19th Annual Posters on the Hill
Council on Undergraduate Research

April 23, 2015
Rayburn House Office Building
Washington, D.C.
The posters presented were supported by the generosity of many governmental and private funders, including:

- Agency for Healthcare Research and Quality
- Amazon Center for Environmental Education and Research
- Barry Goldwater Scholarship and Excellence in Education Program
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- Centre College
- Commonwealth Health Research Board
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  - National Institute of Allergy and Infectious Diseases
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  - National Institute on Aging
  - National Institute on Drug Abuse
- National Multiple Sclerosis Society
- National Science Foundation
- Norwich University
- Notchcode Creative
- Saint Michael’s College
- SC Sea Grant Consortium, National Oceanic and Atmospheric Association
- The Camille & Henry Dreyfus Foundation
- The Richard A. Good Endowment for Undergraduate Research Support
- U.S. Department of Agriculture
- U.S. Department of Education
- U.S. Department of Energy
- U.S. Department of Homeland Security
- U.S. Department of State
- U.S. Department of Transportation
- U.S. Department of Veterans Affairs
- University of Alabama in Huntsville
- University of Delaware
- University of Missouri-Columbia
- University of Nebraska at Kearney
- University of New England
- University of Puget Sound
- University of Wisconsin-Oshkosh
- Vassar College
- Vermont Geological Society
- Wisconsin Space Grant Consortium

- 85% of research projects had direct or indirect financial support
- 60% of funding sources were federal agencies
Dear Posters on the Hill Attendees:

I wish to congratulate all of our undergraduate researchers on their selection to participate in the 2015 Posters on the Hill. Their research projects went through a rigorous review process and were selected as the best from around the country. The Council on Undergraduate Research (CUR) is very impressed by their accomplishments and is pleased that they have been able to come to Washington, D.C. to participate in this prestigious event. This is our 19th annual Posters on the Hill event and directly follows the fifth annual Undergraduate Research Week, held from April 13-17, 2015.

We are proud of the faculty advisors and mentors, who with their students, serve as stellar examples of the best in higher education. In addition, we are pleased to partner with the American Chemical Society (ACS) for Posters on the Hill, and are deeply grateful to them for their support of this event. ACS, a premier non-profit organization, and the largest scientific society in the world, is a global leader in chemistry education, research, and advocacy. Since CUR’s inception in 1978, CUR has benefitted from its association with the ACS and appreciates the opportunity to continue our connection through Posters on the Hill, as well as other endeavors.

We know that the undergraduate research experience has contributed positively to the value of these students’ undergraduate education and that they will be better prepared as a result for their careers, post-graduate studies, and the future. As reflected by the quotes throughout this program, they have had the opportunity to develop skills in analysis, critical thinking, creativity, problem-solving and innovation through research or creative inquiry projects, all of which are important for future success, whichever path they may choose.

To our students, we wish you success as you continue your research and your studies. Perhaps someday you will be a member of the Council on Undergraduate Research and come to Washington, D.C. when one of your students presents his or her research at Posters on the Hill. Or maybe you will be a Member of Congress and attend Posters on the Hill!

Please enjoy viewing the posters and speaking with these incredible students and their mentors during this special event.

Best Wishes.

Elizabeth L. Ambos
Executive Officer
The following posters will be presented April 23, 2015  
5:30-7:30pm—Rayburn Office Building, B357

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<td>Joana Franco, Phoebe Z Ray, Richard Prevost</td>
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**Student:** Lana Ruvolo Grasser  
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**Student:** Anika Catherine Clark  
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**Student:** Virginia Caroline Meyers  
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**Student:** Paige Sophia Martz  
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**Student:** Will Augustus McGuinness  
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**Student:** Stefani Perez-Zamarripa  
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### Ohio

**Students:** Jaycey Hardenstein, Alisha Tungare  
**Institution:** Purdue University, Main Campus  
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**Student:** Paul Pernici  
**Institution:** Ashland University  
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**Student:** Rashmi Borah  
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**Student:** Nicole Biddinger  
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### Oregon

**Student:** Hannah L Bell  
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### Pennsylvania

**Students:** Victoria Yeager, Ashley Beal  
**Institution:** Slippery Rock University  
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### Rhode Island

**Student:** Talia Hettie Martin  
**Institution:** Bridgewater State University  
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Student: Zachary Perzan  
Institution: Middlebury College  
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Virginia

Student: Brittany Paige Allen  
Institution: Virginia Commonwealth University  
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Student: Elena Galindo  
Institution: George Mason University  
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Washington

Student: Renee Deanne Meschi  
Institution: University of Puget Sound  
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Student: Colton Jacob Oldham  
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Wisconsin

Student: Christopher Christopherson  
Institution: University of Wisconsin—Oshkosh  
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Alabama

Student: Kareem Omar
Institution: University of Alabama in Huntsville
Student Home State: Kentucky
Faculty Mentor: Michael Briggs
Sponsoring Agency (Grant #): NASA (NNX13AO89G); University of Alabama in Huntsville Research and Creative Experience for Undergraduates Program
Division: Geosciences
Poster Title: Characterizing the Relationship between Terrestrial Gamma-Ray Flashes and Lightning
Display Area: #1

Abstract: Terrestrial Gamma-Ray Flashes (TGFs) are high-energy bursts of electromagnetic radiation which originate from the Earth, as opposed to a cosmic origin such as a neutron star. Although their relation to thunderstorm activity on Earth has been known for some time, the precise mechanism by which lightning generates TGFs has not been elucidated. TGFs can be detected but not precisely localized by the Gamma-Ray Burst Monitor (GBM) instrument aboard the Fermi Space Telescope. However, comparing the timestamps of TGFs detected by GBM to those of lightning strokes detected by a commercial ground-based radio lightning detector network permits association of TGFs with individual lightning strokes to gain understanding of the TGF generation process. Examining all TGFs with strong lightning associations reveals three distinct timescales of activity. The shortest timescale component includes radio signals within 200 microseconds of the TGF. The second component includes radio signals within 6 milliseconds of the TGF. The third component occurs asymmetrically following the TGFs, out to approximately 800 milliseconds. Signals in the first component are predominantly the TGFs themselves. The pattern of signals in the second and third components confirms the hypothesis in which intra-cloud lightning travels from an upper negative charge layer in the cloud to the upper positive charge layer, generating a TGF, followed by a flurry of further lightning activity between and through both layers. Specifically, the second timescale component consists of vertical strokes, during which TGFs may occur randomly. The third component is horizontal lightning activity that follows.

Arizona

Student: Cedar Mitchell
Institution: Northern Arizona University
Student Home State: Colorado
Faculty Mentor: David Wagner
Sponsoring Agency (Grant #): U.S. Department of Homeland Security (HSHQDC-10-C-US); Goldwater Scholars
Division: Biology
Poster Title: Using Genetic Fingerprinting to Understand the Source and Dynamics of Human Plague Infections in Madagascar
Display Area: #2

Abstract: Yersinia pestis is the biological agent of the disease plague and is arguably one of the most deadly infectious agents in human history. Despite successful measures to control plague in many parts of the world, this disease persists in the island country of Madagascar, where it remains a serious and significant threat to human health. Previous genetic analyses have been extremely successful in identifying the sources of plague. They also have improved our understanding of historical and modern plague epidemics in other regions of the world. Unfortunately, the genetic tools necessary for such studies have been inaccessible in Madagascar due to a lack of sophisticated technological resources. In this study, we developed a highly reliable genetic fingerprinting technology that is compatible with existing resources available in underdeveloped countries, including Madagascar. We then transferred this technology to our Malagasy colleagues and assisted with its technological adoption through an on-site visit in their laboratory in Madagascar. Results from our colleagues have aligned superbly with our own validation efforts and now the fingerprinting technology is fully employed for use in future plague investigations. The consistency of our joint validation efforts indicate that this is a viable approach for the genetic fingerprinting of diseases in underdeveloped countries, and may serve as a model for genetic analyses of other human pathogens that commonly afflict regions with constrained resources. Our introduction of a simple yet highly informative genetic fingerprinting technology reduces the resource driven limitations to genetics research and aids in epidemiological investigations of human pathogens in resource deprived countries.
**Arkansas**

**Student:** Jeffrey Jones  
**Institution:** University of Arkansas at Little Rock  
**Faculty Mentor:** Crista C Gray  
**Sponsoring Agency (Grant #):** U.S. Department of Education, McNair Scholars Program (P217A130004)  
**Division:** Engineering  
**Poster Title:** Simulation and Optimization of Geometric Parameters of a Small-scale Solar Updraft Tower  
**Display Area: #3**

**Abstract:** Renewable energy technologies are paramount to sustainability due to the growing energy crisis. The solar updraft tower is a renewable energy power plant that uses solar irradiance at the base to create an updraft through a tower and turbine to generate energy. The optimal geometric parameters and peak performance for a small-scale solar updraft tower were investigated. A mathematical model that describes the flow was used and the performance of a solar updraft tower design was simulated from the computer model. Five geometrical parameters that were investigated by the simulation process were chimney height, chimney diameter, chimney divergence angle, solar collector height, and air inlet height. The height and angle of the solar collector were the most important physical variables for the solar updraft tower design. Based on the optimal parameters obtained from the simulation, a pilot solar updraft tower was constructed. Data on temperature and air velocity through the pilot solar updraft tower was collected and this demonstrated that its performance was 17–31% greater than comparable models. The tower exhibited that a respective maximum velocity and temperature of 2.5 m/s and 72 deg C could be achieved. In conclusion, the studies have significantly improved the efficiency of a small-scale solar updraft tower.

**California**

**Student:** Dana Cochran  
**Institution:** California State University - Channel Islands  
**Faculty Mentor:** Kathryn Leonard  
**Sponsoring Agency (Grant #):** National Science Foundation (954256)  
**Division:** Mathematics/Computer Science  
**Poster Title:** Comparing Corpus Callosum Images Using the Medial Axis  
**Display Area: #4**

**Abstract:** Over 2 million Americans currently suffer from schizophrenia in the United States. The earlier schizophrenia is diagnosed, the earlier treatment can be made and the better chance for a good long term prognosis for the illness. Doctors use the shape of a patient’s corpus callosum to aid in the diagnosis of schizophrenia, spending hours analyzing brain scans from individual patients. Our goal is to simplify this process by developing an algorithm that can assess tens of or even hundreds of brain scans in a fraction of the time. Given an image of a corpus callosum, we extract the boundary of its shape and construct a skeletal model of this boundary. We then extract the longest path in the skeleton, producing a single curve that captures important features of the shape boundary. In order to compare two paths from different images with different camera angles and distances from the camera, we represent each longest path with a collection of measurements that are scale, rotation, and translation invariant. We then compare these invariant values with the same values taken from the longest path in another image. This comparison allows us to determine if the shape of the individual’s corpus callosum is similar to the shape of a schizophrenia patient’s corpus callosum or to that of a healthy patient. Using shape information from a database of healthy and schizophrenic patients, we can then classify unknown corpora callosa as healthy or unhealthy.

“This scenario first hand...encouraged me to re-envision ways to modify our research to become a more powerful tool for the identification of infection sources and to illustrate the spread of plague throughout Madagascar.”  

— Cedar Mitchell, Northern Arizona University
Student: Haroon Khan  
Institution: California State University - Fullerton  
Faculty Mentor: Geoffrey Lovelace  
Sponsoring Agency (Grant #): National Science Foundation (PHY-1307489); National Science Foundation, Major Research Instrumentation (PHY-1429873); U.S. Department of Education (P031C110116-12)  
Division: Physics/Astronomy  
Poster Title: Simulating Colliding Black Holes for Gravitational Wave Astronomy  
Display Area: #5  

Abstract: Nearly a century ago Einstein predicted the existence of gravitational waves, which are ripples of space and time that are created when the universe unleashes its violent nature in the presence of strong gravity. Einstein’s theory also predicted the existence of black holes, which are extremely dense objects in space whose gravity is so strong that nothing, not even light, can escape from inside them. Colliding black holes are among the most promising sources of gravitational waves. In order to detect the gravitational waves emitted by a pair of colliding black holes, detectors on Earth, such as the Advanced Laser Interferometer Gravitational-wave Observatory (Advanced LIGO), require accurate predictions of how the waves will look and behave. These predictions require numerical simulations on supercomputers. My research focuses on simulating colliding black holes of different sizes that are spinning at different rates. These simulations reveal both the gravitational waves and the behavior of the space and time near the holes; for instance, the simulations show us how rapidly rotating, merging black holes bend the light passing around them. I am also creating visualizations of colliding black holes in order to get an intuitive understanding of how different holes behave when they collide. This research is helping to contribute towards the long-term goal of understanding the behaviors of merging black holes, an important source of gravitational waves for Advanced LIGO.

