Fifteenth Annual

KALMAN

RESEARCH SYMPOSIUM

APRIL 2, 2016
Kalman Research Symposium
April 2, 2016

Program Schedule

1:30p.m. – 3:30p.m. Poster Session in Academic West

Bucknell University

ACWS 108
Sarah Decker/Prof. Isleem
Mohammed Elnaiem/Prof. Thompson
Max Fatiaher/Prof. Lintott
Darren Kuras/ Professors Kuhn, Randall
Audrey Love/Prof. Dosemeci
Leah Murphy/Prof. Carr

ACWS 112
Nicole Bakeman, Adriana DiSilvestro/Prof. Wooden, J. Glather
Isabelle Bristol/Prof. Trop
Jesse Klig/Prof. Ron Smith
Colleen McGonigle/Prof. Grisel
Christian Ouellette/Prof. Jansson
Vikram Shenoy/ Prof. Johnson

ACWS 114
Bret Brachman-Goldstein/Prof. Daniel
Tara Caton/Prof. Martine
Jake Dixon, Jen Terry/Prof. Takahashi
Jahi Omari/Prof. Takahashi
Dominique Ruszala/Prof. Takahashi
Sara Stotter/Prof. Daniel

ACWS 116
Jordan Berger/Prof. Raymond
Hannah Comstock/Prof. Snyder
Tucker Cottrell/Prof. Newlin
Erik Loo/Prof. R. Ziemian
Yash Mittal, Eyuel Seyoum/ Prof. Asare
Melissa Replogle/Prof. Malusis

*Abroad Spring Semester 2016
*Attending Association of Writers & Writing Programs (AWP) Conference
*Competing in Athletic Event

1:45p.m. – 3:15p.m. Oral Presentations in Academic West

Son Pham
Xiaoying Pu
Eli Raeker-Jordan
*Dana Ray
David Reedel
Andrew Reszka
Luke Riehlinger
Jack Robinson
Lindsey Ruff
Kelsey Salerno
Christopher Schwake
Daniele Selzer
Christopher Serfass
Reilly Sonstrom
Sune Swart
Eric Todd
Tong Tong
Kevin VanDelden
Katherine Wagner
Katherine F. Warfel
Julia Wigginton
Keyi Zhang

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Bucknell University

KALMAN RESEARCH SYMPOSIUM
‘Christine Bendzinski ’18

Faculty Mentor: Professor Eric Tillman, Chemistry
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Low Temperature Controlled Radical Polymerizations of Vinyl Aromatic Monomers

It is well-known that it is not only the monomer identity that affects the properties of polymers, but also the stereochemical configuration of the pendant groups along the chain. A series of possible methods for low temperature radical polymerizations of vinyl styrenic monomers was explored, with the ultimate goal being control over the stereochemistry of the polymers by maximizing intermolecular interactions. The interaction of interest to this work, called pi-pi stacking, is known to occur between electron rich and electron deficient aromatic systems. Pentafluorostyrene and styrene were used as monomers to make alternating copolymers, and the progress of these reactions was monitored by NMR and GPC analyses. The guiding hypothesis is that these pi-pi stacking interactions may impart stereoregularity in the polymer as a consequence of the strong intermolecular interactions and thus orientation of the monomers prior to being incorporated into the polymer chain. This work has shown that low temperature radical polymerizations, down to ambient temperatures, are possible, while NMR has shown the interaction of the aromatic and vinyl groups of the monomers.

*Jason Hammett ’17

Faculty Mentor: Professor Brian King, Computer Science
Funding Source: James L. D. and Rebecca Roser Research Fellowship

Using Data Mining to Construct More Practical Weather Forecasting Models

Developing models of the weather is not a simple task. It relies on thousands of numerical equations based on the physics of weather systems. These models use enormous quantities of observations taken from thousands of weather stations across the world. Collection efforts have yielded a deluge of atmospheric and climate data, even for local forecasting, there is too much data from too many sources for any meteorologist to fully analyze requiring massive supercomputers costing billions to run the numerical models. This is a fundamental problem requiring exploration of new techniques. Our work focused on creating accurate hyperlocal weather models that bypass the need for supercomputers by incorporating data mining and machine learning techniques, important, rapidly-evolving fields within computer science. We set out with the goal of exploring the difficult nature of weather forecasting by using time series analysis. Our experiments revealed the Support Vector Machine algorithm was the best performing algorithm at forecasting highly periodic weather data. Different models prove more accurate for different attributes such as temperature or pressure. When taking this into account, alternative techniques such as machine learning and data mining prove to be an excellent technique for forecasting meteorological data. These techniques have the potential to produce practical local weather forecasters that reduce the immense cost and size of current, larger-scale atmospheric models.

Evan Harrington ’18

Faculty Mentor: Professor Alan Cheville, Electrical & Computer Engineering
Funding Source: Helen E. Royer Undergraduate Research Fund

Project of Undergraduate Research

This summer, I took part in Bucknell’s summer undergraduate research program. Through a BizPitch competition, I learned that Bucknell, and more specifically Professor Cheville, was interested in integrating a new security system within a new engineering lab. I began the project by creating a schedule that blocked the ten weeks into three separate phases, in an attempt to predict the amount of time needed. The first phase consisted of research, which was mostly comprised of learning new programming languages and figuring out the most effective way to tackle our project. Although I completed the first section of my project early, most of research ended up being unusable for our project. During the fifth week of our project, my partner and I convened with our professor and a few other technologically inclined faculty members to discuss the progress of our project. After some discussion, we learned that instead of hardcoding an android application, that we should instead create a web application to converse with an Ethernet enabled power strip. I spent the remainder of my summer working with and creating some server accounts and working with the Ethernet enabled power strip. Through the course of the summer, I learned two new programming languages for future reference and I also found out a more effective way to approach a challenging project.

*Carly Hyde ’17

Faculty Mentor: Vanessa Troiani, Geisinger
Funding Source: Gary A. and Sandra K. Sojka Fund for Research, Teaching and Scholarship in Developmental Disabilities, Neuroscience and Human Health

Orbitofrontal Cortex Sulcogyral Anatomy and Value Signals: An Interaction of Structure and Function

The orbitofrontal cortex (OFC) has an important function in codifying individual social and motivational behaviors. Atypical organization of the OFC architecture has been linked to psychiatric disorders including schizophrenia and Autism Spectrum Disorder (ASD) (Watanabe et al, 2014). Little is known about the influence of atypical cortical organization on functional organization of the OFC. Here we characterized two types of motivational brain responses, food and social, as well as their underlying sulcogyral anatomy. This study localizes face-selective and food-selective value signals in OFC for each individual by contrasting faces or food with all other objects. We also characterize subject’s OFC sulcogyral pattern type bilaterally, in order to determine if a pattern exists between variation in OFC sulci and OFC peak signal location for faces and food. Consistent with our hypothesis, we found that medial
value signals were more often associated with faces (27/28 subjects), while only 14 subjects had medial food value signals. While lateral value signals were consistently present for both faces and food (27/28 for food; 26/28 for faces), these were found in distinct sulcogyrral locations within lateral OFC. Frequency of OFC sulcogyrral patterns was consistent with previously published work, with Type I the most prevalent, followed by Type II and Type III. We found that subjects with a Type II pattern (known to increase risk for schizophrenia; Laviole et al. 2014) were more likely to have atypical value signal locations. We also found that individuals with a Type II pattern present in at least one hemisphere scored significantly higher on the Aloof subscale of the BAP-Q (p<0.05). Ongoing analysis and additional data collection to increase sample size will validate these findings and combine the functional and structural characterizations to test for an anatomo-functional relationship.

*Nadeem Nasimi ’17
Faculty Mentor: Professor Evan Peck, Computer Science
Funding Source: Bucknell Program for Undergraduate Research

AniVis: Personalizing Animated Transitions in Information Visualization

A user’s experience with a visual interface can be affected by factors such as age, gender, or culture. In particular, computer-based visualizations are difficult to implement because of the technology’s ability to display complex datasets that correlate multiple variables. Animated transitions are commonly used to display these correlations, which help preserve a user’s context when shifting datasets. Currently, users are typically given identical animated transitions for these shifting datasets, even though they may not be able to interpret those transitions to the capacity of others. Multiple factors can affect the perception of a transition including the number of objects involved, their size, and their speed. We have designed a web browser-based experiment to test the user’s ability to track multiple objects across an animated transition over multiple trials at various speeds to find their ideal tracking speed. In collaboration with the University of Michigan, we have been given the exciting opportunity to launch our test online on Lab In The Wild, an experiment hosting platform. Lab In The Wild is well known for its unique ability to reach testers from widespread demographics, which is notoriously difficult to achieve in the field of research. This platform will allow anyone to try this experiment for themselves and learn about their own visual tracking abilities while our software records their demographic information and experiment results in a secure database for further analysis. Having integrated our experiment with Lab In The Wild, we will soon launch the experiment online, giving us the ability to gather a large data set of ideal user tracking speeds from various demographics. The resulting data can be used to further understand how individuals perceive visual interfaces.

