will lower the participants’ color-blind racial attitudes and White fear. Second, there will be a significant difference between the intervention group and the control group’s ethnocultural empathy and racial attitudes scores. Data will be analyzed using pre and post t-tests to assess any significant changes in the participants’ responses to scale of ethnocultural empathy (Wang et al., 2003) and other measures on diversity attitudes after they watch the videos; a MANCOVA will be performed to detect any significant differences between the intervention and control groups. Findings and implications for multicultural intervention and education will also be discussed.
Valeria A. Copello

Department of Chemistry and Biochemistry

*Substrate specificity and metal dependence of phosphohydrolase activity in the HD domain of CvfA from Streptococcus pyogenes*

CvfA (conserved virulence factor A) is a protein involved in regulating the expression of virulence factors in *Streptococcus pyogenes*. *S. pyogenes* is a pathogenic bacterium involved in upper respiratory and skin infections. CvfA contains four predicted domains, including a metal-dependent phosphohydrolase domain known as the HD domain. We have isolated from genomic DNA a region that codes for a protein containing both the RNA recognition domain (KH domain) and the catalytic HD domain of CvfA. The protein was expressed in E. coli with an N-terminal MBP (Maltose-Binding Protein) affinity tag that facilitated purification and characterization. Our goal is to study the metal ion dependence controlling the catalytic activity and to determine kinetic parameters in response to different substrates and inhibitors that provide an understanding of substrate specificity. The substrates that we used to characterize the phosphohydrolase activity in the presence of manganese(II) were bis-para-nitrophenyl phosphate and para-nitrophenyl phosphate. Future studies will include testing various metal cations to characterize the metal-dependence of the HD domain in CvfA. Phosphodiesterase inhibitors will be used to aid in studying the substrate specificity of the protein.
Bryce Corbett

Department of Zoology

*Effect of beaver dams on stream chemistry*

The North American beaver (*Castor canadensis*) is considered an ecosystem engineer and often a keystone species, as they can greatly alter the landscape and influence ecosystem structure, function, and biodiversity. As a keystone species, the removal of beaver from a community result in the loss of structures or materials altering the habitat type and energy and matter flow. Prior to the early 20th century, *Castor canadensis* was nearly hunted to extinction but conservation efforts have since aided in their recovery. Previous studies suggest beaver dams can alter the hydrology, biogeochemistry, macroinvertebrate community structure, and productivity in stream ecosystems. We measured nutrient (phosphate, ammonia, nitrite, and nitrate) levels, turbidity, and chlorophyll-*a* upstream and downstream of two beaver dams in the Cache River watershed in Southern Illinois to examine the longitudinal impacts of the dam. There were no significant differences between upstream and downstream in any of the variables we examined (\( \alpha = 0.05 \)). Further research could benefit from a greater number of sample collections from a larger number of dams. In addition to a larger dataset, the seasonal effect on stream chemistry could yield different results. Our data do not reflect this because we only took samples in late winter.
The basis of our research is to test Mr. John R. Mullinix’s patented solution of diesel fuel and a solvent. This solution is expected to change cylinder combustion chemistry, pressure in the cylinder, horsepower, miles per gallon, as well as a change in the emissions from the tailpipe. Though we have not obtained final results with our research, these expected changes could be beneficial to the automotive industry. With the Corporate Average Fuel Economy (C.A.F.E.) standards increasing every few years, miles per gallon (MPG) becomes increasingly important to automotive manufacturers. These strict regulations create a need for alternative means to increase MPG anyway they can. This solution could possibly become one of those means. Not only have the standards for MPG gone up, but the standards set by the Environmental Protection Agency (EPA) for tailpipe emissions have become more stringent. With the fines for manufacturers not meeting these standards increasing, the need for decreasing tailpipe emissions has become one of the first priorities for diesel engine manufacturers. With the manufacturers having to meet these standards, it becomes tougher to maintain customer satisfaction with a vehicle. With this solution, we expect to increase the horsepower output of the engine, and keep the customer satisfied.
Kelsey D. Cruse and Sarah J. Kertz, Ph.D

Department of Psychology

Repetitive negative thinking and alcohol expectancy

Repetitive negative thinking (RNT) is defined as cyclical thinking about one’s own problems in the past, current, or future (Ehring et al., 2011) and is present transdiagnostically (Ehring and Watkins, 2008). Rumination is a content specific form of RNT, which primarily focuses on past events (Ehring and Watkins, 2008). Rumination has been associated with increased likelihood of maladaptive alcohol use (Nolen-Hoeksema et. al, 2007). Alcohol expectancies are beliefs that consuming alcohol will affect one’s behavior, perceptions, and attitudes (Leigh, 1989) and may influence alcohol consumption. The current study explores the relationship between rumination, RNT and alcohol expectancies. We hypothesized that higher levels of RNT and rumination would predict beliefs that alcohol reduces stress and tension, and beliefs that alcohol creates more positive social experiences.

The sample included 158 students between the ages of 18 and 43. We conducted two linear regressions with the Perseverative Thoughts Questionnaire (PTQ) and Ruminative Responses Scale (RRS) as independent variables, and the stress reduction and social change subscales of the Alcohol Expectancy Questionnaire-III-Adult (AEQ-III-adult) as dependent variables. Results indicated that the overall model for the stress reduction subscale was significant, \( R^2 = .03, F(2, 168) = 3.22, p = .04 \). Of the individual predictors, the PTQ significantly predicted stress reduction, \( \beta=0.03, t(155), p < .05 \). The model predicting positive social experience was not significant, \( p > .05 \). In sum, high levels of RNT significantly predicted increased beliefs that alcohol reduces tension and stress. Further exploration is needed to determine if alcohol expectancies are associated with increased maladaptive coping of RNT and rumination through alcohol consumption.
John J. DeJaynes, Xylina Delreal, Megan Morrison, and Meera Komarraju, Ph.D.

Department of Psychology

Absenteism culture: Looking at gender differences in attendance norms

One problem that arises in today’s college classrooms is student absenteeism. A study conducted by Burke (2010) has shown that different factors contribute to student absenteeism. A few of these factors are teaching quality, interest in course, and required attendance. A study conducted by Moore, Armstrong, and Pearson (2008) reported that 60 percent of their participants missed class due to low motivation. Past research has reported that 28 percent of students question class attendance when they can achieve adequate grades outside of lecture (Burke 2010). In the current study, 332 undergraduate participants were examined for gender differences using the Absenteeism Culture Scale. Participants filled out self-report surveys relating to academic performance and attendance norm beliefs. Findings suggest that the Absenteeism Culture Scale has a significant negative relationship with ACT score, $r(278) = -.119$, $p = .046$; and expected college GPA, $r(319) = -.110$, $p = .048$. However, the Absenteeism Culture Scale showed a significant positive relationship with the number of classes missed, $r(313) = .143$, $p = .011$. The t-test findings suggest that males ($M = 2.00$, $SD = .81$) identify higher with the Absenteeism Culture Scale than their female counterparts ($M = 1.83$, $SD = .78$). These results suggest that individuals who subscribe more to the Absenteeism Culture Scale are more likely to have lower college GPA, ACT scores, and class attendance. Future research can use this for groundwork when developing classroom interventions.
Nicole M. Dethrow, Sohaib A. Hameed and Amber L. Pond

Department of Anatomy

The Ubr2 gene is expressed in skeletal muscle atrophying as a result of hind limb suspension, but not Merg1a expression alone

Skeletal muscle atrophy is defined as the loss of muscle mass and strength. It occurs with certain diseases, disuse, denervation and with aging. The most effective therapy for skeletal muscle atrophy is exercise; however, not all people can participate in such activity. Our goal is to produce information which will ultimately lead to the improvement of therapy for skeletal muscle atrophy. Our lab has shown that the MERG1a K⁺ channel is expressed in the atrophying skeletal muscle of mice. We showed that electro-transfer of Merg1a into mouse gastrocnemius muscle causes atrophy and that block of the MERG1a channel will inhibit loss in muscle fiber size. Also, we have shown that MERG1a increases ubiquitin proteasome proteolysis (UPP), a pathway demonstrated to be responsible for at least 75 percent of atrophy-related protein loss. Further, MERG1a induces expression of the skeletal muscle specific UPP E3 ligase Murf1. We then asked if MERG1a increases ubiquitin proteasome proteolysis (UPP), a pathway demonstrated to be responsible for at least 75 percent of atrophy-related protein loss. Further, MERG1a induces expression of the skeletal muscle specific UPP E3 ligase Murf1. We then asked if MERG1a increases ubiquitin proteasome proteolysis (UPP), a pathway demonstrated to be responsible for at least 75 percent of atrophy-related protein loss. Further, MERG1a induces expression of the skeletal muscle specific UPP E3 ligase Murf1. We then asked if MERG1a increases ubiquitin proteasome proteolysis (UPP), a pathway demonstrated to be responsible for at least 75 percent of atrophy-related protein loss. Further, MERG1a induces expression of the skeletal muscle specific UPP E3 ligase Murf1. We then asked if MERG1a increases ubiquitin proteasome proteolysis (UPP), a pathway demonstrated to be responsible for at least 75 percent of atrophy-related protein loss. Further, MERG1a induces expression of the skeletal muscle specific UPP E3 ligase Murf1.

Thus, we induced atrophy in mice by hind limb suspension and used histology to determine muscle fiber size and quantitative PCR to determine the time course of E3a-II expression. Indeed, atrophy was induced and E3a-II mRNA was detected at very low levels starting at day two and increased to nearly six-fold over weight bearing controls by day seven of suspension; however, E3a-II expression was not affected by ectopic expression of Merg1a. We conclude that while hind limb suspension does induce expression of the E3a-II UPP ligase, Merg1a expression does not, suggesting that MERG1a alone is not an upstream modulator of E3a-II ligase expression.
Ashton Dixon, Soroosh Songheir, Andrey Soares, Ph.D, Joan Davis, Ph.D.

Department of Biological Sciences

A clinical decision support system (CDSS) for tobacco intervention using electronic health record (EHR)

Nicotine dependence is one of the most common and widespread chemical dependences in the United States. It has been estimated by the CDC that 18.1 percent (43 million) of adults in the United States are addicted to tobacco products. Of these adults, a large percentage struggle with tobacco cessation each year. Tobacco cessation can be a difficult process met with many obstacles. Even though tobacco cessation programs exist throughout the United States, most programs are not tailored to fit the individual needs of users. Therefore, tobacco users find it difficult to utilize these programs and do not have great success in quitting.

Of the adults who are tobacco users in the United States, it is estimated that 70 percent of them visit a healthcare provider annually. Healthcare providers are well positioned to provide tobacco dependence treatment to their patients. However, many healthcare providers state they lack training in tobacco cessation treatment, lack time or do not have in confidence in providing cessation interventions.

This innovative project seeks to use anonymous data collected from over 400 dental hygiene files to 1) predict whether or not a patient uses tobacco regularly through health indicators, and 2) to utilize a clinical decision support system to provide individualized cessation programs to patients. Thus far, the project has successfully predicted the accuracy of smokers versus non-smokers’ tobacco-use by looking at their health statistics. In the future, this project hopes to evolve into developing individualized cessation interventions for tobacco users. If healthcare providers and tobacco users can work together to form appropriate cessation plans, then diseases linked to tobacco-use could be greatly reduced.
Mouse models to study endometrial cancer

The main objective of Dr. Kanako Hayashi’s lab is to understand the effects of deleting the tumor suppressors, Trp53, Pten and Cdh1, on the metastasis of endometrial (uterine) cancer. Her lab combines methods of cellular and molecular biology to evaluate the mice that have been strategically bred to have specific genes or specific gene knockouts. She works in hope to decrease or halt the spread of endometrial cancer. In order to identify the mice that will be used for experiments, their genotypes must be determined. To do this, we have extracted genomic DNA from mouse samples, amplified these genes through the process of polymerase chain reaction (PCR), and found the final genotype by viewing an ethidium bromide based gel. Once the genotypes of the mice have been determined, they are able to be collected to view the internal body parts. To do so, we have assisted in harvesting the endometrial tissue. After acquiring the necessary tissues, they are embedded into paraffin blocks by the histology core facility. Finally, we are able to cut samples from the paraffin wax blocks by using the microtome, mount them onto microscope slides and perform hematoxylin and eosin staining to observe gross tissue histology. In addition to the skills we have already learned while being in Dr. Hayashi’s lab, in the future we plan to have the opportunity to enter the mouse room and perform animal husbandry, and learn molecular techniques, such as real time PCR and cloning.
Cytotoxic T-cells are a critical part of the adaptive immune response. They act by recognizing specific antigens presented on the surface of the cell by major histocompatibility complexes (MHCs). This signal, combined with the costimulation of Cluster of Differentiation (CD) peptides, activates the cell to release a variety of molecules to kill infected cells. In this study, we focus on activating cytotoxic T-cells, or cytotoxic T-lymphocytes (CTLs) to deliver its payload to a liposome with MHCs presenting an antigen and with CD8 bonded to the liposomes through N-Hydroxysuccinimide (NHS) and an intermediate. One of the cytotoxic granules released, perforin, should incorporate itself into the liposomal lamella which is chemically very similar to the plasma membrane. The incorporation of perforin should create large pores in the 10,12-pentacosadiynoic acid (PCDA) and 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC) liposome. The release of a molecule held inside the liposome will stimulate fluorophores on the surface of the liposome, allowing for a quantitative measurement of the CTL immune response by measuring the absorbance-transmission spectrum of the liposome after the procedure. This can then be used as a model to build biosensor for this particular CTL interaction as well as provide a technique for replacing biological entities in intercellular interactions with liposomes. In the future, it may be possible to switch the procedure and create an artificial CTL capable of targeting specific viral infections.
Nicholas D. Flowers and David J. Gibson, Ph.D.

Department of Plant Biology

*The effects Of light-pollution On Achyranthes japonica (Miq.) Nakai seedlings*

Organisms maintain daily, diurnal rhythms throughout their lives. These rhythms allow crucial processes, such as DNA replication, to be partitioned into efficient temporal parameters. The ability to partition these sensitive processes temporally could be advantageous to an organism. The effects of light-pollution on invasive species have both known and unknown consequences. We aimed to better understand the consequences of light-pollution and how it relates to seedling growth in *Achyranthes japonica* (Miq.) Nakai (Japanese chaffflower), an exotic invasive in which the effects of light-pollution are unknown.