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Student: Jason B Alipio  
Institution: California State University - San Bernardino  
Faculty Mentor: Sergio D Iniguez  
Sponsoring Agency (Grant #): National Institute on Drug Abuse, National Institutes of Health (R24DA033877)  
Division: Psychology  
Poster Title: Fluoxetine Exposure During Adolescence Disrupts Spatial Memory Performance in Adulthood  
Display Area: #6  

Abstract: National reports indicate that mood-related disorders are common in children and adolescents. The prevalence of adolescent depression has resulted in parallel increases in the prescription of fluoxetine (FLX), the only antidepressant currently approved by the FDA to treat this population. Although treatment can last for years, very little is known about the long-term consequences of antidepressant exposure during early development on memory performance later in life. Thus, we exposed adolescent and adult male mice to FLX (0 or 20 mg/kg) for 15 days. We then assessed animals’ behavioral performance on the Morris Water Maze spatial memory task, three weeks after antidepressant exposure. Specifically, mice were trained to find the location of a submerged escape platform in a single-day task. Memory for the platform location was tested 24 hours later. To increase the demands of the spatial task, the mice returned to the maze 48 hours after training, with the escape platform absent. We found that FLX exposure did not influence spatial memory learning on the training day; additionally, no differences between the groups were observed when memory was examined 24 hours after training. However, mice exposed to FLX during adolescence swam longer distances to reach the location of the missing platform, when tested 48 hours after training. Our results suggest that as the demands of the spatial memory task increase, deficiencies become apparent in adult mice exposed to FLX during adolescence. This highlights the need to further investigate enduring consequences associated with adolescent exposure to FLX treatment.
Student: Ramon Jauregui  
Institution: Pitzer College  
Student Home State: Arizona  
Faculty Mentor: Kathleen Purvis-Roberts  
Sponsoring Agency: The Camille & Henry Dreyfus Foundation  
Division: Chemistry  
Poster Title: Reactions of Alcohol Amines with Atmospheric Oxidants NOx, H2O2 and O3 Analyzed Through A Particle-into-Liquid Sampler Coupled to Dual Ion Chromatographs  
Display Area: #7

Abstract: Gaseous alcohol amines are emitted into the atmosphere through various sources, including carbon sequestration technologies from power plants, which use alcoholamines to sequester CO2. Yet, little is known about how gas-phase alcohol amines interact with atmospheric oxidants, such as NOx, H2O2 and O3, to form particulate matter. This study is important because particles formed from volatile organic compounds like alcohol amines, which include: monoethanolamine, 2-(methylamino) ethanol, 2-amino-2-methyl-1-propanol, and N,N-dimethylethanolamine, may have short and or long term adverse health effects. In this study, Ion Chromatography separations of the potential reaction products of the target alcohol amines was performed with standards to make a calibration curve from which the concentrations of the target species could be calculated. Then a Particle-into-Liquid Sampler coupled to dual ion chromatographs (PILS-IC’s) was used to analyze the water-soluble ion component of the particulate matter formed with alcoholamine and oxidant under dry conditions and under 30% humidity conditions to account for humid environments. The experiments were conducted in an environmental chamber at the College of Engineering, Center for Environmental Research and Technology, University of California, Riverside (CE-CERT/UCR). The chamber is designed to emulate real environmental conditions allowing the reactions to proceed in a controlled environment. As of now there is little knowledge of how the alcohol amines will react. The experiment will provide data exposing the water-soluble ion component of the particulate matter formed by these alcohol amines, thus far monoethanol amine reaction in the presence of H2O2 and O3 has yielded production of ammonium.

Connecticut

Student: Richard Magner  
Institution: Eastern Connecticut State University  
Faculty Mentor: Mizan R Khan  
Sponsoring Agency: Eastern Connecticut State University Summer Research Fellowship  
Division: Mathematics/Computer Science  
Poster Title: Geometric Questions in Number Theory  
Display Area: #8

Abstract: We introduce some basic concepts of number theory, a branch of mathematics concerned with studying the properties of the integers (0, 1, -1, 2, ...). Common questions in this field are concerned with how numbers break up into products of smaller numbers, with “indivisible” numbers called primes. Determining the divisors of a random number can be very difficult. However, techniques have been developed to translate these questions into algebraic ones, and from there into geometric ones. In our project, we studied certain geometric objects called modular hyperbolas which are constructed using number theoretic data. Our findings include a geometric proof of a classical result which provides insight into a question that is usually resolved less intuitively using algebraic methods. As an expository component to this poster, we trace a bit of the history of algebraic geometry which has evolved tremendously in the past century. This has been motivated by an important number theoretic question, namely counting how many evaluated polynomial expressions are divisible by a fixed prime number, and higher dimensional analogues (concerning the study of finite fields). We also include a description of an application of these known results to modern cryptography, the study of securely transmitting information over untrustworthy media, such as encrypting credit card numbers for online purchases.

“...participating in undergraduate research has developed my critical-thinking and interpersonal communication skills while also teaching me persistence in the face of failure…”

Nicole Biddinger, Purdue University
Delaware

**Students:** Lindsay Yeager, Morgan Lehr, Brian Griffiths, Chelsea Rozanski  
**Institution:** University of Delaware  
**Lead Student Home State:** New York  
**Faculty Mentors:** Jon Cox, Rosalie Rolón Dow, Carla Guerrón Montero  
**Sponsoring Agency:** Amazon Center for Environmental Education and Research; National Geographic, Genographic Legacy Fund; Dickinson College; University of Delaware; Greater Philadelphia Latin American Studies Consortium; Notchcode Creative  
**Division:** Arts & Humanities  
**Poster Title:** Ancestral Lands of the Ese’Eja—The True People  
**Display Area:** #9

**Abstract:** Ancestral Lands of the Ese’Eja—The True People is a cultural mapping initiative conducted in partnership with one of Peru’s remaining traditionally based hunting, gathering and fishing indigenous groups and is a recipient of a National Geographic Genographic Legacy Fund Grant. Our collaborative multidisciplinary team consists of Ese’Eja community members, a community liaison, professors of anthropology, art and education, a botanical expert and University of Delaware students. We conducted a three-week expedition to the ancestral lands and current communities of the Ese’Eja in the Madre de Dios Amazonian region of Peru. We documented their cultural practices and knowledge and their deep spiritual connection to the ecosystem by capturing their worldview, conservation ethic, and community challenges. With limited or denied access to their ancestral lands and historically sacred sites, and in the absence of a shaman known locally as an eyámikekwa, some of the Ese’Eja indigenous histories and knowledge of traditional cultural practices are beginning to fade. Ese’Eja Nation leaders recognize the critical period that they are in—a time that they need to find ways to document their histories and pass on their cultural practices and knowledge from the elders to the children before the elders and keepers of wisdom pass on. The project goals, created in partnership with the board of the Ese’Eja Nation consist of cultural and historical preservation, educational programming, and a Plan De Vida, which will outline a sustainable mode of actions for the Ese’Eja to navigate the 21st century.

District of Columbia

**Student:** Michelle Shevin-Coetzee  
**Institution:** The George Washington University  
**Student Home State:** Maryland  
**Faculty Mentor:** Stephen Biddle  
**Sponsoring Agency:** The George Washington University  
**Division:** Social Sciences  
**Poster Title:** Learning to Share the Pie: Civil-Military Negotiation Over the Defense Budget  
**Display Area:** #10

**Abstract:** After over a decade of war, the United States military faces difficult choices. The Department of Defense (DoD) must determine the appropriate size and scope of a presumably smaller force, much like other drawdowns. Yet as the military maintains a range of capabilities, appropriate levels of readiness, and technological edge, the Pentagon confronts a daunting fiscal environment characterized by shrinking budgets. As a result, the competition between the four services for their share of the defense budget intensifies. DoD’s internal budget dynamics outlined in the Planning, Programming, Budgeting, and Execution (PPBE) process require each service to submit proposals to the Office of the Secretary of Defense prior to their inclusion in the President’s Budget. Each service makes an independent assessment of what programs require funding in order to execute the defense strategy. Fearing deep cuts, the services justify extraneous programs to maintain their share of the pie. Given this incentive structure, there are deep discrepancies between the “theory” codified in manuals for military programmers and the “practice” by which senior officials develop the budget. Drawing upon a series of interviews with government officials, military personnel, and academics, I explain the process by which the military services reconcile the difference between the desirable force and the feasible force. Efforts to resolve this divergence are constrained by three issues: an unrealistic timeline, a stove-piped analytic system to model scenarios prior to budget discussions, and a reliance on external funding supplies, primarily Overseas Contingency Operations funding. Until these constraints are addressed, DoD cannot budget properly for the future security environment and is forced, therefore, to endure additional and unnecessary risk.
Student: Brandon Krishna Lam  
Institution: University of Florida  
Faculty Mentor: Joseph Larkin  
Sponsoring Agency: Lupus Research Institute  
Division: Biology  
Poster Title: SOCS1 Critically Regulates Lupus Like Skin Pathology; Implications for a SOCS1 Like Peptide intervention.  
Display Area: #11

Abstract: Although the immune system is critical for the elimination of pathogens like influenza and ebola, uncontrolled immune cell activation contributes to autoimmunity. Notably, deficiencies in Suppressor of Cytokine Signaling-1 (SOCS1), a protein controlling immune activation, have been observed in lupus patients. The role of SOCS1 in the regulation of immune responses can be examined in mice that are genetically deficient in SOCS1. While mice with reduced SOCS1 develop lupus like pathologies, mice completely lacking SOCS1 develop lethal inflammatory disease, surviving only 21 days. Our lab has demonstrated that treating mice completely deficient of SOCS1 with SOCS1-KIR, a therapeutic peptide that mimics SOCS1 function, prevents perinatal lethality and extends life past 70 days. Patients with lupus develop many conditions including kidney failure and severe skin pathologies. Notably, mice partially deficient in SOCS1, and lacking another immune system regulatory protein interferon gamma, develop both kidney failure and spontaneous skin lesions. Given the importance of understanding this autoimmune disease, our lab has examined the development of these skin lesions. We have found that the neutralization of a single immune activating protein, interleukin 17 (IL17), promotes healing of these spontaneous lesions that occur in SOCS1 deficient mice. We have previously shown that our peptide, SOCS1-KIR, regulates IL17 and we are in the process of testing whether SOCS1-KIR can be used to treat the skin lesions that develop on the mice that develop lupus-like disease. We believe that these results will translate into strategies to treat the pathologies that occur in lupus patients.