Brandon Pesarchick ’16
Faculty Mentor: Professor Jennifer Stevenson, Psychology
Funding Source: Douglas K. Candland Undergraduate Research Fund

Ghrelin receptor (GHS-R1A)

Ghrelin receptor (GHS-R1A) activity has been implicated in reward for the consumption of preferred substances. Ghrelin is an orexigenic neuropeptide that binds to its receptor, GHS-R1A, in response to rewarding cues and enhances the release of dopamine from the nucleus accumbens. Recent evidence has illustrated that ghrelin administration can increase the intake of rewarding foods and drugs. On the other hand, studies show that blocking ghrelin receptor (GHS-R1A) activity, via a pharmacological antagonist, attenuates the reward-induced release of dopamine and, accordingly, reduces the consumption of rewarding foods and drugs. These findings indicate that GHS-R1A activity mediates the consumption of rewarding substances by influencing the mesolimbic dopamine system. However, a recent study in our laboratory suggested that there are limitations to the integral role of GHS-R1A activity in the consumption of rewarding substances. In particular, results to our recent experiment showed that GHS-R1A antagonism reduces early preference for 20 percent ethanol, but not 10 percent sucrose in prairie voles (an unsweetened alcohol consuming species of rodent). Throughout this past summer (2015), our lab conducted additional research experiments in order to further elucidate the role that GHS-R1A activity plays in the consumption of rewarding substances. The current study aimed to determine if the effects of GHS-R1A antagonism depend on the concentration of the rewarding solution being consumed. Results indicated that JMV 2959 reduced reference for 20 percent ethanol and 2 percent sucrose, which were previously determined to be the least preferred concentrations. JMV 2959 did not significantly alter voles’ preference for any other ethanol or sucrose solution concentrations. These findings indicate limitations on the role of GHS-R1A activity in the consumption of rewarding substances. Furthermore, the concentration dependence of GHS-R1A antagonism suggests that GHS-R1A plays a less significant role in the consumption of more highly rewarding substances.
Son Pham '17

Faculty Mentor: Professor Brian King, Computer Science
Funding Source: The Dean’s Fund in Summer Undergraduate Research in STEM

Using Machine Learning to Automatically Predict Feature Representation on Sequential Data

During the past recent years, Artificial Intelligence has pushed human beings further in the field of data analytic. A new AI technology called Deep Learning is now able to automatically detect features from a set of abundant data. This technology does not need any other human input beside the set of data itself to build an accurate representative model for the data it is given. For example, scientist only needs to plug-in human face raw data into the Deep Learning machine to automatically detect eye, nose, or mouth and differentiate human’s face with the accuracy on par with human vision. Audio and image detection have been the primary motivator for this technology. There have not been, however, significant application of this technology on other kinds of sequential data such as biological strings (DNA, protein, ...). Scientists have long struggled to find a meaningful classification model for these strings because these features have to be hand-engineered, which usually contain an incredible amount of anomalies and exceptions as well as humans’ bias. This create great opportunities for computer scientists to apply Deep Learning technology to automatically detect better and unbiased features and build a better classification model for these strings. Therefore, our project aims to apply Deep Learning to build a better classification model for Protein Secondary Structure. We will try to detect features on these strings and see if these features can be used in a meaningful way and help increase the accuracy of protein secondary structure prediction. Protein secondary structure is a good beginning position due to an abundance of protein data. Successful application of Deep Learning on protein secondary structure will lead to further expansion of the project into other fields of analytic such as meteorology, natural language process or finance.

Luke Rieuxinger '17

Faculty Mentor: Professor Donna Ebenstein, Biomedical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship

Analysis of the Effect of Saliva on the Degradation of Absorbable Sutures

Absorbable sutures are designed to hold tissue together as it heals, but degrade in the body to eliminate the need to have them removed. Three common types of absorbable sutures are Monocryl, a monofilament synthetic fiber, Vicryl, a braided multifilament synthetic fiber, and Chromic Gut, a natural multifilament fiber. Absorbable sutures are used in oral and pharyngeal surgery where they are exposed to saliva. The goal of this study was to compare the degradation of suture strength in saline and artificial saliva to help doctors make more informed decisions when selecting sutures for use in oropharyngeal surgery.

Samples of Monocryl (n=90), Vicryl (n=90), and Chromic (n=90) 3-0 sutures were tied with a surgeons knot into loops approximately 10 cm long. The loops were held in tension by a 100g weight. The sutures were submerged in an aquarium containing either phosphate buffered saline or artificial saliva at 37° C. Six samples of each type were removed from the solution at regular time intervals. The breaking force was determined by pulling samples to failure using an Instron machine.

Monocryl degraded the fastest, reaching 50 percent of its original breaking strength after 11 days in both environments. Vicryl and Chromic, when soaked in saliva, reached 50 percent of their initial breaking strength after 18 and 26 days, respectively. In saline neither Vicryl nor Chromic reached 50 percent. The saliva did not cause degradation to begin at an earlier time, but rather enhanced the amount of degradation once the suture strength began to decrease.

Tong Tong '17

Faculty Mentor: Professor Katherine Faull, Comparative Humanities Program
Funding Source: Douglas K. Candland Undergraduate Research Fund

Fusion and Reconstruction: Translation Politics in China after the Cultural Revolution

The main aim of this research is to investigate the intercultural exchange between China and the rest of the world in the 1980s; specifically, why were certain non-Chinese authors translated into Chinese. I’m interested in conducting this research project because many active and renowned contemporary authors in China have confessed that they are deeply influenced by world literature rather than by the traditions and classics of China. Also I chose the decade in 1980s because it is the so-called Golden Age for translation activities in China. This is an ongoing project with Professor Faull which was started in the Spring 2015. So far the database of all the literary works translated and published in one of the most influential literary magazines in China, Shijie Wenxue (World Literature) is established. In the following days, I’m working on the visualizations of the literary “data,” which include the use of geospatial and temporal analysis, network analysis and so on. This is a common way to explore research questions in the Digital Humanities and will definitely contribute to the rigor of the project.
**Chiedozie Ononuju, Graduate Student**

**Faculty Mentor:** Professor Christopher Mordaunt, Mechanical Engineering  
**Funding Source:** Bucknell Department of Mechanical Engineering  
**Combustion Characteristics of Alternative Liquid Fuels**

Concern with the environmental impact of fossil fuel combustion and US reliance on foreign fuels is driving alternative fuel research, with coal-derived and biomass fuels being cleaner-burning possibilities. This study compares several characteristics of alternative fuels – JP-900 (coal-derived), a Fischer-Tropsch (FT) fuel, and a JP-900/FT blend – to those of JP-8 (a standard military-grade aviation fuel).

Heat of combustion values for JP-8, JP-900, and the FT fuel were obtained using calorimetry. JP-8 has an energy content of 43.39 MJ/kg, with JP-900 and FT fuel having values within ±1.5% of JP-8. Chemical composition was determined using gas chromatography-mass spectrometry. Results indicate JP-8 peaks are evenly distributed, ranging in carbon number from C8 to C20, and containing a greater proportion of normal and iso-alkanes than cycloalkanes and aromatic compounds. JP-900 constituents are unevenly distributed, with dominant peaks of trans- and cis-decahydronaphthalene, and compounds ranging from C8 to C14. The FT fuel has a relatively even distribution of predominantly normal alkanes and iso-alkanes, ranging from C8 to C21. Smoke point is an indicator of sooting propensity, with higher values indicating lower sooting. JP-8 has a smoke point of 20.7 mm, JP-900 has a value of 20.0 mm, and the FT is greater than 50 mm. Therefore, JP-900 has the highest sooting tendency and the FT fuel is the least likely to soot.

Future work involves fuel combustion in an atmospheric-pressure model gas turbine combustor using a 633-nm helium-neon laser extinction system to measure the soot volume fractions at varying air-to-fuel ratios.

* Abroad Spring Semester 2016  
+ Competing in Athletic Event
Introduction

Welcome to the fifteenth annual Kalman Research Symposium. An important central element of the Bucknell experience is to offer our students in all disciplines the opportunity to engage in substantive out-of-the-classroom research projects with faculty. As stated in the mission statement for Bucknell’s Program for Undergraduate Research, these opportunities allow students and faculty … to participate in collaborative learning processes designed to dissolve the distinction between teaching and research, and to create a community of learners in which scholarship serves as the basis for teaching and learning.

As is evident in glancing through the abstracts of the projects presented herein, this symposium offers a good view of the breadth and variety of undergraduate research taking place at Bucknell. You are encouraged to attend both the oral presentations as well as the poster session to interact with the scholars and to learn more about their work.

This symposium is named in honor of Ernest Kalman, who graduated from Bucknell in 1956. In addition to his service as a University trustee, Ernie’s generosity to his alma mater has taken many forms, one of which was a significant gift in support of undergraduate research.