We sought to test the hypothesis that light-pollution during the night will influence the growth of *A. japonica*. Seedlings were placed within a randomized block grid (4 x 5) in a greenhouse where light-pollution was 1.58 µmols/m²/sec. Ten of the seedlings were exposed to light-pollution at night, and 10 seedlings were shielded from light-pollution by covering them with a formed, breathable, porous shade cone each night. The total height of the plants, the length of the leaves and the biomass were used to quantify the growth. Data were recorded twice daily (dawn and dusk) for four weeks. A preliminary analysis using a repeated measures mixed model suggests that although leaf length was not affected, overall height of *A. japonica* was affected by light-pollution. The data suggest there was an overall effect on seedling height of time (F_{15,554} = 31.65, P<0.0001), and light-pollution treatment (F_{1,554} = 4.04, P=0.048) regardless of seedling age. Mean height of the light-pollution restricted plants was 1.57 ± 0.03 cm compared to 1.52 ± 0.03 cm in the light-polluted plants. These preliminary data suggest that height decreased when *A. japonica* seedlings were exposed to light-pollution.
Drew Foxx

Department of Geography

*The influence of urban-rural development from sustainable European cities*

Within this research project, I plan to obtain data that specifies what types of social/economic practices the top sustainable cities in the European continent are implementing in order to maintain a habitable environment for future generations. Cities such as Oslo, Norway and Copenhagen, Denmark have integrated sustainable practices rather efficiently. It should be interesting to see how the most sustainable urban cities in Europe are planning sustainable development in their environments and understand what ideas can be implemented into some of America’s least sustainable cities. After finding many of these different sustainable practices established by European cities, the results will show that there are still many unique and efficient ways to promote sustainability among America’s most unsustainable urban areas.

Key unsustainable issues and strategies that will be focused on include technology, urban/city landscape development, water management, waste production and management, energy usage, and transportation. These are key issues that contribute to the largest productions of atmospheric and water pollution, as well as waste in turn degrading communities outside this point source of pollution and their natural resources. Overpopulation in cities and urban expansion has come to be one of the largest issues as well creating difficulty for America to advance on sustainable development. It is important to understand productive sustainable methods that are successful elsewhere, such as Oslo or Stockholm, so sustainability can be implemented in America’s most unsustainable cities in successful ways.
Pyrethroids, a commonly used group of insecticides, accumulate in aquatic systems surrounding treated terrestrial areas, resulting in toxicity to many aquatic non-target benthic species. One of the potential effects of this exposure is behavioral changes that can result in population level effects. Investigating potential behavioral effects is important in understanding the ecological impact of pyrethroid exposure. One of the behavioral effects that may occur is movement of populations in order to avoid contamination. The objective of the current study was to determine if pyrethroid exposure could induce this type of population movement in an epibenthic invertebrate, *Hyalella azteca*. This question was investigated by observing burrowing tendencies of *H. azteca* in clean sediment, versus sediment spiked with bifenthrin, an extremely toxic pyrethroid. Experiments were conducted in which organisms were added to beakers containing water overlying either clean sediment or sediment spiked at bifenthrin concentrations ranging from 5 to 100 ng/g (dry weight (dw)). Ten *H. azteca* were added to each beaker and it was observed whether amphipods would burrow into the sediment within two minutes. The results showed that organisms burrowed less in contaminated sediment at concentrations as low as 10 ng/g (dw), compared to controls. Based on these results, further study has begun to investigate the ability of *H. azteca* to choose clean sediment over bifenthrin-contaminated sediment. The results of the current study indicate that *H. azteca* are less likely to burrow in bifenthrin-contaminated sediment than clean sediment, and therefore may move from contaminated to uncontaminated areas. Movement of aquatic benthic organisms could disrupt existing ecosystems and also cause harm to these populations by, among other effects, increasing exposure to predators or decreasing access to food.
Ovarian cancer and type II diabetes are diseases that are of great importance because of their severity and widespread, global effects. Both diseases share a variety of risk factors associated with metabolic syndrome, and some drugs used to treat diabetes are associated with a decreased cancer risk in individuals. In particular, Metformin (\text{1-carbamimidamido-N, N-dimethylmethanimidamide, C4H11N5})\text{, currently the number one worldwide anti-diabetes drug, shows promise in becoming a prescribed medication for cancer patients. Flaxseed is another substance with emerging potential for reduction of cancer proliferation and development. The lignan component in flaxseed is theorized to decrease ovarian cancer progression by acting as an estrogen receptor agonist or antagonist. Omega-3 fatty acids in flaxseed, on the other hand, slow development of the disease by decreasing inflammation. However, reduction of a nutrient-rich hyperglycemic environment, as evidenced in Metformin’s effects, may be a quintessential puzzle piece that this promising cancer-reducing agent lacks.}

This experiment was designed to compare Metformin and flaxseed in their abilities to alter biochemical serum markers and expression of metabolic genes and to set the stage for a long term study of their direct comparison in reducing ovarian cancer incidence and severity, using the hen model. Metabolic markers were analyzed in hens treated with either of the two substances in a series of \textit{in vivo} studies. Results reveal that Metformin and flaxseed differentially affect these biochemical and genetic markers associated with metabolic syndrome. Therefore, we have laid the foundation for a long-term \textit{in vivo} study of Metformin’s ability to work synergistically with flaxseed reduction of the hyperglycemic, pro-inflammatory cellular environment that fuels cancer growth, and in reduction of growth and proliferation of ovarian cancer.
Kenyahtta Gray and Sandie Bass Ringdahl, Ph.D.

Rehabilitation Institute, Communication Disorders and Sciences

An investigation of early vocalization development in young children with Autism Spectrum Disorder

Research will focus on the early vocal development, specifically distinguishing differences in canonical babble between children who are developing typically and children who are diagnosed with Autism Spectrum Disorder. A current project is underway to collect normative vocal development data from children who are typically developing for the validation of a recently developed questionnaire (Moeller & Bass-Ringdahl, 2010) to track early speech development. The normative data is collected in two stages. The first involves a visit to SIU in order to evaluate the hearing sensitivity of the participant and to collect early speech and language milestones through the use of parent questionnaires. The second stage involves the collection of a 16 hour vocal sample from the home. This data is collected through the use of a small recording device that the child wears in a specially designed shirt. The proposed study will involve the collection of similar data from children who attend the Center for Autism Spectrum Disorders. Data will be collected in the clinic setting as well in the home setting for children enrolled in the study. It is anticipated that distinct differences in the type, quantity, and pattern of vocalizations will be found between the two groups of children. Specifically, children with Autism Spectrum Disorder are expected to produce reduced quantity of vocalizations. In addition, children with Autism Spectrum Disorder are expected to produce vocalizations differing in pitch. Disorder and intensity of production, and vocalizations that different from the typical patterns seen in children who are typically developing.
Jeanette Grosman

Rehabilitation Institute, Communication Disorders and Sciences

*Language development of bilingual Russian/English-speaking children living in the United States*

The number of bilingual speakers in the United States is growing. Children in particular provide unique contributions and challenges to the English-speaking communities in which they live. Various aspects of the young bilingual population have been studied, including an emphasis on the communicative abilities and trends of such children. However, there is a paucity of research regarding communication of bilingual Russian/English-speaking children. The purpose of this project is to review the existing literature on the language development of bilingual Russian/English-speaking children as compared to that of monolingual English-speaking children to establish grounds for further research about this increasing population. The findings encompass the following areas of language development: phonology, syntax (grammar), semantics (vocabulary), and pragmatics (social use). Each area of language development is explored in regards to whether or not differences exist between bilingual children and monolingual children. The review reveals that differences do exist between the language development of bilingual children and monolingual children. There are marked variations in phonology between the Russian language and the English language, and this affects English acquisition. There are also differences in syntax, which affects English acquisition and Russian maintenance. Semantics may be an area of difficulty for bilingual children, with deficits possible in both languages. Some transfer effects exist in learning English pragmatics, but bilingual children eventually come to use English pragmatic models exclusively. This literature review calls for future research in the field of communication disorders and sciences regarding assessment and treatment of bilingual children in general and Russian/English-speaking children in particular.
Shayla Gunn

Department of Plant Biology

The effect of engineered nanoparticles on vegetatively propagated plants

Engineered nanoparticles, which are essentially small metallic substances with dimensions in the 1-100 nanometer size range, have been widely used in commercial products, medicine and even largely within the agricultural field, but have yet to be researched for applications in horticultural production. The high surface area of these nanoparticles makes them extremely reactive, an ideal catalyst, but may interfere with other kinds of biological reactions that occur naturally. There is incomplete information on the extent to which nanoparticles may affect plant health, growth and development regardless of their classification as a native species or agricultural/horticultural crop. The objective of this experiment was to determine the effects that nanoparticles; zinc oxide (ZnO), silver (Ag), copper oxide (CuO) and titanium dioxide (TiO₂) have on vegetatively propagated plants and how they might be further manipulated in the field of horticulture.

Tradescantia pendula, or wandering jew, was the ideal exemplar plant used to represent a commonly greenhouse cultivated crop. This plant is a tender perennial, easily rooted using multiple propagation techniques. The vigor of this plant was also an advantageous trait to withstanding the conditions of experimentation. Using standard propagation and greenhouse techniques, T. pendula stem cuttings were placed in nanoparticle suspensions as rooting media. The subsequent root initiation and establishment was monitored, and growth, survival and contamination were recorded. To determine whether these engineered nanoparticles were, indeed, beneficial or detrimental to the overall health of the plants, quantitative measurements of the plant’s root and shoot systems were collected and infection levels were assessed using a disease index after exposure to Rhizoctonia solani, a root pathogen specific to this species. The results of these data may lead to the advancement of agricultural and horticultural techniques to be used in production incorporating the use of engineered nanoparticles aiding in root establishment and pathogen resistance.
Skeletal muscle atrophy is a loss of muscle size and strength. Atrophy occurs when there is a disruption in the physiological balance between protein synthesis and degradation. Protein breakdown in skeletal muscle results from a number of mechanisms, including the ubiquitin proteasome pathway (UPP) and increased calcium-modulated calpain activity. We have shown that the ERG1a K\(^+\) channel up-regulates UPP activity in mice and that expression of ERG1a in C2C12 myotubes (a mouse myoblast line) induces an increase in intracellular calcium concentration. The increased calcium could certainly cause an increase in calpain activity. However, the mechanisms linking the membrane-bound ERG1a channel and these proteolytic systems are not understood. To study these mechanisms, we need both in vivo and in vitro models. Therefore, in addition to our mouse model, we over-express ERG1a in mouse C2C12 myotubes. To transfect myotubes, we must use a viral vector. We use the human isoform of ERG1a because it: 1) produces higher density K\(^+\) currents in myotubes; and 2) will allow us to monitor both native and viral ERG1a expression with qPCR. Therefore, we designed primer pairs to differentiate between mRNA transcribed from the 80 percent homologous human and mouse ERG1a genes. We tested each pair against serial dilutions (ranging over 5-6 logs) of both human and mouse plasmids. We ensured that there was consistency in Ct across replicates as represented by a low standard deviation among dilution replicates. Then Ct data was plotted against the log of the plasmid concentrations and we calculated: 1) R-square to ensure plasmid dilutions were linear; and 2) the slope which allowed us to determine primer efficiency. Accepting only R-square values of 0.985 or above and efficiencies of 90-105 percent, we have found one pair (out of two) specific for mouse ERG1a and one pair (out of four) specific for the human ERG1a.
Studies of photophysical processes in solar cells

Studies of photophysical processes in solar cells are important in finding a cost efficient way to use coal as a solar cell. This will hopefully make solar cells cheaper and more available to the public creating green energy. For this experiment I calculated using different functionals to find the most accurate method to explain the results of experiments. This is also important because if a method can be found, it would save time and money by eliminating testing. Triarylamine derivatives were studied in order to find the effect of different substitutions on the molecule. The different effects were found using the density functional theory calculations that were preformed on Gaussian finding the optimization, TDDFT, and frequency for the different functionals of each molecule. The different functionals that were tested were: BP-V86, Cam-B3LYP, B3PW91, MPW1PW91, PBEPBE, HSEH1BE, HCTH, TPSSTPSS, and WB97XD. Optimization calculations provide the HOMO (au), LUMO (au), and HOMO-LUMO gaps (eV), which can then be compared to the experiment to find the accuracy of the calculations. The TDDFT calculation provides a UV-Vis absorption spectrum for the derived molecule which can also be compared to find the accuracy of the calculation. The frequency determines the movement of the atoms, the infrared, and whether the molecule is stable meaning the frequencies are all positive or unstable meaning the frequencies contain at least one imaginary number. The results will be presented and discussed.
Gregory Harris, Jr. and Randy Burnside, Ph.D.

1Department of Elementary Education and 2Department of Political Science

Soldiers to scholars: An examination of military Veterans transition to college

Our research proposes to give voice to the student veteran so they may evaluate their overall satisfaction with institutional services provided by Southern Illinois University Carbondale. Veterans will evaluate their structural, social, and cultural integration to the campus of SIUC. Much of the current research suggests improvements and implementation of programs and services that administrators can use as guidelines for best practices in dealing with the veteran student. While these recommendations are vital and have proven to be very successful, the perspective of the veteran-student has not been accounted for in determining “military friendliness”. Possession of this highly acclaimed title by an accredited university increases visibility to the military community and as a result, the university is more likely to see an increase in military student enrollment, a guaranteed source of revenue. A veteran-student applicant may ask how friendly the current student veteran rates the university and how well they made the transition to college. Our research serves as an answer to these questions and offers insight to administrators of the veteran-student perspective.
The role of AGPs in the development of sperm cells in the moss Physcomitrella patens

Cell walls are a unique and important feature of plant cells. They are one of the structures that allowed plants to adapt to life on land. Cell walls are composed of a series of complex polysaccharides. The three main types of polysaccharides are cellulose, hemicellulose, and pectins. Cell walls also contain proteins, among which arabinogalactan proteins (AGPs) are the most important. AGPs are involved in cell-to-cell communication, sexual reproduction and morphogenesis (McNeil M, 1984).