Student: Vanessa Y Rubio  
Institution: Stetson University  
Faculty Mentor: Kirsten A Work  
Division: Biology  
Poster Title: The Effects of Nutrient Cycling by the Exotic Catfish, Pterygoplichthys disjunctivus, on Algal Growth in a Central Florida Spring  
Display Area: #12

Abstract: Nutrient recycling by fish plays a large role in the availability of nutrients, such as nitrogen and phosphorous, in freshwater aquatic systems. The invasive exotic catfish *Pterygoplichthys disjunctivus* has infiltrated central Florida springs and may have contributed to algal overgrowth in these springs due to its digestive by-products. In this research, we focused on whether algae would grow on microscope slides as a direct result of the presence of *P. disjunctivus* feces in situ by implanting an array in Volusia Blue Spring to measure algal growth. The algal accumulation in control and experimental treatments was compared using dry mass as well as spectrometry for chlorophyll a. Algae also were grown over the course of four weeks in a growth medium to calculate the variability of growth from viable algal cells within the excrement. There was significantly more growth of algae in the presence of *P. disjunctivus* feces than in controls. In addition to promoting algal growth, *P. disjunctivus* feces were found to contain viable algal cells that were thriving after being excreted. The addition of nutrients and viable cells due to the presence of feces could be a contributing factor to eutrophication and ecological shifts in Volusia Blue Spring.
**Georgia**

**Student:** Mugdha Joshi  
**Institution:** University of Georgia  
**Faculty Mentor:** Shelley Hooks  
**Sponsoring Agency:** National Multiple Sclerosis Society; Marsha Rivkin Ovarian Cancer Society  
**Division:** Biology  
**Poster Title:** Determining the Role of RGS10 in Regulating Neuroinflammation  
**Display Area:** #13

**Abstract:** Chronic neuroinflammation is implicated as an underlying cause for neuropathic pain and neurodegenerative diseases including Multiple Sclerosis and Parkinson’s. Neuroinflammation results from activation of microglia, immune cells of the central nervous system. Research shows that the protein Regulator of G-Protein Signaling (RGS) 10 plays a role in reducing neuroinflammation. Our study seeks to understand the mechanism behind RGS10’s suppressive effect. G-Protein Coupled Receptors (GPCRs) are important membrane receptors that communicate extracellular signals into the cell. When an extracellular messenger binds to a GPCR, the associated G-protein becomes activated, causing a cascade of events resulting in a specific response. RGS proteins control the activity of GPCRs by deactivating associated G-proteins. An important trigger of neuroinflammation is lipopolysaccharide (LPS), a component of bacterial cell walls. Interestingly, it is known that LPS does not activate a GPCR pathway, yet RGS10, a regulator of G-protein signaling, is able to reduce LPS induced neuronflammation. To explain this paradox, we hypothesized that LPS induced neuroinflammation is facilitated by an intersecting GPCR pathway that is regulated by RGS10. To investigate our hypothesis, we have studied the proteins involved in inflammatory pathways in BV-2 microglial cells through various biochemical methods. Our results allow us to propose a GPCR signaling pathway regulated by RGS10 that facilitates LPS induced neuroinflammation. Ongoing experiments seek to define the specific GPCR responsible for the facilitative effect. Defining this inflammatory signaling pathway and understanding how RGS10 regulates it may illuminate novel strategies for treating chronic neuroinflammation and associated diseases.

**Hawaii**

**Student:** Melanie Keliipuleole  
**Institution:** Kapi`olani Community College  
**Faculty Mentor:** Mackenzie Manning  
**Sponsoring Agency (Grant #):** National Science Foundation (1023665)  
**Division:** Biology  
**Poster Title:** Studying the Genetic Connectivity of the Culturally Significant Urchin, Colobocentrotus atratus, in Hawaii, USA  
**Display Area:** #14

**Abstract:** Population genetics is the study of allele and genotype frequencies in a given population. The use of population genetics to monitor target species in ecologically sensitive areas is an effective management tool for understanding the structure of those populations. Understanding the structure of separate populations will aid in the development of proper management plans for a species. In the Hawaiian Islands, management practices specific to many of our culturally important marine invertebrates are minimal or non-existent, and as a result, overharvesting is a common problem for these species. This study attempts to elucidate the population structure of the marine invertebrate Colobocentrotus atratus, or Ha’uke’uke in Hawaiian. Ha’uke’uke inhabit wave-swept, rocky intertidal shores throughout Hawaii where it is recreationally harvested for consumption of its gonadal tissues. Culturally, it is harvested for its delicious taste, and for its medicinal properties. Tissues from multiple individuals along four different shorelines (north, west, east, south) from four different Hawaiian Islands were collected to determine the level of genetic connectivity within and between populations using a fragment of the Cytochrome Oxidase I (COI) mitochondrial gene. Previous research on taxonomically and ecologically diverse species shows genetic barriers between islands. Therefore, due to a relatively short larval duration (typically one month), we hypothesized that C. atratus would show low or absent gene flow between the different island populations. This project is still in its results stage; however, we hope our investigation into Ha’uke’uke population structure throughout Hawaii will lead to better management practices for this important cultural resource.
Idaho

**Student:** Phillip G Hammer  
**Research Institution:** University of Nevada, Las Vegas  
**Home Institution:** Boise State University  
**Faculty Mentor:** Dale Russell  
**Sponsoring Agency (Grant #):** U.S. Department of Energy (DE-AC07-05ID14517)  
**Division:** Chemistry  
**Poster Title:** Dissolution and Electrochemical Reduction of Zirconium, Thorium, and Uranium in Ionic Liquids  
**Display Area:** #15

**Abstract:** Nuclear energy and the fuel cycle process presents significant challenges today. Both economically and environmentally, the accumulation of spent nuclear fuel (SNF) and its handling are of major concern for our planet’s future. One of the predominant methods for reprocessing SNF is the PUREX process which creates waste streams that still require treatment. We report progress in removing radionuclides from solid oxide wastes via dissolution of metal oxide material in ionic liquid followed by electrochemical deposition of the metal onto a solid substrate. This process will isolate the radioactive metals in a recoverable and reusable solid form. This is advantageous for two reasons: (i) it recovers nuclear material for possible re-use in power generation and (ii) it keeps the radioactive material in a compact, securable form that is more environmentally responsible. Zirconium, thorium, and uranium were used to model actinide behavior, and were reacted under anhydrous conditions to produce a TFSI-based compound found to be soluble in ionic liquid. The electrochemistry of these compounds suggests bulk electrolysis should be a viable method for the treatment of these waste streams.

Illinois

**Student:** Brandon Schabell  
**Institution:** Lewis University  
**Faculty Mentor:** Jason J Keleher  
**Division:** Chemistry  
**Poster Title:** Synthesis of Photo-responsive Polymeric Nanocomposite Films for Reduction of Hazardous Flight Deck Laser Illumination Events  
**Display Area:** #16

**Abstract:** In 2013, there were nearly 4,000 malicious attacks against aircraft pilots, in which laser pointers were used to distract the pilots during critical phases of flight. The number of reports has increased from less than 300 in 2005. Because of the rapid increase in laser attacks, a solution to this problem is essential. In recent years, measures have been taken to deter individuals from executing these laser attacks; however, these efforts have proven ineffective thus far. Having accepted the inevitability of continued laser attacks, we have set out to develop a transparent film that blocks a majority of green laser light. In order to do this in a cost-effective manner, a polymer matrix incorporated with light-absorbing molecules was used. Several of these molecules were investigated in order to create a system that absorbs green laser light while remaining optically transparent in the rest of the visible light spectrum. Using molecular structural comparison and spectroscopy, an ideal system of light-absorbing molecules and semiconductors were determined. These molecules were incorporated into a polymer matrix and deposited on to clear plastic eye-wear. This final product blocked 100% of green laser light at point blank range. Further validation of the film’s efficacy was achieved during strenuous runway tests, during which the film, which was deposited on an aircraft windshield and struck by a laser at various distances, continued to block 100% of green laser light while maintaining optical transparency.
**Poster Title:** Enzyme-Assisted Pathogen Detection Applied to a Microfiltration System for Food Safety

**Abstract:** With a growing number of consumers in the American market and with food production at an all-time high, food safety is a huge priority for both consumers and corporations everywhere. Recently, the Laboratory of Renewable Resources Engineering (LORRE) at Purdue University developed a Continuous Cell Concentration Device (C3D) that has the potential to reduce the amount of time required to detect foodborne pathogens. The C3D utilizes microfiltration to produce a smaller, concentrated sample, which facilitates the identification of microbial populations. Before cell concentration, food samples are subjected to a pretreatment process that utilizes enzymes to prevent the buildup of proteins and large molecules that can plug the hollow-fibers used in the C3D. Pretreated samples are then run through the C3D to recover a solution with a higher concentration of microbial cells. Our research investigates the role of enzymes to enable microfiltration and ensure recovery of Escherichia coli (E. coli) in ground beef solutions. We are working to quantify the effect of enzyme pretreatment E. coli cell viability. Experiments are currently being conducted to determine the effect of enzyme treatment, if any, on microbial cell growth and to optimize the amount of enzyme used. Preliminary results show that enzyme pretreatment effectively breaks down large proteins and prevents fouling of the membrane, as enzyme-treated solutions filter four times faster than untreated food solutions and recover more than 90% of E. coli during the pretreatment process. Thus, enzyme pretreatment, coupled with C3D technology, begins to address the critical need for rapid pathogen detection.

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**Poster Title:** Using Resurrection Ecology to Understand Changes in Heat Tolerance in a Daphnia Population Over the Last Few Centuries

**Abstract:** As global temperature projections continue to rise, tracing the effects of warming on organisms serving as ecological indicators is vital to determine their sustainability. Daphnia, commonly known as the water flea, is an aquatic invertebrate that inhabits lakes. If they are unable to adapt to changing climate, important ecosystem services like freshwater supply may be threatened because of the keystone role they play in lakes. Using methods in resurrection ecology, which enables researchers to hatch resting eggs preserved in lake sediments to compare present and ancestral genotypes, heat tolerance of 17 genotypes separated by >300 years of evolution was compared to test for warming effects on adaptation in this Daphnia population. Data was collected at 28, 30, 32, 34, and 36°C in triplicate, from which mortality rates determined tolerance ranges. There was high survival of all genotypes at lower temperatures, and low survival of all genotypes at higher temperatures. Survival rate for present genotypes was double that of ancient genotypes at 32 and 34°C, revealing a significant correlation between age and temperature tolerance. This difference in tolerance may be due to variances in heat shock proteins (Hsp), which protect vital biochemical and cellular machinery from heat damage. Measuring the rate at which one Hsp gene was transcribed in present and ancient genotypes revealed no difference in expression, indicating tolerance differences are likely due to variation at other genetic locations. Overall, this study lays the foundation for asking rigorous questions about evolutionary changes driven by anthropogenic environmental changes like global warming.

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**Without becoming involved in research, I might not have discovered what my true interests are.**

Jessica Kane, University of New England
**Iowa**

**Students:** Josephine A Suchomel, Casey J Krull  
**Institution:** Wartburg College  
**Faculty Mentor:** Michael Bechtel  
**Division:** Social Sciences  
**Poster Title:** Effects of Animals in Post-Secondary Science Classrooms on Academic Achievement, Academic Retention, and Intrinsic Motivation.  
**Display Area:** #19

**Abstract:** The following study looks at the concept of biophilia, the love of life, and how to incorporate this concept, originally recognized by E.O. Wilson, into schools (Taylor 2007). Studies have shown that animals can increase student interest, motivation, attitude, academic achievement, and academic retention. However, there is resistance to animals in classrooms because of safety. After consulting past research, the prediction is made that after attending a course taught using the 5E learning cycle, students in the class with animals will have higher academic achievement, academic retention, and intrinsic motivation. Students were taught using a 5E lesson design for two lab days. With content covering evolution using living herpetofauna, versus images, and the theory of natural selection using the classroom’s animal tanks as models, versus images. Data was collected by administering different tests. The first test was for academic achievement (15 question multiple choice pre/posttest). The test results will be used to note variances caused by exposure to animals. The second, will research intrinsic motivation looking at animals affecting participant motivation. The last test is an academic retention test, to see if animals affect the students’ ability to recall material, which will be tested one month after the original post-test. Data will be compared using a t-test to check for significant differences between the groups.