The Kalman Research Symposium features projects sponsored or supported by the following:

- ACS Division of Organic Chemistry
- Bucknell University Animal Behavior Program
- Michael Baker Jr. Inc Fund for Undergraduate Research in Civil and Environmental Engineering
- Bucknell University Department of Biology
- Botanical Society of America Undergraduate Research Award
- The Brawley Fund
- Bucknell-Geisinger Research Initiative
- Bucknell Institute for Public Policy
- David Burpee Endowment
- Douglas K. Candland Undergraduate Research Fund
- Bucknell University Department of Chemical Engineering
- Bucknell University Department of Chemistry
- Chloror
- Comcast Tech Fund
- Dalal Family Fund for Creativity and Innovation

continued
The Kalman Research Symposium features projects sponsored or supported by the following: (continued)

- The Dean’s Fund in Summer Undergraduate Research in STEM
- Bucknell University Department of Economics
- Emerging Scholars in Interdisciplinary Studies Research Program
- Bucknell University Department of Geology & Environmental Geosciences
- Graduate Summer Research Fellowship
- Griffith Fellowship
- Tom Greaves Fund
- Heinemann Family Professorship in Engineering
- Jamie Hendry Sustainable Studies Development Fund
- HHMI SEA-PHAGES Program
- Kalman Fund for Biomedical Education/Fellows Fund
- Kalman Fund for Undergraduate Research in the Sciences
- Bucknell University Library & Information Technology
- The Katherine Mabis McKenna Environmental Internship Program
- Wayne Manning Internship Fund
- Mellon Foundation Research Grant
- National Science Foundation
- PPL Undergraduate Research Funds
- Bucknell Presidential Fellowship Program
- Bucknell Program for Undergraduate Research
- Bucknell University Office of the Provost
- Bucknell University Department of Psychology
- James L.D. and Rebecca Roser Research Fellowship
- Helen E. Royer Undergraduate Research Fund
- Russo Family Fund for Undergraduate Research
- Bucknell Scholarly Development Grant
- SIT Study Abroad Independent Study Grant
- Gary A. and Sandra K. Sojka Fund for Research, Teaching and Scholarship in Developmental Disabilities, Neuroscience and Human Health
- Thomas Spitzer Undergraduate Research Fund
- Joann E. Walthour Undergraduate Research Fund
Allison Aaron ‘16
Faculty Mentor: Professor Emily Martin, Music
Funding Source: Helen E. Royer Undergraduate Research Fund Vocal Health Protocols for Undergraduate Music Programs: A Pilot Study

Nora Adams ‘16
Faculty Mentor: Professor Heidi Lorimer, Languages, Cultures & Linguistics
Funding Source: Bucknell Program for Undergraduate Research Repetition Modulates the Range of Learning in Subject-verb Agreement

Eric Andresen ‘16
Hannah Marsing ‘16
Faculty Mentor: Professor Rhonda Sharp, Economics
Funding Source: Bucknell University Department of Economics Examining Discrepancy in Prize Money between Men’s and Women’s World Cup Teams

Sarah Andrews ‘16
Faculty Mentor: Professor Julie Gates, Biology
Funding Source: Fellows Program of the Kalman Fund for Biomedical Education

Ena May World with Garz and Art during Dorsal Closure in Drosophila

Nicole Bakeman ‘16, Adriana DiSilvestro ‘18
Faculty Mentors: Professor Amanda Wooden, Environmental Studies, Janine Glahtar, Geographic Information Systems (ITEC)
Funding Source: Mellon Foundation Grant, Jamie Hendry Sustainable Studies Development Fund, Presidential Fellowship
Fractured Activism: A View of ‘Fractivism’ through an Anti-Incinerator Campaign in Central Pennsylvania

Meghan Balot ‘16
Faculty Mentor: Professor William Flack, Psychology
Funding Source: Kalman Fund for Undergraduate Research in the Sciences
Methodologies for Studying Campus Sexual Assault

Joshua Barna ‘17
Faculty Mentor: Professor Ellen Herman, Geology & Environmental Geosciences
Funding Source: The Katherine Mabbs McKenna Environmental Internship Program
Storm Hysteresis as an Indicator of Matrix Flow Paths in a Conduit-Dominated Spring

Phoebe Belser ‘18
Faculty Mentors: Professors Cabrera-Dutcher, Chemical Engineering, Chemistry, Tim Raymond, Chemical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship
Hydrologic Growth Parameters of Organic Aerosols

Jordan Berger ‘17
Faculty Mentor: Professor Tim Raymond, Chemical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fund
Effect of Electronic Liquid on the Properties and Composition of E-Cigarette Aerosol

Yash Bhutwala ‘17, Alex Robinson ‘17, Trung Tran ‘18
Faculty Mentor: Professor Nathan Ryan, Mathematics
Funding Source: Bucknell Institute of Public Policy, Dalal Family Fund for Creativity and Innovation
Assessment of the Population’s Access to Primary Care Providers in the United States

Christopher Bidlack ‘18, Kaitlyn Carduner ‘18, Sara Christian ‘18, Maxwell Everett ‘18, Lisa Francomacar ‘18, Paulina Gutkin ‘18, Ryan Kirby ‘18, Zachary Kozick ‘18, Madison Kruegp ‘18, Elayne Marcotte ‘18, Eileen McAuley ‘18, Melvieve clay O’Brien ‘18, Lauren Otto ‘18, Samuel Sheridan ‘18, Nicholas Stamatos ‘18
Faculty Mentors: Professors Greg Krukonis, Biology, Marie Pizzorno, Biology
Funding Source: Bucknell University Department of Biology; HHMI SEA-PHAGES Program
Analysis of Diverse Arthrrobacter Phage Isolated in Lewisburg, PA

Alison Billas ‘16
Faculty Mentor: Professor Reggie Gazes, Psychology
Funding Source: Kalman Fund for Undergraduate Research in the Sciences
The Influence of Task Specific Factors on Quantity Discrimination by Brown Capuchins and Squirrel Monkeys

Christina Boyd ‘17
Faculty Mentor: Professor Craig Beal, Mechanical Engineering
Funding Source: Kalman Fund for Undergraduate Research in the Sciences
Trail Braking as a Safety Maneuver for Navigating Corners

Bret Brachman-Goldstein ‘16
Faculty Mentor: Professor Christopher Daniel, Geology & Environmental Geosciences
Funding Source: Kalman Fund for Undergraduate Research in the Sciences
Metamorphic temperature estimates in the Precambrian Rocks of Northern New Mexico: An application of Th-Quartz and Zr-in-Rutile Thermometry

Sarah Bradley, Graduate Student
Faculty Mentors: Professors Molly McGuire, Chemistry; Ellen Herman, Geology & Environmental Geosciences
Funding Source: Graduate Summer Research Fellowship
Mineralogical Characterization of Colloids and Macroscopic Precipitates in Abandoned Mine Drainage (AMD)

Isabelle Bristol ‘16
Faculty Mentor: Professor Jeff Trop, Geology & Environmental Geosciences
Funding Source: Kalman Fund for Undergraduate Research in the Sciences
Sedimentology, Depositional Age, and Provenance of Cenozoic Strata Exposed Along the Little Susitna River, Southwestern Alaska

Sandra Castillo ‘17, Wenbo Shan ‘16
Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics
Gender Earnings Differences in Olympic Sports

Tara Caton, Graduate Student
Faculty Mentor: Professor Chris Martine, Biology
Funding Source: Graduate Summer Research Fellowship
Morphological and Molecular Analysis of Solanum asymmetrophylum and S. sejunctum Intersexual Hybrids

*Rebecca Chambers ‘17
Faculty Mentor: Professor Anthony Stewart, English
Funding Source: Kalman Fund for Undergraduate Research Literature is Not Created in a Void

Elizabeth Christe ‘17
Faculty Mentor: Professor Erin Jablonski, Chemical Engineering
Funding Source: Bucknell Program for Undergraduate Research Robust Millifluidic Devices for Passive Liquid-Liquid Extraction and Emulsion Separation

Maria Cioffi ‘16, Naba Mukhtar ‘18
Faculty Mentors: Professor Nathan Ryan, Mathematics; Joe Kubsinsky, Mathematics
Funding Source: Bucknell/Geisinger Research Initiative
Which are the important procedures in a hospital?

Hannah Comstock, Graduate Student
Faculty Mentor: Professor Ryan Snyder, Chemical Engineering
Funding Source: Graduate Summer Research Fellowship
Investigation into the Formation of Amorphous Dicarboxylic Acid Particles via Monodisperse Droplet Evaporation

Marie Confreda ‘17
Faculty Mentor: Professor Brandon Vogel, Chemical Engineering
Funding Source: Bucknell Program for Undergraduate Research Determination of How Quickly a Drug is Released from Polymer Nanoparticles

Tucker Cottrell ‘16
Faculty Mentor: Professor Jessica Newlin, Civil Engineering
Funding Source: The Katherine Mabbs McKenna Environmental Internship Program
Investigation of Groundwater and Surface Water Interaction on the West Branch of the Susquehanna River

Tyler Craig ‘16, Trey Snow ‘16
Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics
Competitive Balance in Women’s Tennis

Mark Daley ‘17
Faculty Mentors: Professors James Baish, Biomedical Engineering; Cabrera-Dutcher, Chemical Engineering; Timothy Raymond, Chemical Engineering
Funding Source: Helen E. Royer Undergraduate Research Fund Characterization of Particulate and Vapor Phase Nitric Oxide in Electronic Cigarettes

Sarah Decker ‘17
Faculty Mentor: Professor Martin Isele, Languages, Cultures & Linguistics (Arabic)
Funding Source: Douglas K. Candland Undergraduate Research Fund Combating Arab Stereotypes through Cultural and Linguistic Education

Danielle Derchin ‘16
Faculty Mentor: Professor Elizabeth Capaldi, Biology
Funding Source: Bucknell University Department of Biology
Comparative Regional Brain Analysis of Carpenter Bees

Lisa D’Erinco ‘16, Haley Tighe ‘17, Sarah Och ‘17
Faculty Mentor: Professor Ruth Tincoff, Psychology
Funding Source: Joann E. Walhour Undergraduate Research Fund; Bucknell University Department of Psychology
The Effect of Touch on Infant Word Learning

Nicolas Diaz ‘17, Gabrielle Petruso ‘19
Faculty Mentor: Professor Chris Martine, Biology
Funding Source: David Burpee Endowment, Wayne E. Manning Internship Fund, Botanical Society of America Undergraduate Research Award, NSF STEM Scholars Program
The Christmas Tree that Keeps on Giving: The invasive potential of cultivated varieties of American Holly

Jake Dixon ‘18, Jen Terry ‘16
Faculty Mentor: Professor Mizuki Takahashi Biology
Funding Source: Bucknell University Department of Biology
Examining Nest Cleaning Behavior in the Japanese Giant Salamander (Andrias japonicus)