We are just starting to examine the functions of AGPs in the reproduction of seedless plants. Due to the strong presence of AGPs, and their range of distribution during sperm development in Ceratopteris richardii, AGPs appear to play an important role in fern gametogenesis. The evidence collected by Lopez-Smith in Dr. Karen Renzaglia’s lab localizing specific AGPs with immuno-gold labeling points to AGPs as important compounds in development of viable swimming sperm cells in seed-free plants.

AGPs are produced in the cytoplasm of the undifferentiated Ceratopteris sperm cell, and deposited along the wall in a region called the extra protoplasmic matrix (Lopez-Smith, 2013). By using immuno-gold labeling to tag specific AGPs, we can see where in the developing cell these various proteins are being used. JIM13 and JIM8 have been found to be abundant in the extra protoplasmic matrix.

Physcomitrella patens is the model moss for research, and is the only seedless plant with a completely sequenced genome. Gaining new information about the development of sperm cells in land plants will provide a better understanding of the adaptations that allowed plants to move from aquatic environments to non-aquatic ones. We know that AGPs play a role in the development of sperm cells in the fern Ceratopteris; by looking at a plant that evolved earlier, such as the moss Physcomitrella, we can better understand how that evolution occurred.
Robert Higgins¹, Matt Geisler, Ph.D.², David J. Gibson, Ph.D.², Qiang Cheng, Ph.D.¹, and Jane Geisler-Lee, Ph.D.²

¹Department of Computer Science and ²Department of Plant Biology

How belowground roots behave in intraspecific competition: A digital imaging reconstruction approach

Plant competition has been studied extensively in aboveground tissue (e.g. shoots). However, the interactions of plants’ belowground tissue (i.e. roots) have rarely been studied until lately. This has been due to the factors of where plants are growing and what medium the plants are growing in. Plant roots have been studied by carefully extracting them from soil, then weighing and scanning them into images. In this process, the interaction between roots cannot be viewed. In order to observe belowground tissue in vivo without removal from the growth media, we grew *Arabidopsis thaliana* Columbia ecotype (Col) and one transformant line (in Columbia background) with green florescent protein (GFP) in transparent Magenta® boxes with the media containing 1/2 strength of MS medium plus 1 percent sugar with 0.3 percent (w/v) gellan gum. Col and GFP seeds were placed alternately. The GFP plants will turn green with an excitation illumination and a filter to help differentiate neighboring plant roots as they intertwine. Gellan gum produces an optically transparent medium for us to view and image how plant roots grow over time. Two densities were used, single plant and four plants per box. Images of the different sides of the boxes were analyzed using custom written software to visualize root density in three dimensions. In gel boxes that contained four plants, it became clear that root competition begins at a very early stage in the plant’s development. While the exact mechanisms that control these interactions are not well understood, it is clear that the plants can detect their neighbors.
In a cycling female rat, ovarian follicles produce steroid hormones under the influence of gonadotropin release from the pituitary gland. As the cycle of steroid synthesis and secretion increases, a spike in circulating estradiol drives an estrogen-positive feedback, which triggers luteinizing hormone (LH) and prolactin surges from the pituitary. As they circulate in the bloodstream, these hormones contribute to follicular steroidogenesis and luteolysis during the estrous cycle. Recent studies have supported the theory that estradiol circulating from ovarian origin also regulates the synthesis of neuroprogesterone in the hypothalamus, which is involved in the initiation of the LH surge. In order to test this theory as well as the neuroprogesterone effects on the prolactin surge, ovarectomized rats were treated with a known amount of estradiol sufficient enough to elicit the estrogen-induced prolactin and LH surges. The experimental group was treated with 50 nmol aminoglutethemide (AGT) through injection into the lateral ventricle of the brain, which inhibited the P450 side-chain cleavage necessary for steroid synthesis in the hypothalamus. Plasma samples were obtained over seven hours on the afternoon of the surge, and measured through radioimmunoassays for both prolactin and LH levels. Afternoon prolactin surges occurred in both vehicle and AGT-treatment rats, with peak values at 1500 hours. Prolactin levels tended to be lower with a delayed surge in the AGT-treatment group, although not significantly different from the vehicle-treatment group. LH levels were low and unchanged during the afternoon with no apparent surge in either the vehicle or AGT-treatment rats. These data do not support neuroprogesterone involvement in either estradiol-induced prolactin or LH surges.
Heather Huffman and Joseph L. Cheatwood, Ph.D.

Department of Anatomy

Rhox8 expression in rodent brains

The Rhox (Reproductive Homeobox X-Linked) genes have been found to transcribe translation factors that directly affect reproductive events. The Rhox genes were previously thought to have exclusive expression in the testis, epididymis, placenta, and ovaries. In these cells Rhox8 has shown high expression during the periovulatory phase eight which shows that progesterone may be a critical factor in these cells. Recent preliminary studies have shown that the Rhox8 protein is present in brain cells, showing that Rhox8 expression is likely not exclusive to reproductive cells. Sox9 expression had also been found to be expressed in reproductive cells along with brain cells. Preliminarily, we stained mouse brain tissue with antibodies against Rhox8, which resulted in labeling of cells that appeared to be neurons. Therefore, we wanted to determine if Rhox8 mRNA could be detected in rat brain tissue. Rats were euthanized, and brains were removed and flash-frozen. To study the basic expression of the Rhox8 gene in brain tissue, we extracted RNA from the rat cerebellums, and then converted the RNA to cDNA in order to run qPCR on. For the qPCR, quantitative real-time polymerase chain reaction, we will use Rhox8 forward primer 5’-ATCCCTGGGAGC ACAAAGG-3’ and Rhox8 reverse primer 5’-ACCAATTCTCCACTCTGGATTCT-3’. At the time of abstract submission, qPCR reactions are ongoing and results are pending.
Kara Hunt, Alex Nitto, Justine Gold, Jonathan Cross, and Seung-Hee Lee, Ph.D.

School of Architecture, Fashion Design and Merchandising

*Fashion M-commerce shopping behavior among college students*

M-commerce can be defined as any transactions over a wireless network (Suhong, Richard, & Hal, 2008). According to Zhang, Chen and Lee (2013), m-commerce sales have been increased from 2-3 percent to 9-10 percent during recent years. This relatively new technology will have an enormous effect on businesses, specifically the fashion industry. However, there is little research about fashion m-commerce shoppers. Therefore, the purposes of this study were to explore fashion m-commerce shopping behavior among college students, and the gender difference in m-commerce shopping behavior. We began our study by using a quantitative research approach by distributing 40 surveys to college students of all genders, majors and ages. The items for questionnaire were developed by researchers. For data analysis, descriptive statistics, and Chi-squared test were conducted. As a result, overall, 40 percent of respondents have purchased some products using a mobile device. 41.4 percent of women have done this while 36.4 percent of men have shopped using a mobile device. Also, 93.8 percent of mobile shoppers have purchased fashion items such as shoes and accessories. Females are also more willing to use their mobile devices to shop and complete purchases. Women also tend to "window shop" more often on apps as opposed to men, which can often lead to purchases. However, a considerable amount of women will "window shop" but will not buy. The most common reasons that they do not purchase over a mobile device were payment security and the inability to see the items. This is of particular importance to the fashion industry. Our findings provide evidence that fashion items are not commonly purchased through a mobile device yet, but m-commerce is slowly growing steam and advances in security will be the driving factor behind its success. Based on these results, some fashion marketing strategies for fashion m-commerce marketers will be provided.
Jasmine Jackson\textsuperscript{1} and Cynthia Sims\textsuperscript{2}

\textsuperscript{1}Department of Psychology and \textsuperscript{2}Department of Workforce Education and Development

\textit{What goes in this house stays in this house: African-American college students' views on counseling and counseling preferences}

In this research project, we will explore the reasons African-Americans are choosing to not seek counseling at the same rates of other ethnicities. We will do a quantitative study on the stigmas that are contributing to African-Americans underutilization of mental health counseling amongst college campuses nationally. In this study we will be using a sample from Southern Illinois University. The survey will ask participants who they seek for counseling and why. It will include their perceptions on all forms of counseling. We will use data from Southern Illinois University Carbondale’s Student Health Center to calculate the percentages of African-Americans that use the Student Health Center. We will then compare Carbondale’s student health statistics to nationwide college counseling statistics. The purpose of this project is to view the reasons African-Americans do not seek counseling and educate African-Americans on when to seek professional help.
Matthew Jamnik, Ernest Miller, and Alex Willis

Department of Psychology

The relationship between children’s negative affect and aggressiveness of their media preferences

This study sought to investigate the relationship between children’s media preferences and the negative affect that children exhibit. Previous research has demonstrated that frustration and aggression can go hand in hand, with the possibility of either one leading to the other (Dollard et al. 1939). Expanding on this research, the present study broadened the behaviors looked at to include other facets of negative affect and aggression, in addition to frustration.

The 5-year-old children in this study were tested as part of the Southern Illinois Twins and Siblings Study (SITSS; DiLalla, Gheyara, & Bersted, 2013). Parents rated children on externalizing problem behaviors, and children were asked to name their favorite TV shows and computer games. Following this, a 10-minute triadic parent-child interaction was recorded and coded for specific behaviors portrayed by the parent and each twin. One of these behaviors, the amount of negative affect the child demonstrated, was used in the present study.

Results indicated that children’s 5-year-old negative affect ratings were significantly correlated with their preferred video game physical aggression scores ($r(50) = .27, p = .049$) and relational aggression scores ($r(50) = .30, p = .031$), as well as with total aggression scores ($r(50) = .37, p = .007$). Interestingly, children’s externalizing problem behaviors also were correlated with their preferred video game aggression scores ($r(20) = .54, p = .01$).

These results show that children’s aggressive preferences do indeed relate to their negative behaviors and affect. Further research should explore whether negative affect plays a role in promoting aggressive behaviors in children, or if negative affect simply is related to children’s preferred levels of aggressive media. Also, it will be important in future research to determine whether negative affect leads to aggressive preferences or whether experiencing aggressive media increases negative affect in young children.
Corn fiber and bagasse of sweet sorghum are both attractive biomass feedstocks for the production of biofuels. However, in order for biofuels to be produced through the biochemical pathway, fermentable sugars in these two feedstocks need to be released effectively. For this project, we aim to identify a suitable pretreatment condition to unlock simple sugars in these two biomasses. The resulting sugars will be utilized by an oleaginous yeast strain, Cryptococcus curvatus for producing microbial lipids. These lipids can be potentially converted to biodiesel and other liquid transportation biofuels through different processes.
Films reflect society and provide insight into the life of either specific social groups, ethnic groups, or cultures. I used films that came out in theaters this year, such as *American Hustle, Monuments Men, Frozen,* and many more to study sociological research, which demonstrates how cinema is shaped by society, as well as how it shapes society. The film critiques I wrote regarding the aforementioned movies, such as *American Hustle* were read out on Southern Illinois University’s radio station, WSIU. A specific example of the research is the critique of *American Hustle,* which discusses the idea that society is inherently drawn to morally questionable characters who are not all together bad, but in fact contain a few good characteristics, much like the characters in the film. People are intrigued by the characters in the film and by that specific personality type for a number of reasons. First, seeing characters in worse situations or who are worse people in general creates a feeling of self-assurance for audience members and makes them feel like better people. It also makes people feel as though their mistakes are more widely accepted and normal since the characters perform the same if not worse errors in judgment. Finally, it gives individuals hope that they too can start from a rough past and somehow manage to become likeable, successful, good people regardless of their mistakes.
Non-native invasive species are critical to study in order to implement efficient management methods. These species pose a threat to the biodiversity of an area through detrimental competitive interactions. One aspect of competition observed in non-native invasive plant species is allelopathy. Allelopathy occurs when plants release harmful biochemicals (allelochemicals) into the soil affecting nearby native plant species. Studying the persistence of these allelochemicals in soil may provide insight to better management practices. This study focused on the persistent allelopathic effect of Japanese chaff flower (*Achyranthes japonica*) on five plant species, *Achyranthes japonica, Raphanus sativus, Andropogon gerardii, Elymus canadensis* and *Desmodium canadense*. We hypothesized that allelochemicals persisting in soil, in which Japanese Chaff flower has previously grown, will negatively affect the growth of subsequent plant species. Seedlings were grown in greenhouse or field soil subject to three soil treatments: cultured through prior growth of Japanese chaff flower, cultured and amended with activated carbon, or uncultured and amended soil. Individual plants were grown in 20cm conetainers under a 12 hour day/night photoperiod in a greenhouse. Measurements based on plant height, and number of nodes, leaves and tillers were recorded over nine weeks. The results indicate that plant growth was generally larger in the uncultured and cultured field soil compared to the greenhouse soil treatments. A significant interaction was observed between soil type (field or greenhouse) and amendment (cultured, cultured with activated carbon and uncultured) on the leaf production of *E. canadensis* ($P=0.01$) and the leaf production ($P=0.0006$) and height ($P<0.001$) of *A. japonica*. This experiment indicates the significant persistent allelopathic effects of *A. japonica* on other plant species and can provide additional insight regarding the long-term ecological effect of this invasive plant.
Rare earth element concentrations and distributions within the Illinois/Kentucky Fluorspar District