**Kentucky**

**Students:** Grace Anne Martin, Lauren Moskowitz, Liren Yu  
**Institution:** Centre College  
**Lead Student Home State:** South Carolina  
**Faculty Mentor:** Leonard Demoranville  
**Sponsoring Agency:** Centre College  
**Division:** Chemistry  
**Poster Title:** The Use of Ion Mobility Spectrometry for the Detection of Trace Pesticides  
**Display Area:** #20

**Abstract:** A growing interest and concern in the United States is the growth, production, and contents of food that is being imported and grown in the country. With an increasing population, larger amounts of food are needed and current agricultural techniques use a wide range of pesticides. The FDA has reported unsafe levels of pesticide residue on a number of imported and domestically grown produce. Unfortunately, the current method for screening requires laboratory analysis including the use of chromatographic separation coupled with mass spectrometry. The long delay time between testing and analysis can result in food spoilage or limit the sampling capability. There is therefore a need for inexpensive, quick analysis methods used to identify pesticide residues on produce. In addition, the growing market for organically certified products would benefit from a similar, rapid technique. We are studying the feasibility of using swab sampling and ion mobility spectroscopy (IMS) to determine trace pesticide residues on fruits and vegetables. As a first step in this process, we have characterized IMS response to a group of ten pesticides, including determination of reduced mobilities and optimal desorber temperature. These parameters would be required to develop detection algorithms for field-deployed instruments capable of being used by non-scientists. Additionally, we have established the linear range and limit of detection for each of the chemicals, which will enable comparisons to safe limits of pesticide residue. Future studies will focus on verification of pesticide removal from produce surfaces using swabbing.
Abstract: Antibiotic resistance is becoming a very large problem throughout the world. After passing through the human or animal body the antibiotics are entered into the sewage treatment plant, where water is processed and cleaned then returned into the environment. During the sewage treatment process, antibiotics come into contact with bacteria entering the treatment process, as well as bacteria used in the treatment process. The bacteria that are exposed to these antibiotics can become resistant during the treatment process and then expose the antibiotic resistant genes (ARGs) to the environment upon release of treated water from the treatment plant. Because of the contact between bacteria and antibiotics during the process, sewage treatment plants are considered prime habitat to create antibiotic resistant bacteria. There are very limited studies on this subject from a small town sewage treatment plant. Therefore, this study was conducted using raw sewage as well as treated sewage from Thibodaux sewage treatment plant, which serves 15,000 people in rural southeast Louisiana. Samples were collected monthly from Thibodaux sewage treatment plant and antibiotic resistance was monitored using Kirby-Bauer assay. Special attention was given to MRSA in raw and treated sewage samples for the nine month of the study period. Results showed the presence of MRSA in both raw and treated sewage. The presence of mecA gene was confirmed in isolates of pure culture of S. aureus as well as in the sewage samples.

Abstract: In this project, the photodegradation of phenol using a photocatalyst was studied. In an effort to extend the absorptive response, 2-4 nm Au and Ag nanoparticles (NP) were synthesized and attached to TiO2 and ZnO nanomaterials. TEM and XRD characterization confirmed the presence of Au. Due to concern over possible oxidation of the very small Ag particles, the Ag NPs were attached to the TiO2 in an inert environment under N2. This preparation resulted in a dark coloration of the photocatalyst, confirming Ag attachment. The photocatalytic activity of each catalyst was tested through the decomposition of phenol under UV radiation (350 nm) for up to 60 minutes. Rates were determined and compared to unmodified TiO2 and ZnO. Ag-TiO2 was not as good at degrading the phenol as the unmodified TiO2. For the Au-ZnO loading studies, we found that intermediate Au loading on ZnO showed faster phenol degradation than unmodified ZnO or ZnO with very small or high Au loadings. Attachment of Ag to TiO2 under inert conditions provided better results compared to preparations in air. The data collected from this study will be directly applied to photocatalytic degradation of environmental pollutants including oil remediation strategies for spills such as the Deepwater Horizon disaster.
Maine

Student: Jessica L Kane  
Institution: University of New England  
Student Home State: Vermont  
Faculty Mentor: Teresa D zieweczynski  
Sponsoring Agency: University of New England  
Division: Psychology  
Poster Title: The Bachelorette: 17α-ethinylestradiol Alters Mate Choice in Female Siamese Fighting Fish  
Display Area: #23

Abstract: Because they are not removed in the wastewater treatment process, endocrine disrupting chemicals (EDCs) are a threat to aquatic organisms. EDCs have been found to generate a wide range of detrimental effects on physiology and behavior in fishes. Perhaps the most well-studied and prevalent EDC is 17α-ethinylestradiol (EE2), an estrogen mimic that is an active ingredient in birth control pills. Studies in numerous fish species find that male-typical behaviors such as courtship are dramatically reduced after exposure to EE2. While it is likely that alterations in male behavior impact reproductive fitness, this is rarely explicitly examined. To this end, we investigated whether EE2 exposure decreases male attractiveness to female Siamese fighting fish, Betta splendens. Our research group has found that exposing males decreases their aggression, boldness, and courtship, making this species ideal for this line of research. The current study examined whether or not females would discriminate between video images of unexposed males and those of males exposed to an ecologically relevant dose of EE2. Females received four different video combinations (courting exposed + exposed; courting unexposed + unexposed; courting unexposed + exposed; swimming unexposed + exposed). We found females exhibited a strong preference for unexposed compared to exposed courting males when given a choice between the two. Additionally, females spent the least amount of time exhibiting preferential behaviors when presented with two exposed courting males. Our findings demonstrate that EE2 may have significant consequences on fitness in this species by disrupting sexual selection, threatening the success of exposed males.

Student: Mark G Jacobs  
Institution: University of Southern Maine  
Faculty Mentor: James V Masi  
Sponsoring Agency: National Science Foundation S-STEM Scholarship  
Division: Engineering  
Poster Title: Research and Design of Supportive Exoskeletal Aides for the Physically Challenged  
Display Area: #24

Abstract: The purpose of this study is to provide methodology for designing exoskeletal prostheses targeted to specific pathologies associated with: Cerebral Palsy; Limb Deficiency; Spinal Pathologies; and Functional Limb Pathologies. This study will extend to whole body exoskeletal structures. Further work will be done designing the necessary components for the project in Solidworks utilizing a 3D mannequin. The parts will then be fabricated using a C & C machine, first making them from foam insulation, then from wood and finally from aluminum.

“By doing undergraduate research, I have been given the opportunity to develop many valuable life skills. These skills have helped me present my work to a crowd, meet new people from across the state and nation, and allowed me to invest my time in advancing science and enhancing the university.”

Kaylee Dockter, Minot State University
Maryland

Student: Theresa L White
Institution: Towson University
Faculty Mentor: Michelle Dykstra Snyder
Sponsoring Agency (Grant #): National Institute of Allergy and Infectious Diseases, National Institutes of Health (R15 AI085503 01); National Institutes of Health (R25 GM058264 11)
Division: Biology
Poster Title: The Social Amoeba and its Bacterial Prey: Evolution of the Immune System
Display Area: #25

Abstract: Innate immune cells recognize pathogens using receptors (such as Toll-like receptors) that detect molecular patterns on microbes. These receptors activate downstream signaling resulting in antimicrobial responses. The social amoeba Dictyostelium discoideum, which eats bacteria for nutritional purposes, is a simple organism that is used as a model to study the evolution of immunity. Understanding the mechanisms Dictyostelium discoideum uses to respond to bacterial prey provides insight into mechanisms human immune cells use upon encountering pathogens. While Dictyostelium discoideum does not have genes for full-length Toll-like receptors, it does have genes for the signaling portions of the receptors (called Tir domains). Dictyostelium discoideum cells that lack the Tir domain protein, TirA, are unable to prey on certain types of bacteria, indicating that TirA might play similar roles as mammalian Toll-like receptors. In this study we compare signaling responses to bacteria by Dictyostelium discoideum cells that contain or lack the TirA gene. We have found that signaling responses (including the activation of MAPK and the generation of bactericidal reactive oxygen species) are lowered in cells that lack TirA. These same signaling pathways are also critical for human Toll-like receptor-mediated signaling. To further investigate the similarities between TirA and the signaling Tir domains of mammalian Toll-like receptors, we are using a technique known as X-ray crystallography to determine the molecular structure of TirA and compare it to structures of mammalian Tir domains. These studies should give new insights into the evolution of immunity and improve understanding of the mechanisms underlying innate immune responses.

Massachusetts

Student: Megan Ann DeLaney
Institution: Massbay Community College
Faculty Mentor: Giuseppe Sena
Sponsoring Agency (Grant #): National Science Foundation (1154493)
Division: Mathematics/Computer Science
Poster Title: Finding the Optimal Route Around an Amusement Park to Maximize Fun and Minimize Time by Applying a Parallel Genetic Algorithm to the Traveling Salesman Problem
Display Area: #26

Abstract: A parallel version of a type of computer programs designed to manipulate data by mimicking biological evolution, known as a Genetic Algorithm (GA), is presented and implemented on four computer clusters (collection of computers). We use this GA to obtain quasi-optimal solutions to a particular case study of the Traveling Salesman Problem, a type of optimization problem that can only be solved by an exhaustive search of possible solutions from the search space. The proposed algorithm is implemented using the C programming language and the Message Passing Interface (MPI) library. Tests were performed using three different physical clusters, and a virtual cluster based on cloud computing technologies. Results presented show how the performance of the algorithm is affected by variations on the types of clusters used, and specifications of the computer nodes within those clusters. In addition, we analyze how the mutation rate, mutation interval, and population migration policies affects convergence rate of the GA. The particular case study proposed uses an actual scenario from a popular theme park to determine the optimal solution for navigating the park, stopping at each major ride once, but without repeating any ride (Hamiltonian circuit). The results presented show the utility, efficiency, and economic value of the proposed algorithm with the potential to influence any industry affected by complex and grand challenge optimization problems (NP-Complete problems), such as metropolitan mass-transit systems, energy infrastructure, and emergency response procedures.
Student: Tala Hettie Martin  
Institution: Bridgewater State University  
Student Home State: Rhode Island  
Faculty Mentor: Edward Deveney  
Sponsoring Agency: Bridgewater State University  
Division: Physics/Astronomy  
Poster Title: Construction of a Laser Frequency Stabilization System for a Magneto Optical Trap  
Display Area: #27

Abstract: We detail the construction of a laser-frequency stabilization system for Bridgewater State University’s (BSU) proposed Magneto Optical Trap (MOT). Our MOT is designed to cool and trap Rb atoms using a tunable external cavity diode laser (ECDL). The ECDL’s frequency line-width (< 1 MHz) is ideal for selecting a trapping frequency within the line-width typical of atoms and Rb (< 10 MHz). However, because ambient conditions are difficult to maintain, the ECDL trapping frequency can drift by tens of MHz or more per hour, resulting in the loss of trapping and a drift off of the atomic transition altogether. To hold an ECDL to a desired frequency, a feedback system is required to stabilize, or lock, the laser to the set frequency. Several feedback systems have been developed, each with advantages and drawbacks. We are constructing our MOT with guidance from colleagues at Yale, following the scanning transfer cavity lock-stabilization system they have perfected. The ECDL laser is combined in a scanning Fabry-Perot interferometer with a drift-stabilized HeNe laser. With this system, Yale researchers can hold and stabilize a selected trapping frequency over 12 hours. We have completed all aspects of the stabilization system up to and including the generation of feedback error signals. We are nearly finished calibrating those signals for the final step of feeding them back into the ECDL. Then we can measure the long-term drift stability of our system. [1. John Barry, Thesis, Yale; 2. J.H.T. Burke et al., Review of Scientific Instruments 76, 116105 (2005)]

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Student: Jesse Whitfield  
Institution: Michigan State University  
Student Home State: Indiana  
Faculty Mentor: Margaret Holmes-Rovner  
Sponsoring Agency (Grant #): Agency for Healthcare Research and Quality (R03 HS021764); U.S. Department of Veterans Affairs (IIR 05-283)  
Division: Health Sciences  
Poster Title: How Can Doctors Do a Good Job of Informing Patients Without Falling Behind their Schedules?  
Display Area: #28

Abstract: Treatment of low-grade prostate cancer is concerning and controversial because only one recent article has shown a survival benefit to surgery compared to radiation therapy or active surveillance. In addition, surgery and radiation often have undesirable urinary, sexual, and bowel side effects. Patients must understand the information presented, the possible repercussions and benefits, and participate in shared decision making (SDM). SDM is collaboration between physician and patient to make medical decisions, while accounting for both scientific knowledge and patient values. However, many doctors claim lack of time for proper SDM. We investigated this empirically through analysis of 252 audiotaped transcripts of initial diagnosis urologist visits from 4 Veterans Administration (VA) hospitals. Quality of informing was evaluated using Braddock’s Informed Decision Making (IDM) scale (score range: 0-18). The visit time in minutes was obtained from audio recordings. Both IDM scores and visit times were highly variable, with physician performance ranging from poor to excellent (score 0-15); the mean IDM score displays fair quality (IDM M+SD=7.63±2.47). Doctor visits ranged from 6 to 59 minutes (min. M+SD =23±10). Correlation between Time and IDM score was 0.257. This low correlation implies that quality is only modestly related to time taken to discuss results and reach a decision. Additionally, higher IDM score (higher quality informing) was associated with patient choice of surveillance. This work shows that physician-led IDM, though not routinely practiced, is feasible. Through supplementary training for physicians, shared decision making could become more common in preference sensitive decisions, in addition to general care.
Student: Lana Ruvo Grasser  
Research Institution: Michigan State University & Stanford University  
Home Institution: Michigan State University  
Student Home State: Indiana  
Faculty Mentor: Natalie Phillips  
Division: Arts & Humanities  
Poster Title: The Neuroscience of Reading: Integrating Humanities and Sciences in an fMRI Study on Jane Austen  
Display Area: #29