Mohammed Elnasem ‘16
Faculty Mentor: Professor Jennifer Thomson, History
Funding Source: Bucknell Institute for Public Policy
Who is the Subject of Militant Research, A Case Study and Dispatch from the Movement for Black Lives

Polly Englot ‘16
Faculty Mentor: Professor Ann Thustay, History
Funding Source: Bucknell University Library & Information Technology Mapping Historic Taverns in Augsburg, Germany

Max Fatthauer ‘18
Faculty Mentor: Professor Sheila Lintott, Philosophy
Tragedy; the Absurd Victory of The Greeks

Max Ferrer ‘17
Faculty Mentor: Professor John Hunter, Comparative Humanities
Funding Source: Bucknell Program for Undergraduate Research Authenticity in Social Media Representations: Identity Multiplicity, Performativity, and their Effects on College Students

Tony Flores ‘16
Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics
Extracurricular Activities, Particularly Organized Sports

Emma Frawley ‘17
Faculty Mentor: Professor Chris Martine, Biology
Funding Source: Wayne E. Manning Internship Fund; Bucknell University Department of Biology
Celebrating difference: Morphological comparison between a narrowly endemic Australian species (Solanum eburneum) and a locally recognized variant
Kortney Marshall ’16
Faculty Mentor: Professor Elizabeth Durden, Sociology
Funding Source: The Brawley Fund
Depression in Black and White: Racial Disparities in Mental Health within the United States
Maya Martignetti ’16, Christine Quinn ’17, Sara VanTilburg ’16
Faculty Mentor: Professor Kim Dauerman, Psychology
Self Esteem Moderates the Positive Effects of Being Forgiven
Keith Mattner ’16
Faculty Mentor: Professor Brandon Vogel, Chemical Engineering
Funding Source: Helen E. Roey Undergraduate Research Fund
Synthesis of Pyrrolidine-Containing Polyanhydrides for Controlled Drug Delivery
Colleen McGonigle ’17
Faculty Mentor: Professor Judy Grisel, Psychology
Funding Source: Douglas K. Candland Undergraduate Research Fund β-endorphin, testosterone, and estrogen: neuroendocrine implication for coping and alcohol consumption in response to exercise restriction
Connor McLaughlin ’16
Faculty Mentor: Professor Tristan Stayton, Biology
Funding Source: National Science Foundation
Convergent Evolution Provides Evidence of Similar Radiations in Shell Shape in the Turtle Families Emydidae and Geoemydidae
Elyse McMahon, Graduate Student
Faculty Mentor: Professor Mark Haussmann, Biology
Funding Source: The Biology Department and NSF
Oxytocin Mitigates Some of the Negative Consequences of Chronic Social Isolation in Prairie Voles (Microtus ochrogaster)
Sean McMahon ’16
Faculty Mentor: Professor Katharina Vollmayr-Lee, Physics & Astronomy
Single Particle Jumps in Sheared SIO
Mary Medure ’17
Faculty Mentor: Diane Jakacci, Comparative Humanities
The Murder of William Desmund Taylor
Kerra Mercon ’17
Faculty Mentor: Professor Christine Buffinton, Mechanical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship: Site Wall Design and Investigation
William Miller ’17
Faculty Mentor: Professor Kevin Gilmore, Civil & Environmental Engineering
Funding Source: Bucknell Program for Undergraduate Research Using Metabolic Selectors to Facilitate the Development of Activated Sludge Granules
Yash Mittal ’18, Eyuel Seyoum ’18
Faculty Mentor: Professor Philip Asare, Electrical & Computer Engineering
Funding Source: Presidential Fellowship; Bucknell University Department of Electrical & Computer Engineering
Check My Heart in Peace
James Moran, Graduate Student
Faculty Mentor: Professor Joel Wade, Psychology
Funding Source: Psychology Department
Evidence of Pro-cuckoldry Tactics in Heterosexual Males: The Psychology of an Interloper
Leah Murphy ’17
Faculty Mentor: Professor Glynnis Carr, English
Funding Source: Douglas K. Candland Undergraduate Research Fund
The “Other” War: Public Sphere Complications in 1950s Gay and Lesbian Literature
Peter Murray ’16, Marissa Young ’16
Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics
Socioeconomic Barriers: Recruitment for Women’s Swimming and Diving in the Patriot League
James Mynott ’17, Megan Schlosser ’17
Faculty Mentor: Professor Tom DiStefano, Civil & Environmental Engineering
Funding Source: The Katherine Mabie McKenna Environmental Internship Program; Heinemann Family Professorship in Engineering
West Branch Regional Authority Wastewater Characterization
Brandon Nelson, Graduate Student
Faculty Mentor: Professor Michael Kroul, Chemistry
Funding Source: Bucknell University Department of Chemistry; Graduate Summer Research Fellowship
Development of a Stereoselective Synthesis of Allo Bile Acid Derivatives
Kim Nidah ’16, Rich Saunders ’16
Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics
CIAA Basketball Players’ Performance In and Out of Conference
Cassidy Nyfield ’16, Alexander Romango ’17
Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics
Title IX and the Implications Toward Track and Field
Maree O’Brian ’16
Faculty Mentor: Professor Jennie Stevenson, Psychology
Funding Source: Douglas K. Candland Undergraduate Research Fund
Alcohol Alter Oxytocin Expression and Activation in the Paraven tricular Nucleus of the Hypothalamus of Prairie Voles
Jahi Omari ’17
Faculty Mentor: Professor Mizuki Takahashi, Biology
Funding Source: Bucknell University Department of Biology
Effects of predatory wood frog tadpoles (Lithobates sylvaticus) on growth of larval spotted salamander (Ambystoma maculatum)
Maximilian Orobia ’17
Faculty Mentor: Professor Jeffrey Evans, Civil & Environmental Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship
Soil-Bentonite Cutoff Wall: Site Wall Design and Investigation
Christian Ouellette ’18
Faculty Mentor: Professor Peter Janson, Electrical & Computer Engineering
Funding Source: ComCast Tech Fund
Cost benefit of switching to LED lighting in a Smart Residential Microgrid
Elyse Pettaway ’17
Faculty Mentor: Professor Richard Crago, Civil & Environmental Engineering
Funding Source: The Katherine Mabie McKenna Environmental Internship Program
Precision Conservation Mapping of Buffalo Creek, Union County, Pa.
Xiaoying Pu ’17
Faculty Mentor: Professor Evan Peck, Computer Science
Funding Source: The Dean’s Fund in Summer Undergraduate Research in STEM
Improving Decision-making via Wearable Biosensors
Eli Raeker-Jordan ’17
Faculty Mentor: Professor Kathleen Bienvl, Biomedical Engineering
Funding Source: Bucknell Program for Undergraduate Research
Movement Detection with Smart Photoaccelerometers
“Dana Ray, Graduate Student
Faculty Mentor: Christopher Camuto, English
Funding Source: Graduate Summer Research Fellowship
Arranger of Prayers: A Memoir
David Reedd ’16
Faculty Mentor: Professor Rebecca Switzer, Chemistry
A052. Evaluating Substituted Anthraquinones as DNA Methyltransferase 1 Inhibitors
Melissa Reipgle, Graduate Student
Faculty Mentor: Professor Michael Malusi, Civil & Environmental Engineering
Funding Source: Graduate Summer Research Fellowship; Chloro supplement
Impact of mix water quality on bentonite slurry for soil-bentonite cutoff wall applications
Andrew Reszka ’16
Faculty Mentors: Professors Ryan Snyder, Chemical Engineering; Michael Gross, Chemical Engineering
Funding Source: Jamie Hendy Sustainable Studies Development Fund
Modeling SOFC Performance Incorporating Particle Morphologies and Partial Conductivity
Jack Robinson ’17
Faculty Mentor: Professor Carl Millofsky, Sociology & Anthropology
Funding Source: Bucknell Program for Undergraduate Research
Conflict in Northern Ireland Provoked by Differences in Neighborhood Structures
Lindsey Ruff ’16
Faculty Mentor: Professor Bill Flack, Psychology
Funding Source: Bucknell Department of Psychology
Bucknell Sexual Assault Survey: 2016
Dominique Ruszala ’17
Faculty Mentor: Professor Mizuki Takahashi, Biology
Funding Source: Bucknell Department of Biology
Spotted Salamander Egg (Ambystoma maculatum) and Wood Frog Tadpole (Lithobates sylvaticus) Interactions
Kelsey Salerno, Graduate Student
Faculty Mentor: Professor Joel Wade, Psychology
Funding Source: Summer Graduate Research Fellowship; Bucknell University Department of Psychology
Expression of the Deformed Wing Virus Capsid Proteins in Bacteria
Daniele Selzer ’16
Faculty Mentor: Professor Douglas Gabauer, Civil & Environmental Engineering
Funding Source: Michael Baker Undergraduate Research Inc.
Investigation of Motorcycle-to-BARRIER Crashes on Exit/Entrance Ramps
Christopher Serfass ’17
Faculty Mentor: Professor Brandon Vogel, Chemical Engineering
Funding Source: Bucknell University Department of Chemical Engineering
The Effects of Silica Nanoparticle Loading on Injectable Hydrogel Mechanical Properties
Vikram Shenoy ’16
Faculty Mentor: Professor Michelle Johnson, Anthropology
Funding Source: Tom Graves Fund Eco-Spirituality: A Case Study of Hinduism and Environmentalism in Contemporary India
Reilly Sonstrom ’16
Faculty Mentor: Professor David Rovnyak, Chemistry, Cell Biology & Biochemistry
Funding Source: Kalman Fund for Undergraduate Research in the Sciences
Enhanced biosynthetically directed fractional carbon-13 enrichment of proteins for backbone NMR Assignments