Rare earth elements (REE) are a group of 17 precious metals ranging from atomic numbers 58 to 71, and 21, 39, and 57 on the periodic table of elements. These elements are crucial to many technologies such as smart phones that we take for granted today. REE are scarcely found in deposits that are economically exploitable. One area where economic concentrations may be present is Hick’s Dome in Southern Illinois. Hick’s Dome is a dome-shaped cryptovolcanic feature found in an area known as the Illinois-Kentucky Fluorspar District (IKFD) formed by the displacement of sedimentary rocks above an alkaline intrusion at depth. The goal of this project is to analyze the fluorite mineralization within the district and calcite associated with fluorite mineralization in order to learn more about possible distribution and concentrations of REE in the vicinity of Hick’s Dome. To carry out this experiment samples were collected from five localities in the IKFD and samples from 11 other localities were obtained courtesy of the Illinois State Geologic Survey. Concentrations of REE and 46 trace and major elements were measured in 27 mineral samples from 16 separate mines using ICP-MS. We also analyzed 36 calcite samples from 13 of the localities using the Gas Bench-IRMS analysis for their carbon (d$_{13}$C) and oxygen (d$_{18}$O) isotope values using the Thermo Delta V Plus IRMS, GasBench II at SIUC. Variations in d$_{13}$C and d$_{18}$O values among samples from different the mines are interpreted to be a result of hydrothermal influence on the mineralization. The significance of hydrothermal influence on the mineralization is that these hydrothermal fluids may have carried with them quantities of REE and concentrated them in areas of the district. More research is required to better ascertain the precise temperature of the fluids during mineralization and a relationship to the Hick’s Dome geological feature.
Management techniques such as prescribed fire are frequently used to manipulate habitat for the benefit of species such as the wild turkey. In grasslands, creating habitat with high quality invertebrate resources can enhance the chance of survival for young wild turkeys. We sampled burned and unburned grassland sections in Year two post-fire during June-July 2013 using vacuum sampling techniques to assess invertebrate communities among the two differing treatments. The invertebrates were separated from the organic material in each sample and identified to Order; Family, if possible. Once identified, samples were dried and weighed to collect an overall biomass estimate for each. We used a one-way analysis of variance to test for differences in the number of unique Orders, number of unique Families, overall invertebrate count, and biomass between the two treatments. We found no difference in the number of unique Orders (P=0.5003) and no difference in the number of unique Families (P=0.509) between burned and unburned fields. We also found no difference in the count (P=0.8304) and biomass (P=0.8803) between the two fields. We can conclude that while fire is known to have the ability to increase invertebrate abundance, no evidence for an increase of invertebrate abundance was found in our burned areas. While no increase was detected, fire also showed no signs of decreasing invertebrate abundances in burned areas. Because of this finding, paired with other benefits of fire, it can still be a useful management tool for enriching grassland habitat.
Occlusive stroke is a leading cause of lasting disability in humans and often results in deficits in sensory and motor functions. Although some current treatment options exist, they have shown to be of limited success. There is still a need for a treatment option to decrease the severity of stroke and/or enhance recovery of function. Findings suggest a key, bioactive component of a soy-based diet, the isoflavone daidzein, is a potential contributor in post-stroke functional recovery. Our laboratory previously demonstrated rats treated with subcutaneous daidzein at the time of stroke exhibited greater recovery of function on behavioral tasks for two weeks following stroke. However, the longer-term outcomes of this approach are unknown. This study aims to examine whether delayed subcutaneous treatment of daidzein post-stroke is neuroprotective and contributes to enhanced recovery of forelimb use and gross motor function performance in the rat over a four week period after stroke. We hypothesized the rats receiving daidzein treatment to display enhanced recovery of function over a four week period following stroke compared to the control. Two groups of rats were trained on the skilled forelimb reaching task and the skilled ladder rung walking task to assess behavioral recovery of function. All rats were baselined and underwent a middle cerebral artery occlusion to create an ischemic stroke. Twenty four hours after stroke rats randomly received a subcutaneous osmotic mini-pump with either daidzein or vehicle. Behavioral tasks continued for four weeks post stroke. Data analysis revealed there were no statistical significance between the daidzein group and control group on either behavioral task.
Erga Lemish

Department of Psychology

*What do you want to be when you grow up? Work, meaning, and well-being*

In beginning one’s undergraduate studies at a university or college, or shortly thereafter, each student is faced with the task of choosing a specialized field of study or major. It is assumed that certain forces guide each student’s choice of major, whether they are from within or without. One such aspect is a student’s search for meaning within a certain profession. While literature in counseling psychology has mostly focused on a sense of “calling” to one’s profession, emphasizing a source of meaning outside the individual, more recent research has focused on “meaningful work,” in which a sense of meaning could be derived either internally or externally. Throughout this process, students also experience different types of motivation to engage in their work, including intrinsic and extrinsic motivation. In addition, students also vary in their experiences of overall well-being. The purpose of this study was to examine the relationship between these three factors, namely search for meaning, motivation, and well-being. It is hypothesized that students who place a higher emphasis on searching for meaning within their major and profession, and who are intrinsically motivated to engage in their work, would experience greater subjective well-being. Findings from this study may contribute to our understanding of students’ experiences within their major, and throughout the course of their higher education.
Duane J. Lickteig, Savannah E. Howe, and Vjollca Konjufca, Ph.D.

Department of Microbiology

*Immunization of the female genital tract with nanoparticles stimulates a strong humoral response*

The female reproductive tract (FRT) includes the fallopian tubes, uterus, cervix, and vagina. The immune system of the FRT is arranged to conserve a balance between the presence of commensal and potentially pathogenic microorganisms. The FRT’s immune system is regulated by different hormones that suppress responses towards spermatozoa and a distinct fetus. Thickness of mucus and overlaying epithelial cells (ECs) is also affected by hormonal regulation. We have shown that ECs of the small intestine (SI) take up small size ($\leq 50$ nm) nanoparticles (NPs). Further, these NPs can be found within the mesenteric lymph nodes soon after administration. Since ECs of the SI take up NPs, I wanted to determine if this mode of antigen uptake occurs in the FRT. Also, since there is a potential for NPs to be used as a novel delivery vector for drugs and vaccines, I sought to characterize the immune response produced by this vector. 40 nm NPs were administered intravaginally (ivag) to mice. After 40 minutes tissues were excised, snap frozen and analyzed using immunofluorescent microscopy (IMF). IMF revealed NPs in the basolateral side of the tissue near lymphatic ducts that drain to local lymph nodes. To test the feasibility of NPs to illicit an immune response, 20 nm NPs were conjugated to chicken ovalbumin (OVA) and mice were treated with this innovative vaccine system. Blood samples were obtained weekly, and serum analyzed by enzyme-linked immunosorbent assay (ELISA) for the presence of anti-OVA antibody titers. We observed significant anti-OVA IgG1 titers two weeks after the first immunization. After receiving a subcutaneous boost with OVA plus adjuvant, IgG2c and sIgA titers were increased substantially. Our results show that small sized NPs have the ability to establish an effective immune response, and are a viable option for the development of NP based vaginal vaccines.
When treating any raw water to a quality acceptable to distribute to the public, water disinfection byproducts (DBPs) will be produced to some degree. The Environmental Protection Agency (EPA) requires measurement and report of many of the various DBPs at set times, in order to ensure that the water quality is up to the standards. The concentration of the DBP’s varies depending on many factors, including temperature and system residence time (time from the water plant to the sample points). A current Master’s Degree student in the Civil Engineering Department is working on a project relating DBP concentration in the Carbondale, Illinois distribution system to system residence times. My measurements of total organic carbon (TOC) and UV254 (measurements on a UV spectrophotometer at 254 nanometer wavelength) are going to act as surrogates for expensive trihalomethane (THM) measurements – these currently cost about $50 per sample for the Carbondale Water Plant. I am collecting the samples to plot the UV254 average values over a time period at each location versus the residence time of the samples. I will compare this to the Master’s Degree students’ decay plots for haloacetic acid and trihalomethane to find correlations, if any exist. The ultimate goal of the research is to establish a more cost-effective strategy for measuring these DBPs in order to ensure that the Carbondale Water Treatment Plant holds to the EPA requirements for limiting the DBPs in distribution water.
Janna Locke

Department of Psychology

The relations between perfectionism, Type A behavior, and academic motivation in college students

The purpose of this study was to examine the relations between perfectionism, Type A behavior, and academic motivation in college students. The Academic Motivation Scale was used to measure academic motivation. The Almost Perfect Scale-revised was used to measure perfectionism. The Adolescent and Adult Type A Behavior Scale was used to measure Type A behavior. Using a sample of 108 college students, 77.2 percent of which were female and 22.8 percent of which were male, the Academic Motivation Scale, the Almost Perfect Scale-Revised, and the Adolescent and Adult Type A Behavior Scale were administered in order to examine the relations between perfectionism, Type A behavior, and academic motivation. The relations between perfectionism and Type A behavior were also examined to determine if there was an interaction between perfectionism and Type A behavior.
William M. Lyman and Derek J. Fisher

Department of Microbiology

Searching for substrates of the putative C. trachomatis protein phosphatase CTL0511

_Chlamydia trachomatis_ is a gram-negative obligate, intracellular bacterium and is the leading cause of reportable bacterial sexually transmitted infections world-wide. The developmental cycle of _C. trachomatis_ is biphasic and begins when infectious elementary bodies (EBs) enter a host cell and differentiate into noninfectious, replicating reticulate bodies (RBs). Late in the infectious cycle, the RBs differentiate back into EBs and exit the host cell through lysis. Inhibitors disrupting bacterial development would be effective for preventing and treating _C. trachomatis_ infections. Recently, it has been discovered that Ser/Thr/Tyr protein phosphorylation systems perform regulatory roles in the developmental cycles of other bacterial species. _C. trachomatis_ encodes three Ser/Thr protein kinases (two functional and one putative) and three putative protein Ser/Thr protein phosphatases including CTL0511 (PP2c phosphatase family), which is the focus of our study. We hypothesize that protein phosphorylation is used by _C. trachomatis_ to regulate differentiation and that CTL0511 is a key phosphatase in this process. In order to test this hypothesis, we are initially seeking to identify CTL0511 substrates using the _Escherichia coli_-based Bacterial Adenylate Cyclase Two Hybrid (BACTH) system. CTL0511 from _C. trachomatis_ L2 434/Bu was cloned into the suite of BACTH vectors for expression in _E. coli_. Substrate partnering was assessed by plating co-transformants (expressing CTL0511 and a potential substrate) on MacConkey maltose agar plates and observing the plates for the presence of red bacterial colonies due to fermentation of maltose (resulting from reconstitution of adenylate cyclase activity). Future work will include finding interacting substrates and characterizing those interactions.
The purpose of this study was to understand if children diagnosed with ADHD have lower levels of self-esteem compared to control children. Self-esteem levels were examined for a group of children diagnosed with ADHD and a control group. Diagnoses were confirmed through previous diagnostic interviews conducted by Dr. Michelle Kibby. There were 157 participant children total, while 85 participants were diagnosed with ADHD and 72 participants were controls. Children ranging in age from eight to 12 years were used for this study, with a mean age of 9.63 years. Self-esteem was measured using the Self-Esteem Index (Brown & Alexander, 1991). Three types of self-esteem were measured for this study: academic competency, peer popularity, and family acceptance. It was hypothesized that children diagnosed with ADHD would have lower self-esteem scores on all three measurements of self-esteem than control children. It was expected that children with ADHD would have lower peer popularity levels, family acceptance levels, and academic competency levels compared to control children. A MANOVA using the Wilks’ criterion demonstrated that self-esteem measures differed significantly between ADHD and control groups.
Levitation, in popular culture, is the phenomenon of a person or thing rising into the air by apparently supernatural means. However, levitation is not the work of anything supernatural, nor do you have to attended Hogwarts School of Witchcraft and Wizardry in order to learn how to achieve it. The goal of my project is to find a way to levitate a neutral, anisotropically polarizable atom, over a dielectric ring in a vacuum using the laws of Casimir physics. Due to vacuum interactions, the atom practically acts as dipole and because of this, it is said that two neutral materials (the atom and the ring) would attract each other. This is what is known as the Casimir effect. Astonishingly, researchers recently discovered that there are few instances where the Casimir effect can give rise to a repulsive force between these two uncharged objects, such as when a hole or a sphere appears. The magnitude of repulsion in this specific instance relies solely on the radius of the hole, and if the object exceeds over a certain distance from the hole it then goes back to being attractive. So this means a stable point can be reached at a certain height that, as stated earlier, is defined by the radius of the hole, making the levitation of the atom and ring seem possible. However, even though it is stable in the Z direction, it is not in X and Y direction and can easily fly off. I believe that if one can spin the atom, just as if you spin a toy top on a table, it can achieve stability in all directions, thus levitating. Our goal is to prove this very appealing hypothesis analytically.
Lea Matschke, Travis Neal, and David Gibson, Ph.D.

Department of Plant Biology

Is a native fungus a viable biocontrol for the invasive species *Microstegium vimineum*?

*Microstegium vimineum* (Japanese stiltgrass) is an invasive, exotic woodland grass present in about 22 states. It competes against native plants by establishing a long-lasting ground cover and repopulates rapidly from the seed bank. Additionally, after a population of stiltgrass has thrived in an area, the plants alter the pH level of the soil, making restoration of the natural habitat challenging. However, the fungus *Bipolaris sp.* has been observed to infect some populations in Southern Illinois. The objective of this laboratory experiment was to determine whether *Bipolaris sp.* could be used as a possible biocontrol for Japanese stiltgrass. By collecting seed from infected and uninfected populations and treating seedlings grown in containers with ground-up leaf samples (thatch) from each, the effects of *Bipolaris sp.* on Japanese stiltgrass can be observed quantitatively. Experimental treatments included stiltgrass seed source (from an uninfected and an infected population) and stiltgrass thatch (infected thatch added to the soil surface, uninfected thatch added to the soil surface, and no thatch on the soil surface). The height of stiltgrass seedlings were measured daily during their growth, and the biomass of the plants measured at the end of the experiment. If *Bipolaris sp.* from infected thatch can be transmitted to Japanese stiltgrass, then plants exposed to the fungus should demonstrate slower growth than plants not exposed to the fungus.
Traumatic brain injury (TBI) is one of the leading causes of acute and chronic disability in the United States. Out of the 1.7 million Americans that endure a TBI each year, about 257,000 are hospitalized. Isoflavones have been shown to improve recovery of function in animal stroke models by acting on the estrogen receptor (ER), antioxidant activity, as well as, other various anti-inflammatory and anti-apoptotic proteins, such as Arginase 1. Although isoflavones have seen success in stroke research, there has been a paucity of isoflavone research in TBI models, despite the similarities in secondary cellular damage between stroke and TBI. The present study evaluates the potential therapeutic effects of administrating the isoflavone, daidzein, and hypothesizes that the daidzein administration will assist in the recovery of function following TBI.