Abstract: Previous research efforts have illuminated many facets of the neural networks involved in reading. However, these studies rely on single-word or clause-by-clause text presentation, leading to a stilted, nonlinear reading experience. The Digital Humanities and Literary Cognition lab at MSU has sought to study reading by presenting full paragraphs of text, allowing participants to read at a natural pace that better mirrors functional reading. This pioneering fMRI experiment examined two modes of attention: analytical close reading, and casual pleasure reading. Subjects with backgrounds in literary studies (n=18) read a chapter from Jane Austen’s Mansfield Park in an MRI scanner equipped with fMRI-compatible eye tracking. Text was presented in 32 blocks, arranged in alternating “close reading” and “pleasure reading” sections. For the close reading sections, subjects were instructed to write a short literary essay, which they completed after the scan. A unique data set, the literary essays revealed quoting patterns in which subjects referred directly and indirectly to the text. The fMRI data revealed enhanced activity during the close reading condition in areas including the medial temporal gyrus, which has been associated with word processing, the supplementary motor area, involved in movement planning, and the motor and visual cortices. The neuroscientific results have allowed us to examine the nuances of reading, an essential component of humanist studies. Ongoing analysis from the fMRI and written essays will seek to evaluate how patterns of concrete vs. abstract words and positive vs. negative affective language influence neural signatures as well as selective quoting.

Minnesota

Student: Anika Catherine Clark  
Institution: Augsburg College  
Faculty Mentors: Kevin Potts, Miles Ott  
Division: Biology  
Poster Title: The Chimpanzee Social Network: Identifying the Potential Targets of Ebola Vaccination in Wild Chimpanzees  
Display Area: #30

Abstract: Chimpanzees (Pan troglodytes) are endangered, and among the factors most directly threatening future population persistence is the threat of emerging infectious diseases, particularly Ebola. Consequently, preventative action must be taken to ensure that future Ebola epidemics do not decimate chimpanzee populations, as has happened to Western lowland gorillas. In 2014, an Ebola vaccine was developed and shown to be effective in a captive chimpanzee population. The vaccination of large numbers of wild chimpanzees, however, is logistically difficult and would be prohibitively expensive. Because the disease spreads through social contact, targeted vaccination of the most socially central chimpanzees may effectively halt the spread of the disease through a population. Ebola outbreaks are endemic among human populations in Uganda, with the most recent in 2012. Chimpanzee mortality rates from Ebola far exceed those of humans, and have been as high as 98% in outbreaks in Central and West Africa. Uganda’s Kibale National Park is home to the largest and most dense community of chimpanzees in the world, at the Ngogo site, in the center of the Park. By using social network analysis, this research aims to determine which chimpanzees from the Ngogo community would be potential “superspreaders” of Ebola—i.e., individuals with the highest numbers of social contacts in the community. Our long-term aim is to examine the feasibility of vaccinating these superspreaders, who, if infected with Ebola, would pose the greatest risk of spreading the disease.
**Student:** Jamie Lee Morrissette  
**Research Institution:** The University of Minnesota  
**Home Institution:** The College of Saint Scholastica  
**Faculty Mentor:** Cari Clark  
**Sponsoring Agency (Grant #):** National Center for Advancing Translational Sciences, National Institutes of Health (UL1TR000114)  
**Division:** Health Sciences  
**Poster Title:** Polyvictimization and CVD Risk Among Intimate Partner Violence Survivors  
**Display Area:** #31

**Abstract:** To examine the impact of polyvictimization on cardiovascular disease (CVD) risk among intimate partner violence (IPV) survivors, participants reported exposure to four types of prior trauma during an intake interview including witnessing domestic violence in childhood, being psychologically or physically abused as a child, or being sexually assaulted at any time. Exposure to polyvictimization was determined by responding “yes” to three or more of the abuse measures. Indicators of cardiovascular disease risk included: high-sensitivity C-reactive protein (hs-CRP), glycated hemoglobin (HbA1c), Body mass index (BMI), systolic blood pressure (SBP), 30-year Framingham risk score and smoking. Risk factors were ascertained from anthropometric measurements (height, weight, blood pressure) and blood spots taken during a baseline session and from self-reported use of antihypertensive medication, diabetes medications/diagnosis and current smoking status. Linear and logistic regression models, adjusted for age, education, race/ethnicity, and study group were calculated to examine the effect of polyvictimization on CVD risk factors in the IPV population. Study findings indicate that polyvictimization is highly prevalent among IPV survivors and is associated with several major predictors of CVD. Screening for abuse history could aid identification of high risk individuals and inform treatment and intervention decisions to mitigate the long term health effects of polyvictimization.

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**Student:** Sally J White  
**Institution:** Mississippi State University  
**Student Home State:** Alabama  
**Faculty Mentor:** Janet Donaldson  
**Sponsoring Agency (Grant #):** National Institutes of Health (P20GM103646)  
**Division:** Biology  
**Poster Title:** Characterizing the Growth of Listeria monocytogenes Exposed to Bile Salts at an Acidic pH  
**Display Area:** #32

**Abstract:** Listeria monocytogenes is a dangerous bacterium that causes the food-borne disease listeriosis and creates a major concern for food security. Listeriosis is typically acquired through the consumption of food contaminated with Listeria, and it is estimated to cause 20-30% of all food-borne disease deaths. This organism can survive the body's natural defenses within the digestive tract, such as stomach acid and bile. Previous studies showed that bile salts, the bactericidal portion of bile, at an acidic pH (5.5) kill L. monocytogenes better than bile salts at a neutral pH (7.0). This acidic pH mimics the environment encountered as the bacterium enters the small intestine from the stomach. However, these previous studies analyzed only the strain EGDe of the bacterium L. monocytogenes. To determine if other strains were similarly harmed by bile salts in an acidic environment, we analyzed the viability of four different strains in bile salts at a neutral pH and an acidic pH. The data indicate exposure to bile salts at an acidic pH increases toxicity of the bile salts towards L. monocytogenes, but toxicity varies between strains. Strains associated with outbreaks of listeriosis were more resistant to the toxic bile, suggesting the ability of the bacteria to cause disease is related to the ability of the bacteria to resist bile. Further research is needed to determine how this characteristic contributes to a strain’s ability to cause disease, though our initial findings suggest an increased viability within acidic pH may contribute to the overall pathogenicity of the strain.
Student: Virginia Caroline Meyers  
Institution: University of Southern Mississippi  
Faculty Mentor: Shahid Karim  
Sponsoring Agency (Grant #): National Institute of Allergy and Infectious Diseases of the National Institute of Health (AI099919); U.S. Department of State, Pakistan-U.S. Science and Technology Cooperation Program (PGA-P21049); Mississippi INBRE, National Institute of General Medical Sciences, National Institutes of Health (P20GM103476)  
Division: Biology  
Poster Title: Characterization of Dual Oxidase (DUOX) Involvement in Regulation of Microbial Communities within the Gulf Coast Tick, Amblyomma maculatum.  
Display Area: #33  

Abstract: Ticks transmit a variety of pathogens and are second only to mosquitoes in human and veterinary health importance. Over the past 100 years, the Gulf Coast tick, Amblyomma maculatum, has been known as an aggressive human-biting tick, but only in the last 10 years has been confirmed to transmit the bacterial pathogen, Rickettsia parkeri, that causes an infection similar to Rocky Mountain spotted fever. Amblyomma maculatum, which range along coastal states from Texas to Maryland and inland to Kansas, have been reported having the highest associated R. parkeri infection rates of 43% within Mississippi populations, making it a significant public health research subject in the state of Mississippi and beyond. Little is known about tick microbial communities and their relationship with tick molecules; therefore, my research focuses on investigating the dual oxidase (DUOX) gene that has conservation from arthropods to humans, where it has been found to be involved in the defense against pathogen invasion of epithelial tissues facing an external environment, such as the lining of the digestive tract. To evaluate DUOX in A. maculatum, an RNA interference approach was used to assess the role of DUOX in tick blood feeding and associated microbial communities. DUOX knockdown showed increase in microbial load residing in tick tissues (midgut, salivary gland, and ovaries) indicating a potential role of DUOX in microbiome hemostasis while feeding on host blood. Presently, further investigation of alterations in microbial communities and compensatory mechanisms involved in tick innate immunity are underway.

Missouri  

Student: Paige Sophia Martz  
Institution: University of Missouri - Columbia  
Faculty Mentor: Praveen Edara  
Sponsoring Agency: Missouri Department of Transportation, U.S. DOT University Transportation Center; University of Missouri-Columbia  
Division: Engineering  
Poster Title: Transportation Safety Analysis of Diverging Diamond Interchange in Missouri  
Display Area: #34  

Abstract: Diverging diamond interchanges (DDIs) guide traffic to drive on the left side of the road as traffic crosses highways. DDIs offer an alternative method to regulate growing traffic flow and improve safety at a significantly lower cost while maintaining the same amount of land use. Costs can be cut up to 50% compared to the more commonly used interchanges because DDIs can be optimized with fewer lanes on existing land and use fewer traffic lights. DDIs are implemented to integrate left-turning vehicles with vehicles moving through the intersection. The focus of this research was to analyze the before and after accident data of DDIs to quantify the safety benefits by using statistical analysis and a predictive model. Data on 1097 crashes were collected over a period of 3.4 years from 6 DDI sites in Missouri using a database of police report registered accidents. The predictive model utilizes the Empirical Bayes Method, which is used to estimate expected crash frequency by combining a predictive model created from a set of guidelines and observed crash data from the specific sites. The data was analyzed by comparing crashes on each day of the week, time of day, surface conditions, weather, daylight conditions, accident severity ratings, and type of accident. The results show that left-turning accidents decreased by 85% along with severity for DDIs. Additionally, the predictive model shows that DDIs reduce fatal-injury crashes by 62.6%, property-damage-only crashes by 35%, and total crashes by 40.8%, indicating that DDIs are safe alternatives.
**Montana**

**Student:** Will Augustus McGuinness  
**Institution:** Montana State University  
**Faculty Mentor:** Jovanka Voyich-Kane  
**Sponsoring Agency:** Howard Hughes Medical Institute  
**Division:** Health Sciences  
**Poster Title:** Propensity of Novel Staphylococcus aureus Bacteriophage Therapeutics in Conjunction with Iron-doped Nanoparticles  
**Display Area:** #35

**Abstract:** There are approximately 10^31 tailed bacteriophage in the biosphere, making them the most abundant organism. Phage are viruses that infect bacteria. Due to the large diversity and abundance, no two bacteriophage that have been isolated are genetically identical. Phage products have potential in disease therapy to mitigate the steady advance of antibiotic resistant strains of bacteria, such as methicillin-resistant Staphylococcus aureus (MRSA). In this study, a bacteria-specific phage to S. aureus was isolated from bovine hair. The bacteriophage was characterized using purification, amplification, cesium chloride banding, gel electrophoresis, transmission electron microscopy and scanning electron microscopy. These characterizations were the first step in understanding the distinct properties associated with Staphylococcal phage JB. We next investigated the ability of nanoparticles to increase the infectivity of JB phage. Results show mixing JB with a 30.0% iron-doped hydroxyapatite nanoparticle caused a significant increase in bacteriophage infectivity. To determine if the phage-nanoparticle cocktail influenced the ability of the bacteriophage to eliminate S. aureus infection we used in vivo mouse models, which included skin and intraperitoneal infections. Results demonstrate that the phage-nanoparticle cocktail had a significant impact on reducing bacterial burden in both models. These data suggest phage-nanoparticle cocktails could be developed to treat complex multi-drug resistant infections and/or wound management.