Sara Stotter ’16  
Faculty Mentor: Professor Christopher Daniel, Geology & Environmental Geosciences  
Funding Source: Kalman Fund for Undergraduate Research in the Sciences  
Testing models of Proterozoic polymetamorphism in northern New Mexico: U-Pb monazite ages record evidence of one event at 1400-1360 Ma

Sune Swart ’17  
Faculty Mentor: Professor Thomas Beasley, Classics & Ancient Mediterranean Studies  
Funding Source: Mellon Research Grant  
Visualizing Networks in the Ancient Mediterranean (VNAM)

Eric Todd ’17  
Faculty Mentor: Professor Kelly Salyards, Civil & Environmental Engineering  
Funding Source: Helen E. Royer Undergraduate Research Fund  
Dynamic Characterization and Modeling of Varying Support Configurations of a Cantilevered System

Kevin VanDelden ’17  
Faculty Mentor: Professor Peter Stryker, Mechanical Engineering  
Funding Source: James L.D. and Rebecca Roser Research Fellowship  
Measurement of In-Cylinder Pressure in a Small Diesel Engine

Katherine Wagner ’18  
Faculty Mentor: Professor Rob Jacob, Geology & Environmental Geosciences  
Funding Source: James L.D. and Rebecca Roser Research Fellowship  
Icy Debris Fans

Katherine F. Warfel ’17  
Faculty Mentor: Professor Ryan Snyder, Chemical Engineering  
Funding Source: The Dean’s Fund in Summer Undergraduate Research in STEM  
Characterization of even dicarboxylic acid particle morphology using Monodisperse Droplet Evaporation

Julia Wigginton ’18  
Faculty Mentor: Diane Jakacki, Comparative Humanities  
Digital Spatial Analysis

Keyi Zhang ’17  
Faculty Mentor: Professor Alan Marchiori, Computer Science  
Funding Source: Helen E. Royer Undergraduate Research Fund  
Natural Language Search of Sensor Data

*Abroad Spring Semester 2016  
^Attending Association of Writers & Writing Programs (AWP) Conference  
+Competing in Athletic Event
We tested whether participants would adjust their subject-verb agreement based on experience, and whether generalization of subject-verb agreement from one construction to another would depend on the design of the task. We found that collective NP primes caused participants to adjust their agreement for collective NP targets, regardless of whether or not participants produced the preamble. This shows that repeating the preamble itself does not modulate learning when the prime and target constructions are equivalent. We also found that priming with collective NPs caused participants to adjust their agreement with non-collective NPs, but only when they did not produce the preamble. This suggests that repeating the preamble prevents generalization of learning across constructions. Evidence from a second experiment involving partitive constructions provides further support that repetition of the subject modulates how much participants generalize across constructions.

Altogether, we show that language users do adjust their subject-verb agreement based on experience, and that they generalize across constructions. We also show how repeating the subject limits the degree to which participants generalize from one construction to another.

Eric Andresen '16, Hannah Marsing '16

Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics

Examining Discrepancy in Prize Money between Men's and Women's World Cup Teams

This study seeks to identify the factors that contribute to differences in prize money between the women's and men's teams in the FIFA World Cup. We are particularly interested if economic productivity theory explains the discrepancy or if the difference can be explained by manager or customer preferences. We will use hypothesis testing to test if the difference in performance and TV ratings explains the difference in average prize money for the FIFA World Cups. Our data comes from FIFA's Audience and Prize Money Reports, which provided information on prize money and television ratings for the 2010, 2011, 2014 and 2015 FIFA World Cups. We will also use regression analysis to identify which factors are significant in determining prize money to postulate the existence of gender bias in the FIFA World Cup.

Sarah Andrews '16

Faculty Mentor: Professor Julie Gates, Biology
Funding Source: Fellows Program of the Kalman Fund for Biomedical Education

Ena May Work with Garz and Arf during Dorsal Closure in Drosophila

The actin cytoskeleton is an important functional feature required for forming an organism. It lies beneath the cell membrane and is a dynamic network composed of actin filaments that can be modified by other proteins to promote cell shape change. Dorsal closure in Drosophila requires the actin cytoskeleton and allows...
us to investigate how proteins interact with it to facilitate cell shape change. Near the end of embryogenesis, the Drosophila embryo is left with a sizable hole in its epidermis that must be sealed. To facilitate this, many proteins modify the actin cytoskeleton, including Ena. Embryos that lack functional Ena have trouble completing dorsal closure. A recent study suggests that another protein, Garz, functions with Ena during dorsal closure. By looking at actin localization, I am examining the dorsal closure defects that occur when animals have reduced levels of Garz. Typically, Garz turns on a protein called Arf. In order to determine if Garz functions in this way during dorsal closure, I investigated another protein involved in the regulation of Arf, ArfGAP1, which turns Arf off. I compared embryos lacking functional Ena to those that have half the normal amount of functional ArfGAP1 in addition to lacking Ena. I found that reduced levels of ArfGAP1 decreased the frequency of dorsal closure defects. These results suggest that Ena and ArfGAP1 function together, which in turn suggests that Garz turns on Arf during dorsal closure. These experiments provide insight into how cells move and change shape to form organs and tissues.

Nicole Bakeman ’16, Adriana DiSilvestro ’18

Faculty Mentors: Professor Amanda Wooden, Environmental Studies; Janine Glathar, Geographic Information Systems (ITEC)

Funding Source: Mellon Foundation Grant, Jamie Hendry Sustainable Studies Development Fund, Presidential Fellowship

Fractured Activism: A View of ‘Fractivism’ through an Anti-Incinerator Campaign in Central Pennsylvania

The research project “Fractured Activism: A view of ‘Fractivism’ through an Anti-Incinerator Campaign in Central Pennsylvania” is a comparative multi-method study of local activism and environmental attitudes in Central PA. The project is focused on how local communities organize about environmental issues in their communities. The project focuses on the local community activism against the proposed White Deer Township Energy Project, a tire incinerator, which was cancelled early in 2014. The project also investigates if and how this successful campaign influences activists who are organizing to oppose natural gas hydraulic fracturing. The project also makes connections and broadens its scope by investigating environmental attitudes - about the tire incinerator and about shale gas drilling - among the wider public in the region, in connection with national and place-based identity attitudes.

The intended outcomes from this research project are: one-two academic articles written by Professor Wooden; possibly a pedagogical article about the integration of GIS research in the classroom co-authored by Nicole Bakeman, Janine Glather, Jaclyn Tules, and Amanda Wooden; and one-two publicly shared online digital map/s about the tire burner campaign and the connection between anti-Shale gas drilling (“fractivism”) and community opposition to the White Deer Township Energy Project. The project is currently ongoing and is anticipated to finish Fall 2016.

Meghan Balot ’16

Faculty Mentor: Professor William Flack, Psychology

Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Methodologies for Studying Campus Sexual Assault

Recently, there has been fierce debate over the prevalence rates of sexual assault on college campuses. Some argue that current approximations are overestimates, while others argue that they are underestimates. There are many available studies that provide prevalence rates for campus sexual assault, and these rates fall across a wide range of percentages. One explanation of this diversity in results is the wide variety in methodologies used by all of these studies. From the wording of questions to sampling methods, there are many areas of variation between studies that can influence participant responses and, consequently, the prevalence estimates found by them. This literature review gathers a large sample of extant studies in order to explore the methodological and contextual differences between them. This examination leads to a discussion of the influence these differences may have on prevalence estimates and suggestions for future directions for sexual assault prevalence research.

Joshua Barna ’17

Faculty Mentor: Professor Ellen Herman, Geology & Environmental Geosciences

Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Storm Hysteresis as an Indicator of Matrix Flow Paths in a Conduit-Dominated Spring

Studying how the chemistry of karst springs reacts to periods of increased discharge can provide insights into how these systems store and transmit water. A new spring classification system updating the classic 1971 work of Shuster and White will be based on these storm responses. Preliminary data show that high frequency storm data yield additional information on recharge and flow patterns. A clockwise hysteresis occurs in water samples taken from Smullton Sinks, a karst spring in Centre County, PA, over the course of rainstorm events. The Mg/Ca ratio plotted against water depth suggests that Mg-rich water stored in the matrix is being forced out by storm water entering the system.

Depth measurements recorded at Smullton, Springhouse, and Weaver springs (all in Centre County, PA) show similar reaction times in response to increased recharge, though Smullton was classified as a conduit spring and Springhouse and Weaver were classified as having predominantly diffuse flow. Therefore, Smullton would be expected to have faster reaction time than Springhouse or Weaver. Increased sampling frequency will allow...
for springs to be placed more precisely along the continuum stretching from diffuse to conduit flow and from diffuse to focused recharge.

Understanding how water flows through karst systems is crucial for water supply and contamination protection. Changes in concentration of dissolved species in spring water over the course of a storm are key to developing a new classification system. This system once developed will be put to use predicting how complex karst environments react to storm events.