Thirty-one male rats were given a bilateral, frontal controlled cortical impact (CCI) and separated into sham (craniotomy without injury), vehicle (injury without drug) and drug (injury with drug) groups. Osmotic pumps for the drug group delivered daidzein at 0.5µl/hr for two weeks. The sham and vehicle pumps delivered a DMSO/saline solution at 0.5µl/hr for two weeks. The animals underwent a battery of motor and cognitive behavioral tasks to assess recovery of cognitive and motor functions. Lesion volume was also assessed to measure the amount of brain mass that was lost due to injury. Rats given the daidzein treatment showed no significant improvements in any of the behavioral assessments or in lesion volume; however, rats in the drug group did out perform vehicle group in the Morris Water Maze (both reference and working), grid and passive avoidance tasks. Future studies should consider concentrating behavioral tasks to either motor or cognitive. This amendment to the current study could yield more significant behavioral results.
It has been hypothesized that action video game players (AVGPs) have an enhanced capacity to learn the properties of tasks relative to their non-video-game-playing counterparts (NVGPs). The current study sought to behaviorally examine this “learning to learn” hypothesis (Green, Pouget, & Bavelier, 2010) using a statistical learning paradigm. Self-reported AVGPs and NVGPs were tested on a serial reaction time (SRT) task under two conditions, one in which the statistical properties of a stimulus location predicted future stimulus locations, and another where stimulus location was randomly determined. Results indicated that AVGPs and NVGPs had similar reaction times (RTs) when responding to stimulus location at the beginning of the experimental task, but the AVGPs’ RTs decreased more rapidly than RTs of NVGPs. Both groups saw a significant increase in RTs when transferring from non-random to random location conditions. Additionally, the validity of the video game play self-report measure was assessed by comparing actual video game performance between AVGP and NVGP groups, and AVGPs were found to perform significantly better than NVGPs. The findings further support that AVGPs have an enhanced ability to learn new tasks, and that this enhancement is not solely due to differences in attentional ability between the two groups.
Ernest Miller, Matthew Jamnik, and Lisabeth F. DiLalla, Ph.D.

School of Medicine

Examining the relationship between DRD4 gene polymorphisms and emotion recognition skills in children ages six to 10

Our study sought to investigate the relationship between variation in the gene which codes for dopamine receptor D4 (DRD4) and the emotion recognition skills of children. The DRD4 gene has a variable number of tandem repeats, between 2 and 11. Variations of the DRD4 gene have been correlated with emotional reactivity, externalizing behavior in the presence of parental insensitivity, and novelty seeking (Bakermans-Kranenburg & van Ijzendoorn, 2006; DiLalla et al., 2009; Oniszczenko, & Dragan, 2005). We sought to examine whether DRD4 variants were related to children’s emotion skill behaviors.

Buccal cells of children aged six to 10 years (mean=8.15, sd = 1.5) were genotyped to determine DRD4 allele type and grouped according to whether they possessed one or more copy of the long allele of the gene with six or more repeats (6+), or only the short allele of the gene (6-). Emotion recognition skills were tested using a computerized test featuring children displaying happy, sad, angry, or fearful expressions.

Results showed that 6+ children were significantly more accurate in interpreting overall facial expressions when compared to 6- children ($t(56)=2.10, p=.040$). Out of the 16 pictures each child was asked to identify, 6+ children made a mean of 3.96 errors (sd=2.83), whereas 6- children made 5.40 errors (sd=2.08).

The DRD4 long allele has a lower binding affinity for dopamine than does the regular allele, so more dopamine to generate the same response in long allele individuals versus those with the short allele. Dopamine plays a primary role as a chemical messenger for the brain regarding pleasure motivated behaviors, including social skills. One explanation for our findings may be that 6+ children have become more capable of accurately interpreting facial expressions in order to experience the same level of reward from social situations as their short allele peers.
Martisia Mitchell\textsuperscript{1} and Royce Burnett\textsuperscript{2}

\textsuperscript{1}Department of Agribusiness Economics and \textsuperscript{2}School of Accountancy

\textit{Anti-embezzlement effective controls: A study of key red flag indicators in embezzlers’ profiles}

The purpose of this research is to develop a framework to identify and assess white collar crime and how it affects society as a whole. Specifically, this project focuses on embezzlement, which is the act of wrongfully appropriating funds that have been entrusted into your care but which are owned by someone else. It is an external failure which leads to high costs and less trust within the company; ultimately affecting the value of the firm as a whole. This research helps alleviate some of these potential problems by pointing out key indicators of individuals who may participate in fraud. Twelve years ago, an email inbox was created that sends a google alert notifying us whenever an act of embezzlement is reported. The ultimate goal of this research is to use this inbox in order to collect, analyze, and compare the key indicators in each fraud case, thus allowing firms to use these key indicators to generate controls that will be able to identify these red flags in the future, in order to correct them.
Interest in alternate energy sources as a replacement or supplement to traditional fossil fuel is growing in popularity. The main drivers of this interest are the current cost of fossil fuel energy and the impact of carbon dioxide (CO$_2$) emission, a byproduct of fossil fuel use, on global increase in temperature (global warming). In my undergraduate paper, a funded undergraduate green project is presented. The aim of the project was to design, construct and test a bio-digester heater that was monitored remotely via wireless sensor network technology. The energy (heat) generated by the decomposition of organic materials contained within an apparatus, commonly referred to as a bio-digester, was monitored and recorded. The bio-digester was designed to capture that thermal energy and release it into an enclosed space such as a room (living area) as a means of climate control. An empirical study was conducted to determine the effectiveness of the bio-digester heater based on rate of heat generation. The results of our studies suggest that this approach could be adopted on a wide-scale basis for residential homes. Optimizing the heat energy output of a bio-digester heater system could lead to a revolution in sustainable heating that would reduce the carbon footprint of our society, and extend the lifespan of the world’s fossil fuel reserves. The systems can also provide an alternate means of disposal for organic waste, which will extend the lifespan of landfills.
Bridget Munoz and Ruth Anne Rehfeldt, Ph.D.

Rehabilitation Institute

Effects of multiple exemplar instruction on the emergence of derived relations in children with developmental disabilities

A typically developing individual will develop and expand their verbal repertoire with novel derived relations fairly early on in their childhood. The average verbal repertoire typically encompasses the ability to label objects, people, and events. While these capacities are vast amongst a typically developing community, individuals with developmental and educational delays may not always successfully demonstrate the emergence of equivalence with the components of verbal behavior. This investigation sought to examine the effects of multiple exemplar instruction on the establishment of derived tact (labeling) relations in three children with documented developmental disabilities. This study explored whether or not an emergent verbal repertoire could be established through the training of multiple exemplars. More specifically, we examined the participant’s ability to correctly emit novel responses in the form of labeling stimuli that were not directly taught. The stimuli that were used in this study included pictures of constellations that were randomly selected for use during trials. This study will replicate the methodology and expand upon previously published literature on the application of multiple exemplar instruction. Ultimately, the overall objective of this study was to determine whether or not multiple exemplar instruction is effective in promoting a crucial component of the speaker element of verbal behavior in a population in which this ability is not necessarily sufficiently developed. Results will offer important implications towards the application of multiple exemplar instruction as a behavior analytic procedure.
Our research project set out to answer questions about the cost of higher education and inquire about related student perceptions. We learned that over the last 30 years the cost of higher education had increased more than any other sector of the economy. The primary reason for the increased cost is due to cuts in public funding. Decreases in incoming revenues have forced policymakers to make tough choices. Many public institutions are unable to balance their budgets and have left higher education behind other pressing social requirements. We found that most experts agree that higher education plays a significant role in enriching our society. Higher education provides an avenue for citizens to become informed participants in our democratic institutions and strengthen our democracy. Education provides businesses with skilled professionals and innovators that are the pillars of our economy. Most of all, our universities arm our citizens with the critical reasoning skills that create conscientious actors within our civil society. In our survey study we learned that two very important issues had a huge consensus among the surveyed students. The first was that students overwhelmingly agree that our citizens should have access to education regardless of their financial status. Secondly, students overwhelmingly agree that higher education is in the national interest and should be funded mostly by the public. Finally, we found that a significant number of students did not know that the price of education was considerably higher today than it was 30 years ago.
The purpose of this investigation is to aggregate data from services provided to families at the Center for Autism Spectrum Disorders (CASD). We examined a database of usage at CASD over the past five years to calculate the following: frequency counts of usage by county, average age at referral, frequency counts of different referral sources, and average age of diagnosis. This information was compared with national data on referral sources, average age of diagnosis, and wait times between referral and diagnosis. The data indicated a total of 32 counties served by CASD; Williamson, Jackson, Franklin, Jefferson, and Saline were the most frequently utilized counties. Out of the 116 children diagnosed over the past five years, the age of diagnosis has gone down from 62.64 months during years 2009-2010 to 60.06 during years 2011-2013, just below the national average of 61 months (Rutter, 2006). Physicians make up the largest referral source with a total of 393 referrals out of 900 referrals. Other frequent referral sources included child protective services, family friends, and websites. The wait time between initial screenings and conclusive diagnostic evaluations was 4.42 months over the five year period. Once again, the trend is going down over the years at CASD from 5.29 months during 2009-2010 to 3.71 months between 2011-2013. Results indicate CASD is a regional center serving a large geographical portion of the state of Illinois and is used as a frequent resource in Southern Illinois. CASD reflects national data regarding average age at diagnosis and efforts to decrease the length of time between screening and referral is improving. Efforts to increase awareness of autism spectrum disorder among medical providers is reflected in the frequency of physician referrals. This information will be utilized to describe service provision to pertinent agencies.
The tide of sustainability has increasingly inched its way into many areas of life. Sustainability has become an important aspect across the world as environmental concerns have increased. A major factor of a sustainable environment and city is to create efficient buildings and homes. As reducing energy consumption and carbon footprints have become prevalent in design structures, a new building has arisen; a net zero energy building. Net zero energy buildings produce the same amount of energy that is consumed on the site. Their energy footprint has become invisible. Net zero energy buildings are created through efficient appliances, energy systems, and heating and cooling systems, as well as through the use of reusable water systems, solar power and other renewable energy sources, and simply by reducing the amount of energy used in a building. With the construction of net zero buildings, professionals have begun to develop and to experiment with net zero cities by creating a fully eco-friendly environment for hundreds of thousands of people through the use of net zero buildings, as well as renewable energy, economic transportation, and other related areas. As designers, architects create a sustainable, efficient environment for people to be simulated and emboldened to create a sustainable lifestyle for themselves in a conscientious way. Therefore, net zero buildings are significant for creating a sustainable environment. A net zero energy building has become the pathway to net zero carbon buildings that will grow into net zero cities which may pave the way to a future of a net zero world.
Alzheimer’s Disease (AD) is the primary cause of dementia in elderly. AD has two primary features: severe memory impairments and brain neuropathology that includes amyloid plaques and neurofibrillary tangles composed of hyperphosphorylated tau protein. The cause of AD is unknown. Diabetes impairs glucose utilization and is considered a risk factor for AD. Glucose utilization is known to decline in brain regions associated with memory in AD patients. The goal of our project was to determine whether experimentally-induced diabetes would exacerbate memory impairments or brain neuropathology in a transgenic mouse model of AD. 3xTg mice contain human genes that cause plaques and tangle deposition in memory-associated brain regions in an age-related manner. Diabetes was induced in 13-month old 3xTg mice using streptozotocin (STZ; 90 mg/kg on two successive days), a drug that selectively destroys insulin-producing pancreatic beta cells. Hyperglycemia was verified by sampling blood glucose levels. Mice that received STZ injections maintained high blood glucose levels throughout the study (>250 mg/dL), in contrast to mice that received vehicle injections (<120 mg/dL). Three months after injection, all mice were trained in the Morris water maze, a test of hippocampus-dependent spatial learning. After behavioral testing was completed, brain immunohistochemistry was performed to assess amyloid plaque accumulation. STZ-treatment did not significantly worsen learning or memory in the Morris water maze compared with control mice. However, STZ-treated animals showed significantly more amyloid plaques in the subiculum, the only hippocampal region where plaques were seen in either group. These results indicate that amyloid plaques, per se, are not sufficient to cause memory impairments. Further, while diabetes can enhance this aspect of brain pathology, the combination of disrupted glucose metabolism and the transgenes is still not sufficient to cause the cognitive impairments typically associated with AD.
David Palm, Matt Geisler, Jane Geisler-Lee, and David J. Gibson, Ph.D.