**Nebraska**

**Student:** Stefani Perez-Zamarripa  
**Institution:** University of Nebraska at Kearney  
**Faculty Mentor:** John Falconer  
**Sponsoring Agency:** University of Nebraska at Kearney Summer Student Research Program  
**Division:** Social Sciences  
**Poster Title:** Home Is Where the Social Capital Is: An Analysis of Post Emigration Social Capital and Community Ties  
**Display Area:** #36

**Abstract:** Social Capital offers a model for assessing the strength of a community. Evolving demographics in United States communities has raised interest in social capital among certain populations, such as Hispanic communities (e.g., Cheong, 2006). One area that has not received much attention is the social capital among migrant populations and between migrant populations and majority groups. This project used a case-study methodology to better understand social capital on an individual level in subjects who emigrated from Guanajuato, Guanajuato, Mexico to a small town in the Great Plains region of the United States. The literature suggests three indicators to measure levels of social capital on either an individual or community level: civil participation, political participation, and trust. In this study, the same indicators were used to measure social capital. Face-to-face interviews suggest that subjects tended to have lower levels of bridging social capital (connections to other groups) and higher levels of bonding social capital (within the local Hispanic community). One explanation for this could be that the three traditional indicators of social capital that have been used by many scholars do not apply to migrant Hispanic populations, and that other approaches and indicators should be used to measure social capital in these populations.
Nevada

Student: Corey Stone  
Institution: University of Nevada, Reno  
Faculty Mentor: Jeff Angermann  
Division: Health Sciences  
Poster Title: Arsenic Crisis in Bangladeshi Water Supply  
Display Area: #37

Abstract: In 1972 UNICEF launched a campaign in Bangladesh to provide clean water from underground aquifers. In UNICEF’s attempt to provide cleaner water, they induced another problem, arsenic accumulation. Currently, 9 million tubewells provide drinking water for 97% of Bangladesh’s rural populations. This last winter we embarked on a research expedition to Bangladesh in order to investigate the arsenic concentrations in the water supply. Our team traveled to Naria, Bangladesh in the Shariatpur district to collect samples from local tubewells. For each well we collected two samples. One to be analyzed in the field using an arsenic assay and the other to be brought to the United States for analysis. At each location we administered a retrospective cohort survey and recorded coordinates using GPS. By correlating the concentration data with their coordinates we were able to identify a region of high arsenic-load tubewells in Shariatpur district. Wells surveyed in other regions yielded inorganic arsenic concentrations below 50 ppb. The WHO recommends arsenic to be a minimum of 10 ppb to be considered safe for consumption, while the Bangladeshi government amended this to 50 ppb for practical reasons. Our intervention to reduce arsenic exposure was building ‘Kanchan’ filters using iron oxide chelation and depth filtration to remove arsenic from water. We provided filters to families owning wells with the seven highest arsenic concentrations detected. We will be traveling back to Bangladesh in Winter 2014-2015 to further characterize spatial trends of arsenic concentrations in tubewells, and provide additional filters to families in need.

New Jersey

Student: Rebecca Flores  
Institution: The College of New Jersey  
Faculty Mentor: Daniel Bowen  
Division: Social Sciences  
Poster Title: Divided Federalism and Gubernatorial Elections  
Display Area: #38

Abstract: This study seeks to add to the research regarding the causes of divided federalism, the phenomena in which national and state executives of the same party experience different levels of electoral success. The literature on divided federalism has a strong focus on both midterm years and national causes of divided federalism. While scholars have investigated partisanship and its effects on divided federalism, they have failed to go beyond the national parties and look at state parties whose policy positions often diverge from their national counterparts. State party divergence is natural, due to cultural and regional differences, and intentional, assuming that parties want to win office they will adapt their policies to the electorate. Therefore, governors and state parties have the ability to take the national party platform and mold it to please their constituency and thus win state office even if their party does not fare well at the national level. Using data from the 2008 and 2012 gubernatorial and presidential elections as well as 2010 and 2012 CCES public opinion data, this study analyzes the effects of state party divergence on vote margins between gubernatorial and presidential candidates of the same party, as well as approval of governors versus their national counterparts. This study finds that state party divergence has a strong positive causal relationship with divided federalism insofar as different levels of approval and electoral success for national and state executives of the same party.

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This has taught me to manage my time more responsibly, and also the value of compromise in production code—sometimes, a mathematically elegant solution that is overcomplicated and difficult to write may prove inferior to a faster and simpler approach.

Kareem Omar, University of Alabama in Huntsville
New York

**Student:** Kevin P Newhall  
**Institution:** Vassar College  
**Student Home State:** Massachusetts  
**Faculty Mentor:** Bojana Zupan  
**Sponsoring Agency:** Vassar College  
**Division:** Psychology  
**Poster Title:** More Than Just Genetics: How Maternal Environment Induces Changes to Learning Strategies in Mice that Model Autism  
**Display Area:** #39

**Abstract:** Increasing evidence suggests that environmental, or non-genetic factors play significant roles in neurodevelopmental disorders including autism and ADHD. Using a mouse model of Fragile X Syndrome (FXS), the most common single gene mutation that causes autism, we examine how genetic and environmental factors contribute to development of disease-associated traits. Hyperactivity and abnormal sociability are observed in mice carrying the FXS mutation, but our previous data has shown that animals without the mutation exhibit some degree of abnormality. We found that the presence of the mutation in the mother was sufficient to alter the developmental environment of her offspring and induce these disease-associated behaviors. This environmental, or “maternal genotype,” effect may alter behaviors by changing how a certain chemical in the brain, dopamine, modulates processes including movement (i.e. hyperactivity) and emotion (i.e. sociability). Since dopamine can also modulate learning, we decided to test whether the maternal FXS mutation affects this process in her genetically normal offspring. Using a maze to test how quickly mice learn to locate a food reward, we found that offspring of females with the FXS mutation relied on a different learning strategy to complete the task relative to mice with genetically unaffected mothers. This finding suggests that, like hyperactivity and sociability, development of brain circuits mediating certain types of learning is sensitive to both genetic and environmental (maternal genotype) factors. More broadly, our data illustrate that autism and ADHD-related genetic risk factors may not need to be inherited in order to modify behavioral patterns.

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**Student:** Brandon Jon Harmer  
**Institution:** Fordham University  
**Faculty Mentor:** Shushanik Hakobyan  
**Division:** Social Sciences  
**Poster Title:** The Likelihood of Greater Economic Integration  
**Display Area:** #40

**Abstract:** The United States is currently participating in negotiations for the Trans-Pacific Partnership (TPP), a regional free trade agreement that would include nine other countries. The TPP exemplifies the rise in regional free trade agreements (RFTAs) within the past two decades. An RFTA is a commitment among three or more countries to lower tariffs on all imports from one another. An example of an RFTA is NAFTA (the North American Free Trade Agreement). Most importantly, RFTAs signify a greater amount of economic integration between member countries. An even greater amount of economic integration can be attained through Customs Unions (CUs), which go one step further than RFTAs by applying a unified tariff against imports from outside countries. An example of a Customs Union is the Southern Common Market (MERCOSUR). There are many RFTAs, but not nearly as many CUs. This project examines the likelihood of two trading partners forming an RFTA, as well as the likelihood of an RFTA becoming a CU. My research proceeds in two parts. First, I collect and present data on current RFTAs and CUs, including when they were drafted, the number of member countries, and any changes in country membership within the past fifty years. Second, I perform a regression analysis to determine the probability of bilateral trading partners forming a RFTA, as a function of member countries, volume of intra-trade, common language, common currency and other characteristics. The same analysis is used to determine the probability of an RFTA becoming a CU. The findings of this research will provide insight into whether we can expect greater economic integration among regional trading partners.
North Carolina

Student: Mellissa Jeanne Giegerich  
Institution: Davidson College  
Student Home State: New Hampshire  
Faculty Mentor: Cole Barton  
Sponsoring Agency: Davidson College  
Division: Psychology  
Poster Title: Coping and Adaptability of Parents with a Child on the Autism Spectrum  
Display Area: #41

Abstract: Families with children with Autism Spectrum disorder (ASD) face significant challenges. This study will evaluate coping mechanisms for parents with a child with ASD. We will measure the cohesiveness and flexibility of the family. Parents whose children participated in programs directed by a local nonprofit serving families with ASD were selected to participate. Parents responded to either paper or online surveys. First, the CSI is used to assess coping mechanisms in response to stressors; while the FACES IV assesses dimensions of family cohesion and flexibility. The CSI categorizes families as either engaged or disengaged: engaged coping includes problem-focused strategies, seeking social support, and expressing emotions appropriately. Disengaged coping characteristically involves problem avoidance, social withdrawal, and denial. The FACES IV determines a family’s levels of cohesion and flexibility. Scales are categorized as balanced cohesion and balanced flexibility; while the four unbalanced scales are disengagement, enmeshment, rigid and chaotic. Balanced families characteristically possess healthy, moderate, levels of cohesion and flexibility and use practical, behavioral, and cognitive approaches to solve problems. Unbalanced families possess traits that put them on the extremes of cohesion and flexibility and they either avoid problems and socially withdraw or over analyze situations and respond in excessive, extreme ways. We will examine the relationship between degree of engagement and the flexibility of families. We assume that the most efficacious families of ASD children will have an optimum range of engagement, and will have effective problem-solving strategies.

Student: Tiffany Merritt  
Institution: University of North Carolina at Greensboro  
Student Home State: Arkansas  
Faculty Mentor: Saundra D Westervelt  
Division: Social Sciences  
Poster Title: Addressing the Aftermath of a Wrongful Conviction in North Carolina: Policy vs. Practice  
Display Area: #42

Abstract: The state of North Carolina has exonerated 44 individuals who were wrongly convicted of crimes they did not commit. What assistance have these 44 individuals received for reintegrating back into their communities? How has North Carolina’s compensation policy for exonerees translated into actual assistance? What can be learned from North Carolina’s experience and applied more broadly across states? Data were compiled on the “aftermath” experiences of North Carolina exonerees using public legal documents, media publications, and personal interviews. These data reveal a host of obstacles for exonerees, including difficulty finding jobs, mental and medical health care, housing, and transportation. North Carolina Statute G.S. 148-82-84 provides that exonerees are entitled to $50,000 per year of wrongful conviction, up to $750,000, plus some education benefits and job skill training. These provisions are dependent upon receipt of a pardon for innocence by the governor or exoneration via the North Carolina Innocence Inquiry Commission. Data indicate that of the 44 exonerees, 20 (45%) have received financial compensation via the statute; in five cases, the pardon was denied; in eight cases, the pardon is pending. None of the eight NC death row exonerees have received compensation via the statute. Regardless of pardon or financial compensation, no exoneree has received state provided services for reintegration. In a state known for its generous provisions for those wrongly convicted, the data reveal a gap between policy and practice. The project will explore the implications of this case study for the larger question of exoneree reparation nationwide.
Student: William R Rowe
Institution: North Carolina A&T State University
Faculty Mentor: Salam A Ibrahim
Sponsoring Agency (Grant #): National Institute of Food and Agriculture (1003262)
Division: Health Sciences
Poster Title: Practical Approach To Reduce Lactose Intolerance Amongst African American Population
Display Area: #43

Abstract: Nearly 75% of African Americans are affected by the common health issue related to dairy food consumption known as lactose intolerance. Lactose intolerance is the inability to break down adequate amounts of lactose commonly found in dairy products making it difficult for the body to digest. Because of this occurrence, many African-Americans typically do not prefer or consume dairy products. Good bacteria known as probiotics contain lactase (β-galactosidase), the active enzyme that is responsible for the breakdown of lactose. The objective of this research was to examine the level of lactase activity present in yogurt cultures. We evaluated the lactase activity using ortho-Nitrophynl-β-galactoside (ONPG) as the substrate. Our preliminary results showed that the yogurt cultures had high lactase activity. From this study, we can suggest that regular consumption of dairy products containing probiotics could help alleviate symptoms of lactose intolerance among the African American population. We also are considering altering the lactase activity level by over-expression of the lactase gene. These over-expressed cells could be used as a carrier of high-level lactase activity to be used in other dairy products. Further studies will be conducted to evaluate the impact of nutrients on lactase activity. We anticipate that our findings would help African American consumers understand the impact of dairy product consumption on their health and well-being.