Phoebe Belser ’18
Faculty Mentors: Professors Dabrina Dutcher, Chemical Engineering, Chemistry; Tim Raymond, Chemical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship

Hygroscopic Growth Parameters of Organic Aerosols

Currently, one of the largest uncertainties in global climate models, is the interaction between organic aerosols and water in the atmosphere. Aerosols, which are suspended liquid or solid particles within a gas, play significant roles in the environment. Aerosols have direct effects such as impacts on visibility, cloud formation, and even human health. The role of aerosols on global climate is still being understood. Aerosols also have indirect effects, which are related to the ways in which aerosols interact with and form clouds. Indirect forcing by aerosols relates to the way in which the particles in the aerosol interact with water. The interactions of inorganic aerosols with water are relatively well understood unlike the interactions of organic aerosols. If a particle takes on water it can act as a Cloud Condensation Nucleus (CCN) and contribute to cloud formation. The ability for a particle to collect water is referred to as its hygroscopicity and is represented by a kappa value. Our hypothesis states that aerosols made from the ozonolysis of chemicals from a class of natural organic products, known as monoterpenes, all share a common hygroscopic growth parameter (κ) with a low variability. The κ parameter is determined through the simultaneous analysis of aerosols generated in a smog chamber by reacting the monoterpenes with ozone. The goal of this research project was to find κ values for many single and combinations of monoterpenes as well as to look for a trend in κ values, as more parent compounds were present.

Jordan Berger ’17
Faculty Mentor: Professor Tim Raymond, Chemical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fund

Effect of Electronic Liquid on the Properties and Composition of E-Cigarette Aerosol

In recent years, electronic cigarettes, or e-cigarettes, have rapidly gained immense popularity throughout the world and specifically the United States. Despite the increase in use, little is known about the health effects of these vaporizers, compared to traditional cigarettes. The e-cigarette uses a wick and heated coil to atomize e-liquid, creating the aerosol inhaled by the user. E-liquids are composed of propylene glycol, glycerin, usually nicotine, and various flavoring agents. The main goals of this research project were to identify the size distribution of particles in the vapor and identify the components of the vapor. Particle distribution focused on utilizing the Condensation Particle Counter and an Engine Exhaust Particle Sizer. For chemical analysis, the focus has been to utilize gas chromatography-mass spectrometry to determine nicotine concentration and the potential presence of carcinogens, primarily formaldehyde. The composition of the e-liquid was controlled to measure how nicotine content and flavoring agents affected particle size, particle distribution, and the composition of the aerosol produced. The relationship between how power ultimately affected the aerosol composition was also studied. The research, on going through the school year, continues to enhance understanding of the operation of e-cigarettes and the vapors they produce.

Yash Bhutwala ’17, Alex Robinson ’17, Trung Tran ’18
Faculty Mentor: Professor Nathan Ryan, Mathematics
Funding Source: Bucknell Institute of Public Policy; Dalal Family Fund for Creativity and Innovation

Assessment of the Population’s Access to Primary Care Providers in the United States

The Constitution of the World Health Organization states that “the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition”. To determine whether or not this fundamental right is equally enjoyed among the population, this project studies the physical access to healthcare provider in the United States. The project preliminarily defines this physical access as the use of typical modes of transportation (walking, driving and using public transport) to access a primary care provider within a 30-minute time constraint. Pennsylvania is the first state to be examined for our analysis of healthcare accessibility. From the calculated accessibility scores, we plotted a Lorentz curve of healthcare accessibility versus population and based on this Lorentz curve, we determined the Gini index, which measures how equitable healthcare is distributed in Pennsylvania. Preliminary results show that there is an inequitable distribution of access to primary care provider. Further study will include more specific demographic analysis, accounting for groups of different race, gender and age, as well as the analysis of states other than Pennsylvania.
Analysis of Diverse Arthrobacter Phage Isolated in Lewisburg, Pa.

We isolated twelve unique phage, viruses of bacteria, that infect the host *Arthrobacter* sp. ATCC 21022 (a bacteria in the order Actinomycetales). Phage were isolated and purified from local soil samples. DNA was extracted and characterized using PCR, which led us to select six phage genomes for DNA sequencing. The phage not selected were part of the AN cluster, which is reasonably well described. Of the five sequences received so far, each of the phage were from a different cluster, indicating a rich diversity. Genome size ranged from approximately 40kb to 70kb and genomes contained 60 to 113 putative genes. Transmission Electron Microscopy revealed all isolated phage have a siphoviridae-like morphology. Though the phage were all isolated from a small geographic region and infect the same host, they have little genetic similarity. These results will contribute to the larger SEA-PHAGES research program and our analyses will be available through National Center for Biotechnology Information (NCBI). Through the SEA-PHAGES program student researchers gained both practical experience with in vitro and in silico laboratory techniques, bioinformatic tools, and acquired an understanding of phage diversity and biology. In addition to providing a better understanding of phage-bacteria interaction, phage research has possible applications in the fields of human and animal health, nutrient cycling, and food safety.

Alison Billas '16

Faculty Mentor: Professor Reggie Gazes, Psychology
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

The Influence of Task Specific Factors on Quantity Discrimination by Brown Capuchins and Squirrel Monkeys

Previous studies have revealed that non-human primates discriminate quantities, however, their performance is highly variable both within and between species. Discrepancies in performance may be a result of a variety of factors, including species-specific differences and representational format of the stimulus presented. Six brown capuchin monkeys (*Cebus appella*) and six squirrel monkeys (*Saimiri sciureus*) were presented with two numerical quantities in three different conditions, testing for the effect of representational format on performance. These experiments directly replicated the Schmitt and Fischer (2011) study. Primates were rewarded with a quantity of food corresponding in number to the quantity of stimuli selected. Results revealed an influence of modality and species on performance, however, other potential confounding variables remained that may have affected performance. Additional testing of the influence of the motivational value of the food reward and the time delay between choice and reward revealed a significant affect of motivation on performance. Increasing the motivation resulted in the lack of an affect of both modality and species on quantity discrimination performance. These results suggest that poor performance in quantity discrimination tasks can be potentially explained by a lack of motivation to perform.

Christina Boyd '17

Faculty Mentor: Professor Craig Beal, Mechanical Engineering
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Trail Braking as a Safety Maneuver for Navigating Corners

Trail braking is a technique that entails braking past the entrance of a corner and allows an expert racing driver to travel faster through a corner while maintaining stability. This technique, highly effective in racing, has potential to assist not only expert drivers, but serve as a safety maneuver in passenger vehicles as well. While average drivers lack the experience to employ trail braking, modern control systems may be able to coordinate steering and braking inputs to maintain stability in a case where the driver has entered a corner too fast. For such a control system to be effective, the vehicle’s dynamic behavior must be well understood. This 2015 summer research project focused on development of a tool to better represent the relationship between driver inputs, tire-road factors, and safe operating boundaries. A well-known 2D phase portrait visualization tool was expanded to a 3D phase portrait visualization tool enabling examination of lateral velocity, longitudinal velocity, and yaw rate to determine vehicle stability under different operating conditions. Investigation focused on how tire friction, tire slip, and steering angle affect the stability boundary, stability curve, and vehicle trajectories. Experimental testing was conducted, including steering and cornering with and without braking, to validate the 3D visualization tool. This new model serves as a working tool for visualizing stable and unstable operating regions and will be used to develop a controller that employs the trail braking technique for vehicle stabilization.
Bret Brachman-Goldstein ’16

Faculty Mentor: Professor Christopher Daniel, Geology & Environmental Geosciences
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Metamorphic temperature estimates in the Precambrian Rocks of Northern New Mexico: An application of Ti-in-Quartz and Zr-in-Rutile Thermometry

Metamorphic temperature estimates using trace element thermometry Ti-in-quartz and Zr-in-rutile were recently calibrated experimentally and yielded small experimental error of ±20 °C relative to older major element exchange thermometry (±50 °C). Metamorphic rocks were analyzed for titanium concentrations in quartz and zirconium concentrations in rutile in three samples from the Northern Taos Range and four samples from the Picuris Mountains of Northern New Mexico. Analysis were measured at the electron microprobe facility at Rensslelear Polytechnic Institute and applied to the Thomas et al. (2010) Ti-in-quartz and Tompkins et al. (2007) Zr-in-rutile temperature calibrations. Ti-in-quartz temperature estimates for the Northern Taos Range range from 478-515 °C (±11-12 °C) at 6-8kbar and Picuris Mountains estimates range from 403-420 °C (± 35-26 °C) at 4-5 kbar. Zr-in-rutile temperature estimates for the Northern Taos Range are 536-567 °C (±22 °C) at 6-8kbar and Picuris estimates range from 454-458 °C (± 31 °C) at 4-5 kbar. My estimates are significantly lower than previous estimates by Pedrick et al. (1998) in the Northern Taos Range which were 650-750 °C at 6-8 kbar but may record resetting during deformation after peak metamorphism at 1.4 Ga. My temperature estimates for the Picuris are at the lower end of estimates by Daniel et al. (2006) which yielded three ranges of 405-470 °C, 500-520 °C and 510-525 °C at 4-4.2kbar. My work suggests that trace element thermometry is beneficial when trying to reduce experimental temperature uncertainties but may record resetting due to deformation after peak metamorphism.

Sarah Bradley, Graduate Student

Faculty Mentors: Professors Molly McGuire, Chemistry; Ellen Herman, Geology & Environmental Geosciences
Funding Source: Graduate Summer Research Fellowship

Isabelle Bristol ’16

Faculty Mentor: Professor Jeff Trop, Geology & Environmental Geosciences
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Sedimentology, Depositional Age, and Provenance of Cenozoic Strata Exposed Along the Little Susitna River, Southwestern Talkeetna Mountains, South-Central Alaska

This is the first detailed study of outcrops along the Little Susitna River immediately south of the Castle Mountain fault. New geologic data including mapping, sedimentology, U-Pb detrital geochronology, and palynology were collected from stratigraphic sections to constrain depositional age, environments, and provenance. These new data allow for correlation with rocks from Cook Inlet, Matanuska Valley, and Susitna Basin.