Department of Plant Biology

*How aboveground shoots behave in intraspecific competition*

In most natural conditions plants are in constant competition for resources, not only with members of other species but with members of the same species as well. Knowing how plants behave in response to other members of the same species is crucial to our understanding of intraspecific competition among plants. This study was conducted to determine the aboveground growth response of the Columbia (Col) and Wassilewskija (LWs) ecotypes of *Arabidopsis thaliana* under competitive conditions in a growth chamber. A single plant of each ecotype was planted in the center of a pot either by itself, or surrounded by four plants of the same ecotype or two plants of the LWs ecotype and two plants of the Col ecotype. The plants which shared the same pot were in competition for resources such as light, water, nutrients, and space. The rosette diameter of each plant was measured. Two-way repeated measures mixed model analysis of variance (ANOVA) showed that by 32 days after planting (DAP), the center plants grew to be larger when surrounded by the LWs ecotype than when growing alone or when growing in the presence of the Col ecotype, regardless of which ecotype was grown as the center plant. These results seem to suggest that the Col ecotype is the more competitive of the two ecotypes and that the LWs ecotype is more likely to "back off" in the presence of members of the same species.
Jaclyn Parks

Department of Microbiology

Characterization of cell populations involved in the uptake of intra-vaginally administered small-sized nanoparticles

The female reproductive tract (FRT) includes tissues of the Fallopian tubes, uterus, cervix and vagina. The FRT is covered by distinct epithelial cell layers, with the vaginal tract being lined with a protective stratified squamous epithelial layer and the endocervix and uterus being covered by simple columnar epithelium. Dr. Konjufca’s research group has shown that epithelial cells (IECs) of the small intestine (SI) take up small-size (<50 nm) nanoparticles (NPs). Furthermore, these NPs appear in mesenteric lymph nodes (MLNs) within minutes of administration. The potential for NPs to be used as novel delivery vectors for drugs and vaccines has led to growing interest in characterizing the immune responses to these substances. To test the feasibility of NP transport across the vaginal wall, 20 and 40 nm NPs were administered intra-vaginally. Within one hour, NPs are found within the vaginal tract tissue, regional lymph nodes, and the MLNs. The Konjufca group has also shown that NPs conjugated to the protein Ovalbumin (Ova) have the ability to induce substantial antibody titers against Ova, suggesting that intravaginal immunization using small-sized NPs can establish effective immunoglobulin responses in the female genital mucosa. Further delineating the uptake and transport of NPs by vaginal mucosa will be vital for NP-based vaccine and drug delivery possibilities, as well as characterizing methods of entry by viruses in the FRT. I will be using immunofluorescent staining and microscopy techniques to further characterize the cell populations involved in the uptake of small-size NPs (<50 nm) within the FRT. I will also determine which cells are involved in the transport of NPs to deeper lymphoid tissues and lymph nodes.
It is necessary for children living near the New Madrid Seismic Zone to be properly educated about earthquakes in order to be prepared for a future catastrophe. A mixed methods explanatory approach to collect qualitative data and quantitative pre and post-test data was initiated to assess earthquake knowledge gained from different educational interventions. A total of 244 children from sixth and seventh grades in a middle school located in Southern Illinois completed a content and opinion pre-test, then they were instructed using a presentation, video, both, or neither. Afterwards, each student completed a post-test, identical to the pre-test. All interventions resulted in an increase in general, local, and preparedness earthquake knowledge scores. Children exposed to both interventions scored the highest on the post-tests compared to only one or no interventions. A combination of both interventions also resulted in an increased response in confidence of earthquake readiness and higher correct responses to safe practices. There was no significant difference between scores for gender or grade level. The final results suggest middle school children gain the most knowledge of earthquakes and confidence in readiness and safe practices through a combination of an educational lecture based presentation and an informative safety video.
Comparing nest site characteristics for Southern Illinois lagomorphs

Swamp rabbits (Sylvilagus aquaticus) and eastern cottontails (S. floridanus) co-occur along the Cache River in Southern Illinois. Swamp rabbits are bottomland hardwood specialists, whereas cottontails use a variety of early successional habitats. Here, we examine differences in structural and compositional components of nest sites used by swamp rabbits and cottontails at two bottomland sites along the Cache River. We located 92 daytime resting sites (0800-1500 hr) for 15 radiocollared rabbits (n = 9 swamp rabbits, 6 cottontails) from 09 June-18 November 2013. We recorded UTM coordinates of each location and returned <1 week to sample vegetation in 20x20 m plots centered on the rabbit’s location. At each location, we walked three parallel transects of ~20 m and recorded cover (shrub, grass, log, bare ground, or herbaceous) and number of understory and overstory trees. We estimated basal area and percent canopy closure from the center of the plot. We measured visual obstruction 10 m away from the center in all four cardinal directions using a 1.5 m Robel pole. We used generalized estimating equations with a binomial response variable (species) to evaluate the importance of plot characteristics in SPSS. We excluded variables that were highly correlated with one another (r ≥ 0.70) and evaluated variable importance using quasi-likelihood model selection. Our models suggest that canopy, grass, and herbaceous ground cover were important predictors of species. Swamp rabbits were more likely to be in areas with high canopy closure ($\beta_{SR} = 2.67 \pm 0.84$ (SE)), a higher proportion of herbaceous cover ($\beta_{SR} = 4.41 \pm 1.69$), and lower proportion of grasses ($\beta_{SR} = -5.68 \pm 1.68$). Our results suggest that these two species have differential resource use where they co-occur. Management strategies that preserve early successional forests, grassland, and canopy gaps within mature stands may benefit both species where they co-occur.
For more than three decades, the importance of brand loyalty has been recognized in the fashion industry. Brand loyalty is an important marker because it leads to marketing advantages when loyal consumers repeatedly buy the same brand (Assael, 1998). Brand consciousness is having a high awareness of brand names. Face consciousness is being aware and affected by others’ opinion of oneself. Thus, it would be very meaningful to investigate fashion brand loyalty with regard to brand consciousness and face consciousness among young consumers. The purpose of this study is to examine the differences in brand loyalty, brand consciousness, and face consciousness among college students, and the differences these three variables have among male and female college students. We surveyed 40 college students (20 male and 20 female) on a 1-5 Likert scale based on how brand conscious, face conscious, and brand loyal they were. For data analysis, descriptive statistics, correlations, reliability, and t-test were conducted. Cronbach’s alpha for each scale ranged from .68 to .94. In doing so, we found a significant correlation between brand consciousness and face consciousness. People who were highly brand conscious were also highly face conscious. Also, we broke this down between males and females and found that women were more brand conscious as well as face conscious and that males had a higher brand loyalty. Results also showed that men were more willing to pay a higher price for brand name apparel than women and that they were also more highly brand conscious. To further investigate our findings, we looked into the differences of this subject between Caucasian and African-American students. Results showed that African-American students had a higher brand loyalty but were less brand conscious and that Caucasians were more face conscious. Based on these results, fashion brand marketing strategies will be provided.
Secernin 1 is a cytosolic protein that has been researched as a possible drug target for the treatment of various cancers. Secernin is involved in the secretion of histamine by mast cells; it is known to increase the degree of exocytosis which plays an important role for mast cells; it is also known to function in protease activity, which means it has the ability to cut other proteins to smaller sizes. Lastly, it has been observed that secernin increases the sensitivity of mast cells to calcium ion concentration. In order to have a better understanding of the mechanisms regulating the functions of secernin, it is essential to determine the 3-dimensional structure of the protein. As a prerequisite for structural investigation by the methods of either NMR (nuclear magnetic resonance) or X-ray crystallography, it is necessary to obtain relatively pure protein samples. To this end, we have performed molecular cloning of secernin (cloning means the insertion of a DNA encoding the secernin protein into a protein expression plasmid vector) and successfully expressed the protein in bacterial cells. We will purify the soluble secernin protein by using affinity chromatography. In this process, the His-tagged secernin will bind to the Ni ion that is immobilized in a resin. The bound secernin will be eluted with 200 mM immidazole. Then the His-tag will be removed from secernin by protease cleavage. After the secernin protein is purified, we will concentrate the protein in a solvent containing 25 mM Tris-HCl (pH 7.5) and 200 mM NaCl, to a final concentration of approximately 10mg/ml. We will then perform crystallization trials of the concentrated protein sample using several hundreds of different crystallization buffers (various pHs, buffers, and salts). We hope that we will be able to crystallize the protein and determine its structure by X-ray crystallography.
Occlusive stroke is a leading cause of lasting disability in humans, often resulting in permanent deficits in sensory and motor functions. In the past few years, our lab has verified the ability of soy protein-based diets to decrease the severity of post-stroke behavioral deficits when provided before the onset of stroke. The isoflavone daidzein has been shown to be an essential component of the soy protein-based diet, as preliminary data has shown it has neuroprotective capabilities. However, to this point, daidzein’s precise mechanism of action is not well understood. The ability to provide delayed treatment after the time of stroke injury is highly desirable. In an attempt to determine daidzein’s efficacy in this area, this study examined daidzein application via an osmotic mini-pump as a post-stroke treatment to reduce neuronal degeneration after stroke in rats. Specifically, brains were cut at 50µm and processed via fluorojade C staining to reveal degenerating neurons around the lesion site as well as lesion volume. Brain sections were digitized using a Nikon Super Coolscan 5000 ED, and statistical analyses were performed using Prism 6 for Windows. All portions of the study were completed in a blinded fashion, including behavioral evaluations, surgeries, and analyses of fluorojade C positive neurons. Importantly, although final results are pending, the information found in our study will provide useful information to aid in future studies aimed at understanding how daidzein is neuroprotective following stroke and how it may be used to enhance recovery.
Julianna Richie¹, Jacob D. Huffstutler¹, Milinda Wasala¹, Andrew Winchester¹, Sujoy Ghosh¹, Swasik Kar², and Saikat Talapatra, Ph.D.¹

¹Department of Physics, Southern Illinois University Carbondale, and ²Department of Physics, Northeastern University, Boston, Massachusetts

Synthesis and electrochemical characterization of liquid phase exfoliated graphene flakes

The results of the synthesis and characterization of graphene nanoflakes using a liquid-phase exfoliation technique will be presented. The sample was prepared using bulk graphite in isopropanol alcohol (IPA). These flakes were characterized through the use of ultraviolet-visible (UV-VIS) spectroscopy, transmission electron microscopy, cyclic voltammetry (CV), electrical impedance spectroscopy (EIS), and galvanostatic charge-discharge. The samples were also deposited onto teflon membrane filters through vacuum filtration and used to fabricate electric double-layer capacitor (EDLC) electrodes.
Devon Ruhde, Dagong Ran, Matthew Schrock, Reza Habib, and Sarah Kertz

Department of Psychology

A review of empirically supported treatment components in iPhone apps for anxiety

Technology is exponentially growing, taking the field of mental health with it. As a result, a number of smart phone applications have been developed, purportedly to help decrease symptoms of worry and anxiety. However, very few of these applications have been studied empirically. There are currently no standards for the provision of behavioral health interventions via smartphone applications and such apps may contain inaccurate information or interventions that are not evidence based. Thus, the goal of the current study was to review the currently available iPhone apps targeting worry and anxiety to examine the extent to which empirically supported treatments are represented.

Using the search terms “anxiety” and “worry,” 566 iPhone applications were found via the iTunes store. A coding scheme was developed based on empirically supported treatment components for generalized anxiety provided by the American Psychological Association Division 12 Society of Clinical Psychology (www.psychologicaltreatments.org). Preliminary process excluded non-free apps, n=384, and n= 160 apps that were clearly irrelevant to worry or anxiety, (i.e. Curing Dog Anxiety). All the remaining apps were coded based on a list of 10 criteria (as shown in the table), and each app were given either 0 (not consistent), or 1 (strongly consistent) for all criteria. In addition, we assigned each app an overall recommendation rating of 0 (not recommended), 1 (recommended with hesitation), or 2 (highly recommended) based on its consistency with empirically supported treatment methods and overall usability.

Present findings suggest that, as technology continues to grow, more research will be needed to determine the effectiveness of smartphone apps for reducing symptoms and how these applications can be utilized in therapy.
Allison Rump and Vjollca Konjufca

Department of Microbiology

The intra-vaginal uptake and transport of small-sized nanoparticles to regional lymph nodes

The female reproductive tract (FRT) includes tissues of the fallopian tubes, uterus, cervix and vagina. Distinct epithelial cell layers cover the FRT, with the vaginal tract being lined with a protective stratified squamous epithelial layer and endocervix and uterus being covered by simple columnar epithelium, which is also found covering other mucosal tissues, such as the small intestine (SI). We have recently reported that epithelial cells (ECs) of the SI take up small size (<50 nm) nanoparticles (NPs). Furthermore, these NPs appear in mesenteric lymph nodes (MLNs) within minutes of administration. Lymph nodes are highly organized tissues that occur when two or more lymphatic vessels converge. They contain populations of both T-cells and B-cells, meaning that humoral and cell mediated immunity occur at these locations. Since we have previously shown that the transport of NPs to lymph nodes does occur, we aimed to determine the uptake and transport of NPs after intra-vaginal immunization under physiological conditions. For these studies we use fluorescent NPs as a model particulate antigen. We have intra-vaginally immunized C57BL/6 mice with 20 and 40 nm NPs and assessed the uptake of NPs and their transport to the draining lymph nodes. We find that within one hour of administration, NPs have crossed from the lumen to reside within deeper tissue regions of the FRT. Furthermore, NPs are transported to regional lymph nodes, as well as the MLNs, which drain the SI. Further characterizing the uptake and trafficking of the NPs will be important to understand the physiological uptake of particulate antigens in mucosal tissues, such as the FGT. This will allow us to better understand the pathogenesis of small-sized viruses and to design mucosal vaccines and therapies.
Christine Ryder

Department of Psychology

Faking the implicit relational assessment procedure examining ideographic relationships

The following study aims to examine the effects of instructing participants to “fake” their performance on an ideological Implicit Relational Assessment Procedure (IRAP). The IRAP is a computer task, similar to the Implicit Assessment Test, which uses latency and accuracy measures to determine implicit relationships and biases. 57 participants were given instructions and practice on how to complete an IRAP. Consistent blocks required participants to respond to a name of someone who they view positively with positive words and a name of someone who they view negatively with negative words. The inconsistent blocks required participants to respond to the opposite pattern. There were three conditions, two of which participants were given instructions on how to “fake” their responses during the second and/or third IRAP. The other condition was a control group, in which no faking instructions were given. In previous research, faking instructions given to participants for the Implicit Association Test (IAT) was successfully faked. However, previous research of providing faking instructions to participants for the IRAP did not lead to significant results. The results of this study have shown that faking the IRAP, with this study’s instructions, was significant. The implications of this study were to demonstrate that if the IRAP can be faked, that it can lead to difficulty administering this measure in the criminal justice field.
Tapiwa Saliji and Meera Komarraju, Ph.D.