North Dakota

Student: Kaylee Ann Dockter
Institution: Minot State University
Faculty Mentor: Mikhail M Bobylev
Sponsoring Agency (Grant #): North Dakota INBRE, National Institute of General Medical Sciences, National Institutes of Health (P20GM103442)
Division: Chemistry
Poster Title: Rapid Synthesis of N(2-hydroxybenzyl)acetamide
Display Area: #44

Abstract: Aldehydes and ketones are valuable building blocks for chemical industry. Reductive amination is an important chemistry process that dramatically expands the application of aldehydes and ketones by transforming them into amines. Most commonly, the amines are then transformed into the respective amides as much more stable and often less toxic compounds. Acetaminophen that is obtained via acetylation of p-aminophenol provides a good example of a reduced toxicity. The Leuckart reaction is a unique one step method of reductive amination. It is a remarkably simple process that includes only two components: the carbonyl compound and formamide. The long processing time is the only major shortcoming of the reaction. This problem was solved in our lab by Dr. Bobylev et al who developed an accelerated procedure for the Leuckart reaction that can be completed in minutes instead of hours. Another potential shortcoming of the Leuckart reaction is that it produces amines as their formyl derivatives, or formamides. If an amide other than formamide is desired, then the formamide has to be hydrolyzed to a respective free amine which then has to be acylated again, adding two more steps to the process. In this work, an attempt was made to investigate if the Leuckart reaction can be used for a direct synthesis of amides other than formamide. The investigation resulted in the synthesis of an acetylated amine as the main product of the Leuckart reaction. The reaction comprises an important step towards developing a new general method for the synthesis of amides.
**Student:** Paul Pernici  
**Institution:** Ashland University  
**Faculty Mentor:** Paul Cao  
**Sponsoring Agency:** The Richard A. Good Endowment for Undergraduate Research Support  
**Division:** Mathematics/Computer Science  
**Poster Title:** A Comparison of Feature Extraction and Feature Selection Algorithms for Pattern Recognitions  
**Display Area:** #45

**Abstract:** Pattern recognition is the science of discovering the inherent properties of large sets of data. A popular approach uses an artificial neural network (ANN), which is a biologically inspired machine learning model capable of mimicking human cognitive functions. Each ANN consists of a set of neurons and weighted connections, or synapses, between those neurons. The weight of a connection between two neurons represents the strength of their relationship, and is updated during the network's training. Training may use various approaches, but all seek to minimize the errors the network makes on a set of training examples. In the end, the ANN is tested on a new set of data different from the training set. In order for an ANN to recognize handwritten digits, the images used in training must undergo dimension reduction. This reduces each image’s noisiness and speeds up the ANN’s training, which is quite important in real-world applications. Two general methods of dimension reduction exist: feature selection and feature extraction. Feature selection algorithms choose a subset of pixels from the image based on some criteria, but leave them unchanged. Feature extraction transforms the entire image and in the process achieves dimension reduction. We chose one algorithm of each type: singular value decomposition, a feature extraction algorithm based on matrix algebra, and the Fischer Discriminant Ratio, a feature selection algorithm employing statistical methods. A large scale simulation was carried out which showed that feature extraction algorithms provide better accuracy and robustness, though they are generally more computationally intensive.

**Student:** Rashmi Borah  
**Institution:** The Ohio State University  
**Faculty Mentor:** Mariko Nakano  
**Division:** Arts & Humanities  
**Poster Title:** Prophylactic Organ Removal as a Means of Cancer Prevention: A Programmatic Analysis of Relevant Ethical Considerations  
**Display Area:** #46

**Abstract:** Prophylactic organ removal refers to the surgical removal of a healthy organ, devoid of any indication of tumor growth at the time of removal, in hopes of preventing the potential onset of tumor growth. Prophylactic organ removal has been used as a treatment option for patients presenting with mutations in the BRCA-1 or BRCA-2 gene. These mutations place patients at a heightened risk of developing breast and ovarian cancer. Current literature focused on evaluating the efficacy of the practice has focused almost exclusively on the physiological arguments for or against the practice, with a limited focus on impact of the practice from a non-physiological, patient-centered perspective. My research methodology will focus on the explication and critical discussion of three particular topics: 1) therapeutic applications of prophylactic organ removal, particularly at the psychological level, 2) a feminist perspective which acknowledges that, with women being the majority of patients undergoing this practice in this context, the impact of this practice on a woman’s conception of herself and society’s conception of femininity is crucial, and 3) whether the traditional arguments describing, supporting, or challenging the working definition of autonomy apply in this case, and whether alternate considerations about the execution of autonomy are relevant to this particular procedure. A systematic, explication of these three topics provide the support for my main argument, which is that an evaluation of this practice is incomplete without considering all of the factors, particularly non-physiological factors, that contribute to the wholesome well being of the patient.

"During my research, I was able to draw from what I learned through my coursework and apply it in meaningful and creative ways, thus solidifying my understanding of the material."  
Brandon Schabell, Lewis University
**Pennsylvania**

**Students:** Victoria Yeager, Ashley Beal  
**Institution:** Slippery Rock University  
**Faculty Mentors:** Julie Amy Snow, Robert Jack Livingston  
**Sponsoring Agency (Grant #):** National Science Foundation (924369)  
**Division:** Geosciences  
**Poster Title:** Analysis of Wind Transportation and Mercury Concentration in the Great Lakes Region  
**Display Area:** #47

**Abstract:** Coal-fired power plants pose a risk to the health of humans, the environment, and wildlife by releasing mercury into the air. Winds carry mercury to regions far from the power plants and transfers it to the ground, a process that consistently contaminates the environment. A variety of human health issues can result from high exposure to mercury. This long-term study examines the relationship between wind patterns and high levels of mercury in rainfall in the Great Lakes Region. Using data from the Mercury Deposition Network and tracking winds with the National Oceanic and Atmospheric Administration Hysplit model, high mercury concentration levels in rainfall were tracked and the regional source locations were identified. Measurements were taken at two locations, one in northern Maryland and another in eastern Pennsylvania, over a nine-year period from 2004 to 2012. Analysis of the regional air transport in Maryland showed that over the study period wind direction varied between the northwest and southwest. During the spring, southwesterly winds dominated and flowed from the Ohio River Valley, a well-known geographic region of coal burning. These winds coincide with high mercury concentrations in rainfall. In contrast, the Pennsylvania site receives less air from the Ohio River Valley and mercury concentrations in rainfall are lower. This study provides analysis of important mercury sources and will aid in guiding emissions policy decisions for coal-fired power plants.

**South Carolina**

**Student:** Brittany Kathleen Crocker  
**Institution:** The Citadel  
**Faculty Mentor:** John Weinstein  
**Sponsoring Agency (Grant #):** SC Sea Grant Consortium, National Oceanic and Atmospheric Association (N155)  
**Division:** Biology  
**Poster Title:** From Plastic to Microplastic: Decomposition of Three Common Plastic Polymers in a Salt Marsh Habitat  
**Display Area:** #48

**Abstract:** Plastic debris represents one of the most pervasive and persistent pollution problems in the marine environment. Recent studies have estimated that there are over 6,900 kg (=7.5 tons) of plastic debris in Charleston Harbor. As part of the degradation process, most plastics undergo fragmentation caused by mechanical abrasion and UV radiation. The smallest of these fragments (<5 mm) are known as microplastics, and they have been receiving increased research attention due to their potential effects on wildlife. In order to understand the process of plastic degradation and fragmentation in a salt marsh habitat, strips (15.2 x 2.5 cm) of high density polyethylene (type #2), polypropylene (type #5), and polystyrene (type #6) were field deployed in June 2014 and monitored for biological succession, weight, UV penetration, and fragmentation. Subsamples of strips were collected after 4, 8, 16, and 32 weeks. Within 4 weeks, a biofilm and algae composite developed on all three polymers with evidence of grazing marsh periwinkles (Littoraria irrorata). Within 16 weeks, barnacles and oysters had settled on the strips. Surface area and weight of the plastic strips did not change following 16 weeks of field exposure. UV penetration through the strips decreased 90% relative to controls due to the accretion of biofilm and silt. A mechanical fragmentation test demonstrated that the production of microplastic particles from all three polymers begins between 4 and 8 weeks. These results provide valuable information concerning the process of plastic degradation and microplastic formation in salt marshes.
South Dakota

Student: Megan Elaine Johnson  
Institution: Dakota Wesleyan University  
Faculty Mentor: Paula Mazzer  
Sponsoring Agency (Grant #): South Dakota INBRE, National Institute of General Medical Sciences, National Institutes of Health (P20 GM103443)  
Division: Chemistry  
Poster Title: Effects of Airborne Particulate Matter on Rat Neuronal Cells  
Display Area: #49

Abstract: In a recent survey of epidemiological evidences, a panel of experts concluded that data suggest a lower incidence of age-related dementia in developing regions. Air pollution, especially particulate pollution, might be partially responsible for this disparity. Recent studies of dogs and humans living in the highly polluted megacity of Mexico City, Mexico, showed evidence of oxidative stress and amyloid b accumulation in brains in animals as young as 4 months. We investigated the cytotoxic impact of two defined types of airborne particulate matter on rat neuronal cells in culture. Out results showed definite neuronal cytotoxicity, primarily from lipid oxidation. A comparison with the soluble compounds found from both types of airborne particulate matter, studied via FTICR-MS, showed different oxidized aromatic compounds—which may be related to the observed differences in cytotoxicity. Results from this study may impact air pollution regulatory decisions.

Tennessee

Students: Alex Roschli, Andrew Messing  
Research Institution: Oak Ridge National Laboratory  
Home Institution: University of Tennessee at Knoxville  
Faculty Mentor: Lonnie Love  
Division: Engineering  
Poster Title: Big Area Additive Manufacturing  
Display Area: #50

Abstract: Additive Manufacturing, or 3D Printing, is the process of adding material to grow a part rather than subtracting material, as is the case in typical machining or milling. Big Area Additive Manufacturing (BAAM) brings this technology to a commercial scale with unparalleled speed and accuracy. As opposed to more common desktop 3D Printers, BAAM prints 3000 times larger and 1000 times faster. The development of this project includes a complete redesign of current slicing software and 3D printing hardware. Improvements to the slicer include new support generation algorithms, arc-spline fitting for increased resolution and accuracy, and skeletonization of polygons for single bead insertion. Hardware improvements include a device for leveling the material after extrusion and a dispenser to apply a release agent for easy support material removal. In September 2014, we created the World’s First 3D Printed Car using the hardware and software of BAAM. This project was a great demonstration of the technology and was the result of a partnership between Oak Ridge National Lab, Cincinnati Incorporated, and Local Motors. After making the first 3D Printed Car, we went on to create a replica Shelby Cobra for the car’s 50th Anniversary. The Cobra has since been highlighted by President Obama.
Abstract: Samples of synthetic trinitite were developed and created in previous experiments were analyzed to determine if they could serve as an accurate surrogates for the nuclear forensics community. By determining the major soil constituents found in Alamogordo, New Mexico and adding small amounts of uranyl nitrate, the synthetic trinitite recipe was developed to create sample matrix. Samples were also synthesized that were elementally similar to the urban environments of Houston, TX, USA and New York City, NY, USA. Half gram to gram quantities of each matrix were then melted in a high temperature drop furnace, removed quickly, yielding glass beads. All samples were analyzed via multiple analytical methods and it was determined that the synthetic samples produced could serve as a suitable surrogate for the nuclear forensics community.