Sampled strata are divided into three lithofacies: conglomerate association (FA1), sandstone association (FA2), and mudstone association (FA3). FA1 is mostly massive clast-supported pebble-conglomerate with lenticular bed geometries. FA2 includes cross-stratified lithic sandstone, minor pebble-conglomerate, plant fragments, and lenticular bed geometries. FA3 includes sandstone lenses encased in mudstone with organic debris, calcareous concretions, and plant fragments. These lithofacies represent deposition in gravelly braided channel-bar complexes, sandy braided channel-bar complexes, and meandering channel-point bar-floodplain environments.

Abundant, diverse pollen and spores from FA3 mudstone indicate late Miocene deposition, consistent with the youngest populations of U-Pb detrital zircon ages (~26-22 Ma) from FA2 and FA3 sandstone. FA3 compares in age and lithology to the Beluga Formation of Cook Inlet and Susitna basins, while FA1 and FA2 correspond to the Tyonek or Beluga Formation.

Paleocurrent azimuths from cross stratification (FA2, FA3) suggest south-southwest-directed sediment transport. Detrital ages from Cenozoic samples yield a broad population of late Triassic (~220 Ma) to late Miocene (~22 Ma) ages, with higher...
populations of ~70-50 Ma ages overall. Inferred source terranes include the Arkose Ridge Formation and Jurassic-Cretaceous plutons in the Talkeetna Mountains and Alaska Range northeast of the study area.

**Sandra Castillo ’17, Wenbo Shan ’16**

*Faculty Mentor:* Professor Rhonda Sharpe, Economics  
*Funding Source:* Bucknell University Department of Economics  

**Gender Earnings Differences in Olympic Sports**

It has been 44 years since Title IX granted women an equal opportunity to participate and compete in the male-dominated world of sports. Although the Title IX legislation states that no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance, the inequality in conditions for men and women in sports still exists today. In many professional sports, such as basketball and soccer, the average male athlete’s earnings are higher than those of an average female athlete. In our paper, we seek to examine if an earnings inequality also exists with respect to male and female athletes competing in the Olympics. Specifically, we will compare the differences in endorsement and sponsorship earnings for male and female Olympic swimmers given 1) their relative distances raced, and 2) the amount of media coverage, drawing data in particular from Bernstein, A. (2002) and Eastman, S.T. and Billings, A.C. (1999), both of whom analyze both the amount of media coverage as well as distance raced by both male and female Olympic swimmers. Combining their research with compensation and endorsement data available from various media outlets, we will seek to shed light on whether there is any inequality in earning potential between the sexes in the field of Olympic swimming.

**Tara Caton, Graduate Student**

*Faculty Mentor:* Professor Chris Martine, Biology  
*Funding Source:* Graduate Summer Research Fellowship  

**Morphological and Molecular Analysis of Solanum asymmetriphyllum and S. sejunctum Interspecific Hybrids**

The overall purpose of this study is to investigate the hybrid offspring produced from the cross of *Solanum asymmetriphyllum* and *S. sejunctum*, two dioecious spiny Solanum species from northern Australia. The goal of the study is to determine the morphological and genetic relatedness of the artificially produced interspecific hybrid offspring, crossed in cultivation for the first time and unknown in the wild, to the parent plants. Both *S. asymmetriphyllum* and *S. sejunctum* have been described morphologically and genetically, which provided evidence that *S. asymmetriphyllum* and *S. sejunctum* are two distinct species. The data collected from this study will either support or refute this speciation event. The methods include morphological measurements, a species-determining restriction enzyme digestion pattern assay of the gene CYP703, a sporopollenin precursor gene, and chromosomal ploidy level determination. Molecular analyses will also be run on a potential wild hybrid with leaf tissue collected from herbarium specimens labeled as *S. asymmetriphyllum*, but resembling an intermediate form with *S. sejunctum*. Once sexually mature, hybrid crosses and backcrosses will be made to investigate reproductive ability. If none of the above tests confirm hybridization then it can infer one of two things: either that speciation between *S. asymmetriphyllum* and *S. sejunctum* has occurred too recently, or they are not two separate species. If the tests show distinct variation of the hybrid, then they can be defined as two species. Defining these species will better guide conservation efforts which may be necessary if these species are distinct and their overall population numbers are reduced, making one or both of the parent species vulnerable. All of these data better explain the evolutionary relationship between *S. asymmetriphyllum* and *S. sejunctum* and provide a better understanding of the mechanisms that isolate these two sister species.

*Rebecca Chambers ’17*

*Faculty Mentor:* Professor Anthony Stewart, English  
*Funding Source:* Helen E. Royer Undergraduate Research Fund  

**Literature is Not Created in a Void**

This research examines the Pulitzer Prize for Novels and Fiction, its relationships to the authors who have won the award, and what the award’s history has to say about American culture. The goal is to determine a story of America and its ideology using the themes and ideas presented in the books. After reading 28 winners so far, including the entire early Novel category, certain trends have emerged. The majority of the prize winners fall into the romance genre with emphasis on good morals, hard work, and economic independence. Themes such as order, preservation, and redemption also recur. Certain outliers necessarily emerge that signal a shift in the path of the prize. These outliers are normally contingent upon either a new Pulitzer jury, a change in the award’s criteria, or an event that had a profound impact on America such as the World Wars and the Great Depression. In fact, many of the books deal directly with these events. Through creating the story of America through the Pulitzer Prize, this research highlights the changes in America and its ideals and dreams.
Elizabeth Chrise ’17  
Faculty Mentor: Professor Erin Jablonski,  
Chemical Engineering  
Funding Source: Bucknell Program  
for Undergraduate Research  
Robust Millifluidic Devices for Passive Liquid-Liquid Extraction and Emulsion Separation  
Continuous liquid-liquid extraction of rhodamine 6G from pentanone into water occurred in a millifluidic device. Liquid-liquid extraction was possible through concurrent laminar flow of the organic and aqueous streams. The millifluidic device used for separation has flow rate capabilities of up to 500 mL/min, where continuous aqueous flow is stabilized along a hydrogel boundary. While the maximum flow through the device is 500 mL/min, the flow rates used in this study were lower to enable finer interface control between the two phases. Water flow rates were varied from 5 mL/min to 20 mL/min while the pentanone flow rate remained constant at 25 mL/min. The concentration of rhodamine 6G in pentanone was also varied while the flow rates were kept constant. The mass transfer coefficient was determined to be $(9.61 \pm 7.51) \times 10^{-2}$ cm/s. The millifluidic devices used in this research have a geometry that allows the mass transfer coefficient to be calculated accurately because of the well-defined interface between the organic and aqueous phases. Performing liquid-liquid extraction at the millifluidic scale enables greater control of the separation process when compared to the industrial scale. The unique millifluidic devices used in this research have myriad potential applications including the separation of low volume, high value materials such as pharmaceuticals.

Maria Cioffi ’16, Naba Mukhtar ’18  
Faculty Mentors: Professor Nathan Ryan, Mathematics;  
Joe Kloubusicky, Mathematics  
Funding Source: Bucknell/Geisinger Research Initiative  
Which are the important procedures in a hospital?  
Geisinger has millions of data entries consisting of twelve years’ worth of patient records: their procedures, the departments they’ve visited, etc. We use this data to deduce in what ways and how quickly sepsis is spread through the hospital system. We examine the hospital as a network of nodes, the nodes being departments or procedures, then determine which nodes are the most “important.” One of the factors of importance is how central a node is. Centrality could refer to how many connections a node has or how close it is to other nodes. There are a number of existing ways to measure centrality. We consider three algorithms: degree, closeness, and betweenness centrality. We intend to make adjustments though for our specific data set. One reason being, we want to use a weighted, directed graph as a representation where the weights could be the number of patients moving from node to node or the probability of a patient moving from one node to another. Another motivation for modifying the algorithms is that we consider combinations of the algorithms. We also compare the centrality measures to other measures of importance such as Markov chains and basic statistical inferences.

Hannah Comstock, Graduate Student  
Faculty Mentor: Professor Ryan Snyder,  
Chemical Engineering  
Funding Source: Graduate Summer Research Fellowship  
Investigation into the Formation of Amorphous Dicarboxylic Acid Particles via Monodisperse Droplet Evaporation  
Producing solid particles where the size and morphology are controlled is important in many industrial processes including those in the food, cosmetics, and pharmaceutical industries. In the pharmaceutical industry specifically, the purity, size, and internal structure are very important and being able to control all three aspects in one processing step is very beneficial in creating a product. This research focused on controlling the internal structure (crystalline or amorphous) using a method that already controls the solid particle size. Use of a vibrating orifice aerosol generator (VOAG) created uniformly sized solid particles from solution by monodisperse droplet evaporation in both a pure (solute in solvent) solution as well as a blended (solute and additive in solvent) solution. While a pure solution gives a crystalline structured particle, a blended solution using polyvinylpyrrolidone (PVP) as the additive gives varying degrees of amorphous structured particles based on the percent of PVP in the solution. The effect of PVP addition was studied in a single solute as well as in a class of solutes (simple dicarboxylic acids) in order to observe trends in the amount PVP necessary to change the internal structure form crystalline to fully amorphous. Scanning electron microscopy was used to ensure uniformity of particles and to observe surface morphologies while powder X-ray diffraction and differential scanning calorimetry were used to determine the internal structure of particles.