Department of Psychology

*Is Tyrone’s mistake worse than Brad’s? A study on perceptions on leadership qualities of leaders based on their race/ethnicity*

The basis of this research is to further explore the current issues that surround diversity and leadership with a specific focus on race/ethnicity and type of job performance on perceptions of leadership qualities. These issues can reinforce the glass ceiling effect and stereotypes toward race/ethnicity in leadership roles. Stereotypes about race/ethnicity can continue to influence the perception of individuals in leadership roles and this can be problematic to an organization.
Kelly Schmidt and Buffy S. Ellsworth

Department of Physiology

The role of FOXO1 in pituitary development at e16.5

Pituitary hormone insufficiency occurs in approximately one of every 4000 live births. Our goal is to understand how different gene mutations may contribute to pituitary hormone insufficiency. Forkhead transcription factors are present in various tissues in the body, including the brain, vasculature, ovary, heart, and pituitary. They aid in development of various organs in the body. FOXO1 is necessary for normal development and function of several organs. An embryo lacking FOXO1 in the vasculature will terminate around embryonic day (e)10.5, which is approximately half way through development. FOXO1 is also found in the pituitary gland. Its role in the pituitary gland is not understood. The pituitary is responsible for controlling hormones throughout the body. FOXO1 controls cell proliferation, cell specification, and development in several tissues. In order to assess the requirement for Foxo1 during pituitary development, we are currently studying mice in which the Foxo1 gene has been deleted in the pituitary gland. We found that growth hormone production is delayed in e16.5 embryos lacking Foxo1 in the pituitary gland. These experiments will help to determine the role FOXO1 plays in the pituitary gland at e16.5. By better understanding FOXO1’s role in the pituitary, specifically its effect on specification of cells into growth hormone cells and proliferation, we will be able to provide information that will help humans with various hormone-related ailments.
The Implicit Relational Assessment Procedure (IRAP,) is a relatively new measure of implicit cognition that provides some advantages over existing implicit measures such as the Implicit Associations Test. Most of the existing data with the IRAP has involved nomothetic stimulus presentations, and the possible advantages of an ideographic approach have been unexplored. In the current study, participants were given paper measures in which they provided two names of people they personally know. One name was of a person the participant regards positively, and the other name was of a person the participant regards negatively. These names were then used in the IRAP, along with other preselected evaluative words. Participants engaged in this IRAP and a nomothetic IRAP containing the names Adolf Hitler and Abraham Lincoln. Along with the IRAP, we also administered various self-report measures including measures of regard for Adolf Hitler, Abraham Lincoln, and the positively and negatively regarded names provided by participants. We examined the data for any possible differences in the direction and magnitude of implicit biases between these two IRAPs. We also analyzed the relationship between the self-report measures and the IRAPs. Our results reveal modest differences between the ideographic and nomothetic approaches and suggest future directions in this line of research.
Megan Schwarzinger, Elliott Zieman, and F. Agustin Jiménez, Ph.D.

Department of Zoology

*Pathological effects of Cytaxzoon felis in the bobcat, Lynx rufus*

*Cytaxzoon felis* is a tick-borne apicomplexan that infects wild and domestic felids. The parasite is able to infect mononuclear phagocytes where feeds and undergoes cell division (schizogony). In domestic cats schizogonyous cells induce splenomegaly due to enlarged size and therefore obstruction of capillaries. The disease is transmitted through the lone star tick (*Amblyomma americanum*). Both the lone star tick and bobcat are abundant in Southern Illinois yet there is no information about the prevalence of this parasite in bobcats of Illinois. The objective of the current study was to determine the prevalence of *C. felis* in the bobcat population of Southern Illinois, and screen for their presence in mononuclear phagocytes. In order to show that this parasite causes pathological effects on bobcats, previous spleen samples of were collected for the screening of this parasite. Polymerase chain reaction using primers specific to *C. felis* were performed to confirm if the parasite was present in the spleen. Approximately 67 bobcat samples were screened for the presence of the parasite via PCR. The parasite was found in 70 percent of examined bobcats. The results suggest that this parasite is very common in Southern Illinois and the disease may pose a high risk for outdoor domesticated felines.
This project focuses on the application of semiotics to the interpretation of music from the classical period. Through semiotic analysis, the deeper structures and patterns within the pieces studied become clearer and more meaningful. To a performer, semiotics lends significance to each figure on the page. This significance is first divined through thorough harmonic and formal analysis of the piece. These factors determine the identities of each individual motive, which are characterized by a letter or number. In turn, these signs are organized in a semiotic chart, which documents the contour and modulations of the music within a piece. Once completed, the semiotic chart gives musicians and amateurs alike the means to follow the course of the given musical work. As a result of this project, a number of semiotic charts have been produced for future submission to OpenSIUC. In addition, this course of study in semiotics is proven to strengthen the student’s proficiency in music theory and performance.
Erin Scott\textsuperscript{1} and Melinda Yeomans\textsuperscript{2}

\textsuperscript{1}School of Social Work and \textsuperscript{2}Center for Inclusive Excellence

Challenging stereotypes about female athletes and the culturally prescribed forms of femininity

The research will be a study the different stereotypes experienced by female athletes at Southern Illinois University Carbondale’s campus. It will examine the issues surrounding why, how and for what reasons females are stereotyped when playing sports. The study will be an investigation of the culturally prescribed norms of femininity and reasons why female athletes are stereotyped and will help investigate different norms stereotypes and experiences of women athletes on the SIU campus, including how these particular women athletes challenge and confront these stereotypes on a daily basis. Through this project we would like to raise consciousness and provide a new perspective on how stereotypes affect the lives of female athletes, their self-esteem when dealing with stereotypes, and how these stereotypes might be challenged through extending the performance and definition of femininity to include women's athleticism as empowerment.
The purpose of this experiment is to examine eastern newts (*Notophthalmus viridescens*) and their input of energy into a pond via egg laying. However, it is generally impossible to find an entire clutch in the field as newts lay individual eggs, this will be done in a lab setting by collecting eight pairs of *N. viridescens* and have them breed in enclosures. The eggs collected will be weighed to obtain the wet mass, then dried to obtain the dry mass, and then an ash free dry mass will be obtained by using a muffle furnace. The carbon content of the clutch which will then be used to find the energy within that entire clutch. Eight clutches will be measured to obtain an average size and carbon content. The SVL (snout-vent length) of each female will be taken to see if the size of a female will play a part in the number of eggs laid in the clutch as it is predicted that larger females will have a larger clutch size. The average amount of carbon energy content obtained from the lab findings will be then multiplied by the number of gravid female newts that were caught in traps in the field to obtain a general estimate of the amount of energy input into ponds via newt eggs. The information found in this experiment will then provide us with a rough estimate to how much energy *N. viridescens* puts into ponds via egg deposits during the breeding season.
In this presentation, a compact microstrip-fed planar monopole antenna with an ultra-wideband (UWB) radiator of a “bull’s eye” configuration is given. A tapering, main bridge joins the radiating element from the microstrip-feedline-outer ring junction to the bottom of the center ring of the bull’s eye configuration with a symmetrical, main bridge spanning from the top-center ring to the top-outer ring, so as to achieve impedance match for a compact size 44 x 40 mm. Similar bridging is also done perpendicular to the main bridges with smaller dimensions and also in still-smaller dimensions in divisions of 45 degrees from the main bridges. The proposed antenna is designed in CST Microwave Studio and then fabricated with the LPKF ProtoMat S62 and tested with an HP 8510C Vector Network Analyzer and in an anechoic chamber, showing an operating frequency range from 2.2 to 22.5 GHz, derived from its S11 and voltage standing wave ratio (VSWR) measurements. The presented antenna’s radiation patterns are monopole-like and demonstrate its maximum absolute gain, which measures from 1.7 to 5.47 dB across the frequency of operation. This proposed antenna could be used for a wide range of UWB applications, such as an UWB jamming device, high speed video streaming, modern RADAR, wireless LAN, satellite television broadcasting, etc.
Structural studies and mRNA binding specificity of the KH domain in conserved virulence factor A from Streptococcus pyogenes

Streptococcus pyogenes is responsible for causing a wide variety of human diseases such as scarlet fever, impetigo, pharyngitis, necrotizing fasciitis, streptococcal toxic shock syndrome and the post-streptococcal sequelae of rheumatic fever. This species of bacteria exclusively infects humans and can cause mild to life-threatening infections in a wide variety of tissues that present unique environmental and nutritional challenges. In order to thrive in these various conditions, S. pyogenes must somehow regulate gene expression to optimize the utilization of what is available in its surroundings. The conserved virulence factor A (CvfA) protein has four domains: a transmembrane (TM) domain at the N terminus, a coiled-coil (CC) domain, an hnRNP K homology (KH) domain towards the middle, and a histidine-aspartate-containing phosphohydrolase (HD) domain near the C terminus. We hypothesize that the CvfA protein of S. pyogenes uses its KH domain to target specific mRNA for degradation via cleavage by the HD domain. This mRNA decay is designed to control gene expression related to metabolism and virulence based on nutrient availability. We cloned, expressed and purified CvfA to use as a target for Systematic Evolution of Ligands by Exponential Enrichment (SELEX) studies to identify sequences with a high affinity for the KH domain. RNA binding affinity was measured by electrophoretic mobility shift assay (EMSA). Using homology modeling, we have refined our protein constructs to increase solubility and stability. We have also developed more effective strategies to express and purify the KH domain. This purified protein will be used for NMR chemical shift mapping to determine the structural details of how the KH domain recognizes mRNA. We will also characterize the interaction of CvfA with enolase, a proposed component of the degradosome in S. pyogenes.
Jazma Sutton and Pamela Smoot

Department of History

Transcending the fire: Motherhood for 19th century enslaved African-American women

Despite the significant array of literature on African-American slavery, there remains a lack of source material directly relating to the experiences of enslaved African-American women. Many Antebellum records were written by white men and a few black men, who in many ways ignored the lives of these women. For centuries, they were faced with the double burden of gender and race, forcing them into subordinate roles. This study examines the motherhood of antebellum African-American women as they courageously withstood the oppression of American society. This research contributes to understanding the realities and experiences of enslaved African-American mothers.
Attention Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by inattention and/or hyperactivity-impulsivity (American Psychiatric Association, 2000). Symptoms of ADHD affect academic and social aspects of a child’s life (Gadow et al., 2004). Some children have executive function deficits, which encompass areas such as set-shifting, inhibition, planning, interference control, and working memory; however, not all children experience the same deficits, if they experience any (Barkley, 1997; Pennington & Ozonoff, 1996; Nigg, 2010). The Wisconsin Card Sorting Test (WCST) is frequently used to assess set-shifting, although results are inconsistent in the ADHD population. The Behavior Rating Inventory of Executive Function (BRIEF) is a common parent and teacher rating of executive function; studies using various BRIEF subscales (i.e., Inhibit) have been consistently significant in showing deficits in children with ADHD. The participants for the current study were recruited from a larger NIH-funded project and were between the ages of 8 and 12 years. Typically developing children and children diagnosed with ADHD-C or ADHD-PI were used in this study. The parents of the participants completed the BRIEF by selecting “never,” “sometimes,” or “often” to all 86 questions before the testing session. A fixed battery of assessments, including the computerized WCST, was administered to each child. On the WCST, the child sorted a deck of cards according to shape, color, or number based on feedback given by the program. The child had to use this feedback to accurately shift to new sorting principles. The current study used WCST performance and three of the BRIEF subscales (inhibit, shift, and working memory) to predict ADHD in children via hierarchical logistic regression.
Crafting culture: Fan labor in the Homestuck fan community

Fan communities ("fandoms") are communities of fans centered on a shared common interest. They are increasingly prolific subcultures in Western society and beyond, and with the advent of the internet and its many channels of communication, fans are able to come together regardless of boundaries that may have previously inhibited cultural development. One of the defining features of a fandom, setting it apart as a distinct community, is the practice of fan labor. While fans of any interest will, as expected, be consumers of that interest, members of fandoms will additionally become producers, creating derivative works of many forms based upon their item of interest; this is fan labor. These works may be as concrete as art or writing or as abstract as theoretical reinterpretations of the source material or performing identities based on the characters or ideas involved. I hypothesize that it is the act of continuous fan labor more than anything else that binds a fandom together and that perpetuates its existence and evolution, both by reinforcing relationships within the culture, and by introducing new ideas and activities into the culture in order to prevent its stagnation. This project focuses on the fandom surrounding the online comic Homestuck, which has gained a massive following and subsequent fandom since its launch in 2009. I attended a fan gathering in Merrillville, Indiana to interact with and interview members of the Homestuck fandom directly, and also gathered data through online surveys distributed through social networks that the fandom uses to communicate. The resulting data shows that fan labor, at least in the Homestuck fandom, functions as both a form of commoditized cultural wealth (in an economic anthropology model) and as a vehicle for constructing and reconstructing fan relationships to each other and to the source material (in a ritual anthropology model).
James Throgmorton¹, Jane Geisler-Lee², and Matt Geisler²

¹Department of Cinema and Photography and ²Department of Plant Biology

How could photography, classic (wet) & digital (dry), affect scientific illustration: Taking below ground root behaviors as example

In 1945, Dr. Vannevar Bush published “As we may think” in The Atlantic Monthly. He imagined a scientist of the future, who would use an infinitely focusable “dry” camera mounted to his forehead that would record his observations as he conducted experiments. Dr. Bush used the word “dry” to describe what we know as Digital Photography. From his perspective, Analog Photography as a “Wet” process differentiated it from the “Dry” electronic sensor. Although the modern science lab has left wet processes behind in favor of the convenience of the dry digital camera. The organic crystalline structure of the silver halide lattice allows photons to etch out images at the atomic level in developed films. On the other hand, 24 megapixel cameras can digitize a 4000 by 6000 grid of pixels almost instantaneously. These 16 bit images can produce prints of 20 by 13 at 300 dpi. The numbers do sound impressive; but is there something more that can be captured and communicated using the wet process of analog film? Digital cameras capture light on a sensor that is linear. If the light of a scene overexposes any of the red, green or blue channels, that pixel will report erroneous information. Although film also has a limited latitude in respect to overall light in a scene, it has “shoulders” in respect to being pushed to the point where it overexposes and loses data. In short, wet processes overexpose more gracefully than dry processes do, which changes how photographers create images with these tools. In this study of root behaviors, samples were captured by both methods, modern dry digital sensor and wet process of film, in order to compare and contrast the differences between these two techniques for image creation.
Jacqueline R. Valdez

Department of Psychology

The contribution of social network support to romantic relationship quality: An experimental test

In this experimental study we examined the causal effect of support from social network members for a romantic relationship on the quality of that relationship. Prior research has found that social network support for a romantic relationship is positively associated with measures of romantic relationship quality, including commitment, satisfaction and love. However, those prior studies were non-experimental and therefore could not determine if a causal association existed. The current study attempts to use experimental methods to improve upon prior research in this area of study. Participants were college students from a large Midwestern University who were involved in a romantic relationship. Participants were asked to select either a friend or parent who was aware of the participant's romantic relationship. Next, participants were induced to either assimilate the friend/parent towards or contrast the friend/parent away from a social network member who ideally supported the participant's relationship. The assimilation condition was used to increase a person’s perception of romantic relationship support from a social network member and the contrast condition was used to decrease a person’s perception of romantic relationship support from a social network member. Measures of romantic relationship commitment, satisfaction, and passionate love were collected to examine the causal effect of perceived social network member approval on romantic relationship quality.
Stephanie Venis, Caleb McGee, and Tsuchin Chu, Ph.D.