Students: Nicolas Nikoloutsos, Lauren Richardson, Jamie Tran, Maritza Aguilar, Gabriel Graham
Institution: Lamar University
Faculty Mentor: Ian Lian
Sponsoring Agency (Grant #): U.S. Department of Education TRIO Programs (P217A120126)
Division: Biology
Poster Title: Formation of Physiologically Realistic Cancer Cell Spheroids with Soft Substrate Microenvironments
Display Area: #52

Abstract: According to American Cancer Society, 585,000 U.S. residents are expected to die from cancer in 2014, accounting for nearly 1 out of every 4 deaths. The economic impact for 2009 was estimated by the National Institutes of Health to be 216.6B USD; approximately 1.5% of the 2009 GDP. Cancer cell behaviors are known to be associated with the environments in which they are grown. Based on this rationale, we hypothesized that by utilizing environments with conditions like those in the body we can produce more realistic cancer cultures that reflect more physiologically relevant malignant states. Inside the body of a cancer patient, cancer cells form amorphous, 3-dimensional structures and are metastatic (invasive). Currently, cancer studies are primarily conducted on monolayer cultures grown on rigid surfaces, which provide inaccurate models of tumor structures and behaviors in the body. In order to study cancer biology in a more realistic scenario, we have developed a cell culture system resembling the stiffness of the natural environments in which they arise. Interestingly, our preliminary data shows multiple cell lines under such conditions can consistently form 3D spherical structures exhibiting characteristics of metastatic tumors. Multicellular spheroids are known to be an improvement over the 2D model, and current protocols for cancer spheroid formation primarily utilize low-adhesion surfaces on stiff substrates. Our method of biomimetic cell culture platform would provide a cheap, reliable, and more physiologically relevant source of production for cancer spheroids to be used in research and therapeutic purposes.
Utah

**Student:** Grant Alan Holyoak  
**Institution:** Utah State University  
**Faculty Mentor:** Douglas Jackson-Smith  
**Sponsoring Agency (Grant #):** National Science Foundation, EPSCoR (EPS 1208732)  
**Division:** Social Sciences  
**Poster Title:** Utah Resident Climate Change Beliefs as Predictors of Residential Water Use and Local Water Conservation Policies  
**Display Area:** #53

**Abstract:** While extensive research has been performed on the effects of climate change on water resources, little analysis has been performed that examines how a population’s belief about climate change affects its residential water use behaviors and its support of local water resources policies. This study, as an appendage of the extensive “iUtah” Project (innovative Urban Transitions and Aridregion Hydro-sustainability), seeks to fill this gap in the research through statistical analysis of a household survey distributed to over 2,000 Utah households during the summer of 2014. The project analyzes Utahan responses in both an analytical and an explanatory fashion, demonstrating how belief or disbelief in anthropogenic climate change is predictive of specific residential water use behaviors. The effects of climate change beliefs are also examined as predictors of resident support of potential local water conservation policies.

Vermont

**Student:** Hannah L Bell  
**Institution:** Norwich University  
**Student Home State:** Oregon  
**Faculty Mentor:** Amy Woodbury Tease  
**Sponsoring Agency:** Norwich University  
**Division:** Arts & Humanities  
**Poster Title:** Love/Law: Deconstructing the Binary in Alice Walker’s The Color Purple and Jeanette Winterson’s Oranges are not the Only Fruit  
**Display Area:** #54

**Abstract:** Christianity is often misunderstood as a religion defined by law; the Old Testament is structured around a series of meetings between God and his people in which He articulates rigorous religious law. In today’s world, the Church is perpetually scrutinized for enforcing ideologies that supposedly force people—and specifically women—into institutionalized boxes. This paper examines how religious women writers are attempting to negotiate their faith and the laws imposed on them by it. Specifically, Alice Walker’s The Color Purple and Jeanette Winterson’s Oranges are Not the Only Fruit take the framework of law and introduce love as its counterpoint. Hannah Bell’s analysis of these novels focuses on how the main characters encounter this binary (love/law) and attempt to deconstruct it in an effort to stabilize their identities. Bell reveals that both law zealotry and absolute pursuit of love lead to tragedy. She argues finally that through their exploration of love Winterson and Walker advocate for a balance that explodes the binary between love and law and asserts their interdependence. These novels speak to the reality that women today come up against as it exposes institutionalized binaries that place limits on their domestic and professional lives. The ongoing debate over women’s healthcare in the public and private sectors of business and law is a prime example of the imposition of binaries by institutions upon women. Winterson and Walker artfully articulate the intricacies and effects of such conflicts, positioning these novels in a contemporary conversation.
The STEM program at Kapiolani Community College encourages students to be proactive thinkers...Being passionate about the research that we do, keeps us engaged in course work, and keeps us moving forward onto the next steps in our academic and/or professional careers.

Melanie Keliipuleole, Kapiolani Community College
**Virginia**

**Student:** Brittany Paige Allen  
**Institution:** Virginia Commonwealth University  
**Faculty Mentor:** Rebecca L. Heise  
**Sponsoring Agency (Grant #):** National Science Foundation (CMMI-1351162); National Institute of Aging at NIH (R01AG041823-01A1); Commonwealth Health Research Board  
**Division:** Engineering  
**Poster Title:** Creating a Scaffold for Lung Modeling and Regeneration  
**Display Area:** #57

**Abstract:** Chronic obstructive pulmonary disorder (COPD) is a lung disease that affects an estimated 12.7 million people worldwide and it is the third leading cause of death in the U.S. In end-stage COPD, lung transplant is the only cure. However, organ availability is limited and lung transplants have low success rates. We are investigating the biomechanics of COPD and addressing lung transplantation by designing a material that serves as a scaffold for the growth and differentiation of lung cells. This could lead to knowledge about the development of COPD and the generation of functional lung tissue. Using the technique of electrospinning, which creates sheets of fibers that can harbor cells, we created a sturdy scaffolding material from the synthetic polymer poly-L-lactic acid (PLLA) mixed with extracellular matrix (ECM) from pig lungs. ECM is a network of proteins that cells adhere to in their native environment. ECM contains growth factors and cell signaling molecules that are important for cell growth and differentiation. The PLLA-ECM hybrid material was found to improve cell attachment and growth in vitro in comparison to PLLA alone, which is essential for creating a viable lung-mimicking material. Incorporating ECM into PLLA changes PLLA’s mechanical properties to be closer to natural lung material, which is important for lung function and signaling lung cells. Coupled with the superior cell attachment and growth rates of the scaffold material, this indicates a promising start for designing replacement lung tissue.

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**Student:** Elena Galindo  
**Institution:** George Mason University  
**Faculty Mentor:** Reid Schwebach  
**Sponsoring Agency (Grant #):** National Science Foundation (1240031)  
**Division:** Social Sciences  
**Poster Title:** Attributes of Successful Mentored High School Research Experiences in Virginia Governor’s Schools  
**Display Area:** #58

**Abstract:** Mentored student research in science, technology, engineering, and mathematics (STEM) fields is commonly seen in University settings, and to a lesser extent, in USA high schools. Little is known about the the attributes of successful mentored research experiences, including what teachers can do to best support their students’ research. My research has determined several attributes of these mentorship experiences that support student research, showing how teachers and schools can support high school students working on advanced research projects. My research has examined how STEM teachers of gifted and talented high school students are mentoring their students’ research and what these teachers need to do, to help mentor the research. I surveyed and interviewed 14 teachers of the STEM focused Virginia Academic Year Governor’s Schools (AYGS). These AYGS are specialized schools that engage gifted and talented secondary school students throughout Virginia. I discovered various themes of effective STEM high school mentorship, including: (1) teachers give students freedom when selecting their own research questions and topics, but provide a good amount of direction; (2) interdisciplinarity and interdepartmental school collaboration is sought and beneficial for student success; (3) individual projects differ greatly in terms of time invested, materials, access to external mentors and laboratories, which affects student success; (4) time and access to materials is a substantial bottleneck for high school researchers due to rigid schedules; (5) teachers look for common attributes when evaluating successful projects. Importantly, these attributes of successful projects were described in my research.
Washington

**Student:** Renee Deanne Meschi  
**Institution:** University of Puget Sound  
**Faculty Mentor:** Amy Fisher  
**Sponsoring Agency:** University of Puget Sound Richard Bangs Collier Summer Research Scholarship  
**Division:** Arts & Humanities  
**Poster Title:** People, Plants, and Fungi: Examining the Ecological and Social Landscapes of the Swan Creek Park Food Forest  
**Display Area:** #59

**Abstract:** A ‘food forest’ is a garden that grows food and medicine bearing plants and trees in a way that mimics the structure of natural woodland ecosystems. The Swan Creek Park Food Forest (SCPFF) in Tacoma, Washington is an ecologically diverse food forest located in the city’s most ethnically diverse neighborhood. My project is a portrait of the SCPFF site’s social and ecological landscapes, told via the historical connections between people and plants, and the ways in which they continue to affect one another. My research begins with the ways in which local Native American tribes used the plants and fungi that are indigenous to western Washington. I focus mainly on the Puyallup Tribe, whose Reservation boundaries used to include Swan Creek Park. I also discuss local Native culture as it exists today, highlighting Native American food sovereignty projects that reclaim traditional food plants. I then illustrate how waves of immigration from early European settlers to today’s Ukrainian diaspora intensified the complexity of the SCPFF site, bringing nonnative and invasive plants to this continent. Finally, I outline a method for determining the informal names of plants and mushrooms that are important to stakeholders, but difficult to translate because they are primarily passed down through oral tradition without corresponding scientific names. My research provides the basis for the creation of informed and culturally sensitive surveys and interviews that will gather input from community members in spite of cultural and linguistic barriers. This will allow for greater multicultural inclusion as the SCPFF develops.

Wisconsin

**Student:** Christopher Christopherson  
**Institution:** University of Wisconsin—Oshkosh  
**Faculty Mentor:** Nadia Kaltcheva  
**Sponsoring Agency:** Wisconsin Space Grant Consortium; University of Wisconsin Oshkosh Student Scholarly and Creative Activities Program  
**Division:** Physics/Astronomy  
**Poster Title:** Observing Nebulosities: the Cygnus Superbubble  
**Display Area:** #60

**Abstract:** Current X-ray, radio, and optical observations reveal the Cygnus superbubble to be a giant ring of hot gas more than 1,000 light years in diameter and filled with regions of star formation. It is surrounded by a shell of cooler hydrogen gas and a complex network of gaseous filaments and dust structures. Observing Nebulosities is a student-led project at the University of Wisconsin Oshkosh, undertaken to study star-forming complexes with the aim of gaining more understanding of their large-scale structure. The Cygnus superbubble is the project’s first target. We are imaging a field covering 22 x 17 degrees of the sky in the Hydrogen-alpha, Hydrogen-beta and Oxygen-III emission lines. Emission lines are particular wavelengths of light which are emitted from the gaseous component of star-forming regions. The computer guided modified Canon DSLR camera used for this project allows us to observe large areas of the night sky, much larger than the fields covered by professional telescopes. Our project complements existing archive data and provides additional details on the interaction between the massive stars and the surrounding interstellar medium in this giant star-forming field. A comparison between the Hydrogen-alpha and Oxygen-III emission allows us to trace regions where physical conditions change rapidly due to supernova shock fronts and strong stellar winds. Comparing the Hydrogen-alpha and Hydrogen-beta emission allows us to trace the distribution of interstellar dust. The valuable hands-on experience in the collection and reduction of astronomical observations yields insights on the entire process from obtaining data to final results.
My research project [is] the highlight of my undergraduate career as it boosted the confidence I had in my learning process and ability to produce high-caliber work.

Rebecca Flores, The College of New Jersey

My research experience has provided me with the opportunity to develop crucial communication skills such as writing an abstract and presenting information to both technical and nontechnical audiences.

Sally White, Mississippi State University
The ability to communicate has been one of the most advantageous skills that I have developed through research; being capable of clearly and concisely articulating fundamental engineering principles and complex scientific phenomena has enabled me to share my research with others outside of my field. Establishing this connection has been one of the most satisfying aspects of research and has further exemplified the importance of communication in educating both my own peers, as well as the general public about advancements in engineering, science, and technology.

Jaycey Hardenstein, Purdue University

I’ve developed the ability to contribute synthesis and context to the scholarly conversation in my field.

Renee Meschi, University of Puget Sound

After enduring endless headaches through my research experience in attempts to justify or fix unexpected results, I have realized that a vast part of research is learning to cope with unexpected outcomes.

Ramon Jauregui, Pitzer College