Department of Mechanical Engineering

Biopsy retrieval methods

A core biopsy is used to retrieve a sample of tissue to be analyzed for abnormalities. This project focuses on the needles used in this process. The objective of this research is to explain how biopsy needles work, compare different types of biopsy needles, and evaluate the effectiveness of different designs. The comparison will allow us to see if the prototypal needle could adequately replace the commercial needles. The current commercial needles, which take one sample, will be compared to multiple dual core biopsy needle prototypes, meaning that they have two grooves, each of which will retrieve one sample from the biopsied region. This project shows the differences in damage to the biopsy needle when a soft metal and a hard metal are used. As the needle must be sharp and accurate when taking a biopsy sample, the metal used in the needle must be strong enough to withstand the stress of testing. The needles were tested using substances such as banana and apple which may mimic the density of real organs. The samples are measured by the amount retrieved with each biopsy, and compared to the other tests done on the same substance. After taking each biopsy, the samples will be removed using another smaller gauge needle which can fit inside the groove of the biopsy needle. During an actual biopsy, the sample would then be placed in a secure container and sent to a pathologist for analysis.
Nicole M. Villarreal and Michelle Y. Kibby, Ph.D.

Department of Psychology

ADHD and dyslexia on working memory

Working memory variations were examined in attention-deficit/hyperactivity disorder (ADHD), reading disability (RD), comorbid ADHD/RD and controls in a clinical sample of children aged eight to twelve. These groups were evaluated on a series of tests that measured their working memory skillset and these tests included: The Test of Nonverbal Intelligence (TONI), the Rhyming Words and Semantic Association subtests of the Swanson WM task, The Verbal Comprehension Index (VCI) of the Wechsler Intelligence Scale for Children (WISC), and Visual Short Term Memory and Visual Sequential Memory subtests of the Test of Visual-Perceptual Skills-Revised (TVPS-R).
Jason Voyles and Ken Diesburg

Department of Plant, Soil and Agricultural Systems

Low-input establishment of Zoysia grass in differing soil aggregates: seeded

Zoysia grass (Zoysia japonica var. 'Zenith') established by seed is one of the most environmentally friendly turfgrasses that performs well in Southern Illinois and similar regions nearby. Little information is known about managing Zoysia grass during the establishment phase of its life and this study helps to answer the question about what is the best aggregate size distribution for it to establish. This study will be performed using low-input which means that no fertilizer, herbicides, pesticides, and little to no irrigation, except to get the seed to start germinating, will be used as to keep with Zoysia grass's environmentally friendly characteristics. Unlike many other turfgrasses found in the region, this study specifically will attempt to discover what is the optimal amount of tillage that Zoysia grass seeds require to have the most emergence in this low-input setting.
Cody Ward and Dale B. Hales, Ph.D.

Department of Physiology

*Can prostaglandin production be induced in ovarian cancer cells in tissue culture?*

It has been shown that the group of fatty acid compounds known as prostaglandins promote inflammation. We know that non-steroidal anti-inflammatory drugs (NSAIDs) can inhibit the production of prostaglandins by reducing the activity of cyclooxygenase-2 (COX-2). COX-2 is the rate-limiting enzyme in the conversion of arachidonic acid to prostaglandins and specifically PGE2, which is the most pro-inflammatory prostaglandin. High, constant rates of inflammation are associated with increased cancer incidence and severity.

The objective of this study was to determine if the production of prostaglandins could be induced in ovarian cancer cells in tissue culture in order to establish an in vitro system to study the mechanism through which anticancer agents inhibit their production. For this study, SKOV3 ovarian cancer cells were utilized. The Cayman Chemical PGE2 ELISA kit was utilized to determine that these cells do not constitutively produce prostaglandins in tissue culture. Three agents that have been previously shown to induce COX-2 activity were selected for the study: phorbol 12-myristate (PMA), tumor necrosis factor alpha (TNF-α), and hydrogen peroxide (H$_2$O$_2$). The cells treated with PMA were treated in three groups of concentration 0.5ng/mL, 5ng/mL, or 50ng/mL for 24 hours. For the TNF-α treatment, three groups of cells were treated with 0.1ng/mL, 1ng/mL, or 10ng/mL concentrations for 24 hours. Cells were treated with 1μM, 10μM, or 100μM concentrations of H$_2$O$_2$ for 4 hours. PGE2 was then measured. The study determined that the production of prostaglandins was induced in a dose dependent manner with all concentrations of TNF-α, PMA, and H$_2$O$_2$. H$_2$O$_2$ was the most potent of the agents. The development of this model will enable future studies to examine the mechanism through which anti-inflammatories inhibit the production of prostaglandins.
Amanda Weidhuner, April Vigardt, and Stuart Alan Walters, Ph.D.

Department of Plant, Soil, and Agricultural Systems

*Sustainable fertility management in organic broccoli using cover crops*

Cover crops are a sustainable way to produce crops through the protection and enrichment of the soil. The objective of this research was to protect and enrich the soil though a combination of two different types of cover crops grown at once for multiple benefits in one cropping season. Both crops were grown together and separately and monitored through multiple soil samples and foliar samples taken from broccoli which was grown on the soil plots at a later time. The soil analyses tested for pH, organic matter, est. N. release, Bray I Phos., exchange capacity, percentage base saturation of cation, Mehlich III extractable P, Mn, Zn, B, Cu, Fe, Al, S, Ca, Mg, K, Na, and available N (NO3 + NH4). The cover crops grown were crimson clover and tillage radishes. Crimson clover is a legume and therefore fixes nitrogen into the soil. Tillage radishes have taproots that drill through soil compaction and consequently, through rapid spring decay, aids in the warming up and drying of soil. The radishes also encourage weed suppression through light competition of the leaves. Essentially these particular cover crops were chosen because of the nitrogen fixing and organic matter-building aspects, which are the two main goals of cover crop usage. Broccoli was then transplanted onto the plot after overwintering of the fall planted cover crops for a spring planting. Broccoli was used to monitor nutrient up-take and growth variation between plots.
Wood ducks have a major presence in the wetland ecosystem, which means that these animals would be the perfect species to be an indicator on the health of the Southern Illinois wetlands based on reproductive success. Establishing a population number of species especially ducks is usually conducted as a rough estimate, and it is difficult to quantify the actual amount (percentage) of growth in a population. A potential approach towards an estimation of breeding propensity, initial and re-nesting attempts by hens, is with the use of photoreceptor geolocators. The process of estimating breeding propensity has never been conducted or proved viable with the use of light level geolocators.

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Jessica R. Whitaker\textsuperscript{1} and Andrew A. Sharp\textsuperscript{2}

\textsuperscript{1}Department of Zoology and \textsuperscript{2}Department of Anatomy

Non-invasive control of avian hind limb muscle using light-activated ion channels

A detailed understanding of the embryonic development of the nervous system and the role of embryonic motility has been hampered in part by the difficulty of manipulating delicate embryonic tissues. Optogenetic tools allow researchers to manipulate the activity of ion channels in living organisms using light alone. Ion channels are specialized proteins involved in the transport of charged molecules in and out of cells which causes differences in charge across membranes. Membrane potential is important in the transmission of electrical signals in the nervous system and in the contraction of muscle fibers. Our lab has used targeted neural tube electroporation of channelrhodopsin-2 (ChR2), a modified transposon-based expression system, during embryogenesis to incorporate excitatory light-activated ion channels into neural tissue. In addition, we have shown that leg movements can be initiated and spontaneous movement in embryonic chicks can be altered when the hind limb is exposed to blue light. We propose that the addition of light-activated ion channels to muscle tissue, another excitable cell type, may be useful in answering questions about embryonic movement and nervous system development. In order to express light-activated ion channels in desired muscle cell membranes, it was necessary to electroporate ChR2 into somites (embryonic structures that contain muscle precursor cells) using techniques similar to those used in neural tube electroporation. We have observed expression of ChR2 in muscle of living embryos and sectioned tissue using a fluorescent reporter molecule as late in development as E16. Most importantly, we have caused movement of the hind limb upon light activation of ChR2 expressed in hind limb muscle. The control of muscle fibers via light-activated ion channels provides an exciting new approach to studying the development of the nervous system and the importance of embryonic movement to normal development.
A large amount of pollutants are released into the environment due to human activity. The Illinois Environmental Protection Agency employed the Fish Contaminant Monitoring Program to monitor heavy metal, pesticide, and PCB pollution within Illinois aquatic environments. However, this monitoring effort has not examined brominated flame retardant contamination. Brominated flame retardants are substances added to plastics and electronics to prevent spontaneous combustion. Due to their chemical nature, brominated flame retardants escape from products and enter the aquatic environment. Brominated flame retardants have shown to reach high levels within predator species of fish and mammals, and may effect thyroid hormone levels, neurodevelopment, and reproductive success.

The Illinois Environmental Protection Agency has archived samples of fish ranging back to the 1980s. With the agency's cooperation, this project aims to test the archived and recent fish samples for nine brominated flame retardant compounds. Impaired river systems, as well as their sources of contamination, will be identified. Environmental and human health risks, as a result of the impaired river systems, will be determined. The concentrations of brominated flame retardants will also be compared against known thresholds to determine whether there are any current adverse effects on aquatic wildlife. This information may be used by the Environmental Protection Agency to regulate further monitoring projects or take actions to reduce the amount of contaminants within Illinois waters.
Carlie Willis and Prema Narayan

Department of Physiology

The effects of activated luteinizing hormone receptor on the testis

Within the testis there are specialized cells called Leydig cells (LC), which develop during puberty and are primarily responsible for the production of testosterone. Located on the surface of the LC are receptors (LHR) specific for luteinizing hormone (LH), which is secreted from the pituitary gland. When the LH binds to the LHR on the LC it initiates the production of testosterone. In humans, constitutively active mutations in LHR have been documented that result in a condition called familial male-limited precocious puberty (FMPP). Boys with FMPP present with high testosterone levels, Leydig cell hyperplasia and puberty by age four. A knock-in mouse (KiLHR) has been created to mimic FMPP by mutating an aspartic acid in LHR to glycine. This is the most common mutation found in boys with FMPP. There are many changes that occur in KiLHR mice as a result of this change. KiLHR mice exhibit precocious puberty, high testosterone levels and stop reproducing much faster then the normal wild type (WT) mice. In addition, KiLHR mice at one year of age develop Leydig cell tumors. The goal of this study is to further characterize the testicular tumors in the KiLHR mice. Towards this goal, testis sections from one year old KiLHR and WT mice will be stained with Leydig cell specific markers and markers of proliferation. These studies will confirm that the tumor is from Leydig cells.
Undergraduate Research Opportunities at SIU

REACH (Research-Enriched Academic Challenge)
This competitive program is open to SIU Carbondale undergraduate students in all disciplines, and offers 20 grant awards each year to students working on independent research or creative activities with a faculty mentor. Awards consist of one-year grants of up to $1,500 combined with undergraduate assistantships of 10 hours per week. Students present project results at the Undergraduate Creative Activities and Research Forum held each spring semester on the SIU Carbondale campus. For more information about the program, visit reach.siu.edu, or contact staff in the Center for Undergraduate Research and Creative Activities office in the Student Services building, room 126, at 618/453-4433, or via email at reach@siu.edu.

Saluki Research Rookies Program
This competitive program offers SIU Carbondale freshmen and sophomores the opportunity to engage in faculty-mentored, hands-on research or creative activities. Students explore their intended majors, develop relationships with faculty in their field, and gain valuable research and critical thinking skills. For more information, you may contact staff at the Center for Undergraduate Research and Creative Activities office in the Student Services building, room 126, at 618/453-4433, or via email at curca@siu.edu.

McNair Scholars Program
This federally funded program offers SIU Carbondale undergraduate students hailing from underrepresented groups, including minority and first-generation/low-income students, preparation for graduate school. It provides mentoring, GRE preparation, and academic support. McNair Scholars take part in a summer research institute and present research results at a campus symposium and at conferences in their discipline. For more information, you may visit mcnair.siu.edu, or contact staff in Woody Hall B139-B145, or at 618/453-4585.
Louis Stokes Alliance for Minority Participation

SIU Carbondale is a member of the Illinois Louis Stokes Alliance for Minority Participation, a statewide coalition dedicated to increasing the number of underrepresented minority students in science, mathematics, and engineering. Funded by the National Science Foundation, this program provides paid, mentored research experiences for SIU Carbondale undergraduates. For more information, visit ilsamp.siu.edu, or contact staff in the Center for Undergraduate Research and Creative Activities office in the Student Services building, room 126, at 618/453-4433, or via email at curca@siu.edu.

Undergraduate Assistantship program

The Undergraduate Assistantship program provides a unique opportunity for SIU Carbondale undergraduate students. The program offers on-campus research and/or creative activity opportunities for full-time SIU Carbondale undergraduate students. Students selected for an Undergraduate Assistantship work directly with a faculty member or professional level staff member in a project that leads to a poster or oral presentation at the Undergraduate Creative Activities and Research Forum held each spring semester on the SIU Carbondale campus. Selected students spend 10, 15, or 20 hours per week working on the project and are paid $10/per hour. The UGA program, is one of the programs in the Center for Undergraduate Research and Creative Activities, a unit of the Office of the Provost, and has cooperating support from Human Resources, Payroll, Office of Sponsored Projects Administration, University Honors, and the University hiring departments. For more information and eligibility requirements, you may visit undergraduateassistantship.siu.edu, or contact staff in the Center for Undergraduate Research and Creative Activities office in the Student Services building, room 126, at 618/453-4433, or via email at ugrada@siu.edu.
The Undergraduate Creative Activities and Research Forum is presented by CURCA (Center for Undergraduate Research and Creative Activities).

CURCA, a unit managed by the Provost and Vice Chancellor for Academic Affairs, serves as a unique resource for students by providing opportunities to discover through hands-on experience.

To celebrate and recognize creative achievements and research by undergraduate students, CURCA and the Office of the Provost are collaborating with SIU Technology Transfer program and the Student Innovation Incubator to sponsor SIU Carbondale’s annual Undergraduate Creative Activities and Research Forum and Saluki App Competition.

For more information, visit curca.siu.edu