Marie Confreda ’17  
Faculty Mentor: Professor Brandon Vogel,  
Chemical Engineering  
Funding Source: Bucknell Program  
for Undergraduate Research  
Determination of How Quickly a Drug is Released from Polymer Nanoparticles  
The Vogel research group is developing new materials to detect, target, and treat disease. The goal of the project I am working on is to develop an injectable hydrogel formulation with embedded polymer nanoparticles to modulate the controlled release of a hydrophobic drug. The project consists of several different aspects. We first developed a method to make polymer nanoparticles with the solvent dimethyl sulfoxide (DMSO) in an impinging jets mixer. We needed to determine the phase behavior of the polymer-DMSO-water system to determine the concentration window that would allow us to produce particles.
less than 100 nm in diameter. It was concluded that the ideal weight fraction of polymer is 4.00 x 10^{-4} \text{ wt/wt}. We used an impingement jets mixer to mix a polymer-drug-DMSO solution with water. The rapid mixing of the two solutions causes polymer nanoparticle formation with an entrapped drug. To complete the nanoparticle formation we remove the excess solvent, DMSO using an ultrafiltration stir cell. After the DMSO was removed, sucrose was added to the solution to prevent aggregation during freeze drying. The solution was then lyophilized overnight, and the particles were separated. Finally, an aqueous solution of nanoparticles was used to dissolve two hydrogel precursors. When mixed the hydrogel precursors crosslink and form a solid hydrogel. This drug in nanoparticle hydrogel was used in an in vitro controlled release study to determine the effect of having the drug loaded into polymer nanoparticles has on the rate of drug release from the hydrogel device. The controlled drug delivery study is currently ongoing and results will be reported in due time.

**Tucker Cottrell '16**

**Faculty Mentor:** Professor Jessica Newlin, Civil Engineering  
**Funding Source:** The Katherine Mabis McKenna Environmental Internship Program

**Investigation of Groundwater and Surface Water Interaction on the West Branch of the Susquehanna River**

Interaction of groundwater and surface water is primarily affected by the interchange of local and regional groundwater flow systems with the rivers. Input of groundwater to a larger river in valley areas can have varying influences over the discharge and water quality in the surface water of the larger river. In the lower West Branch of the Susquehanna River, this unexplored interaction is investigated in two locations where multiple bedrock formations intersect the river valley. The required data consists of public well log data, geologic maps, and reasonable interpretations of the subsurface layer thickness. ArcGIS and ArcScene are used to create and display a 3D visualization of the various subsurface layers. The idea of creating a subsurface model that allows for visualization of data is being investigated to aid the interpretation of the hydraulic connection between the groundwater system and the surface water system.

**Tyler Craig '16, Trey Snow ’16**

**Faculty Mentor:** Professor Rhonda Sharpe, Economics  
**Funding Source:** Bucknell University Department of Economics

**Competitive Balance in Women’s Tennis**

Maintaining competitive balance best supports the integrity of sports. However, this balance is often corrupted by the actions of individuals and institutions. Even non-revenue, collegiate sports present an uneven set of circumstances where success can be influenced by unequal recruiting, facilities and branding. These factors hinder parity and often support dynasties. Success can create higher revenue and higher scholarship offerings. Disproportionate scholarships between colleges may lead to higher success on the court, by attracting superior talent pools. This paper aims to test the relationship between institutional spending on scholarships and performance in women’s college tennis. We will use scholarship data for NCAA Division I schools provided by the Office of Postsecondary Education Equity in Athletics as well as overall season records provided by the NCAA. A hypothesis test will determine a correlation, or lack thereof, between the variables of scholarship expenditures and a school’s team record. Looking at women’s tennis, we look to evaluate the level of competitive balance with examining the revenue of scholarships. The research is ongoing and the results of this study will be conducted and concluded for the symposium.

**Mark Daley ‘17**

**Faculty Mentors:** Professors James Baish, Biomedical Engineering; Dabrina Dutcher, Chemical Engineering; Timothy Raymond, Chemical Engineering  
**Funding Source:** Helen E. Royer Undergraduate Research Fund

**Characterization of Particulate and Vapor Phase Nicotine in Electronic Cigarettes**

Due to the rapid increase in popularity and the relatively little scientific knowledge of electronic cigarettes, several regulatory bodies, including the FDA and WHO, have expressed interest in obtaining a better understanding of their potential health hazards. Electronic cigarette emissions consist of two different phases, a vapor and particulate phase, which form due to rapid heating of an e-liquid, the nicotine-containing fluid delivered to users. This investigation was designed to determine the mass and distribution of nicotine available between the two phases. Emissions were drawn through a quartz filter and open-cell polyurethane foam filter to capture and separate the two phases. Gas-Chromatography Mass Spectrometry (GC MS) was utilized to quantify the actual mass of nicotine available in each phase. A theoretical nicotine mass was also calculated from the change in mass of the electronic cigarette after each trial. These tests were performed three times at three power levels: standard (7.4 W), high (12.4 W), and extreme (16.3 W). It was observed that particulate phase nicotine production differed little between the high and extreme powers, but was higher at the lower, standard power. In contrast, the vapor phase nicotine was produced in greater quantities at increased powers. This change in distribution is potentially responsible for altering the absorption characteristics of emissions and potential blood nicotine concentrations, a critical factor in assessing behavioral and health effects.
Sarah Decker ’17

Faculty Mentor: Professor Martin Isleem, Languages, Cultures & Linguistics (Arabic)

Funding Source: Douglas K. Candland Undergraduate Research Fund

Combating Arab Stereotypes through Cultural and Linguistic Education

This study surveyed the bias-related responses of Bucknell students through a question set distributed online using Qualtrics software. The survey was designed to reveal whether or not variables such as the demographic of one’s hometown or one’s experience with Arabic language and/or culture had an impact on the ability of the student to recognize common Arab stereotypes within bias traps. Multivariate analyses of variance using race, gender, and exposure to Arab culture revealed several correlations. The survey supports the author’s assumption that experiencing other identities through relationships or home environments allows for an understanding of those individuals’ lived realities. This understanding acts as a direct counter to the assumptions rooted in common media stereotypes, particularly those that surround the Arab identity. The author also conducted an interview with four current Bucknell students in a group setting as well as an individual interview with one Bucknell international Arab student in order to reveal the attitudes of students toward the problems involving race and discrimination on Bucknell’s campus. The data from the survey and the interviews supports the conclusion that the ability to recognize Arab stereotypes is derived from understanding the lived realities of Arab individuals. Therefore, a feasible solution to Bucknell’s current diversity problems must occur outside of the institutional framework and must rely on students, faculty, and staff members as social agents for change. In this mindset, professors will empower individuals to make change within their community by exposing their students to the lived realities of their peers.

Danielle Derchin ’16

Faculty Mentor: Professor Elizabeth Capaldi, Biology

Funding Source: Bucknell University Department of Biology

Comparative Regional Brain Analysis of Carpenter Bees

Neural Plasticity is the process by which experiences reorganize neural pathways in the brain to generate long term functional alterations. In the past 20 years the insect brain has emerged as a model subject for studying the effects of experience on neural reorganization. Of specific interest is the brain region known as the mushroom body because this structure is thought to be the primary center of multimodal sensory integration. Mushroom bodies contain neurons responsible for associative learning in a variety of insect species. They have been demonstrated to receive sensory input from both visual and olfactory sources. For the last 20 years, the mushroom body neuropils have puzzled neuroscientists because of their large size and ornate neural architecture. Previous studies have shown that mushroom body neuropils change in organization as a result of experience and age in honeybees. Here we report the first investigation of the brains of the eastern carpenter bee, Xylocopa virginica. Adult carpenter bees heads were morphologically measured and their brains dissected for histological analysis. We intend to compare the relative sizes of the primary neuropils and Kenyon cells of carpenter bees to that of honeybees. This study is a step toward understanding if the neuroplasticity of the honeybee mushroom body is a shared common feature in the brains of other bee species.

Lisa D’Errico ’16, Haley Tighe ’17, Sarah Och ’17

Faculty Mentor: Professor Ruth Tincoff, Psychology

Funding Source: Joann E. Walthour Undergraduate Research Fund; Bucknell University Department of Psychology

The Effect of Touch on Infant World Learning

Abstract Text: We examined the effect of touch on word mapping in infants (4 to 6-month-olds and 9- to 11-month-olds). Infants were exposed to a stream of syllables. One string of three syllables was always paired with a touch to the body. Another three syllable string was paired with touch once. Previous research shows the importance of touch for finding words. We measured looks to body part and distractor videos while listening to the target syllable strings. The results show that touch facilitated speech segmentation for the 4- to 6-month-olds and possibly for the 9- to 11-month-olds, but there was no evidence of word mapping. Future studies will investigate the effects of more explicit exposure to the word-referent mappings.

Nicolas Diaz ’17, Gabrielle Petruso ’19

Faculty Mentor: Professor Chris Martine, Biology

Funding Source: David Burpee Endowment, Wayne E. Manning Internship Fund, Botanical Society of America Undergraduate Research Award, NSF STEM Scholars Program

The Christmas Tree that Keeps on Giving: The invasive potential of cultivated varieties of American Holly

The genetic, ecological, and demographic effects of invasive plant species have already been widely documented and studied. The effect of escaped cultivars of native species introduced outside of their natural range, however, has been given little to no attention. This preliminary study sought to locate and identify wild and escaped populations of American Holly (Ilex opaca), record sex ratios, and collect sample specimens for future genetic analysis. Site locations were provided by the Pennsylvania Natural Heritage Program. A voucher was collected for each observed population and small tissue samples were collected from individuals within a given population. After the first field season, the study revealed a few noteworthy trends: (1) at locations where Holly was believed to have escaped, high levels of recruitment were observed in shaded understories, (2) a number of populations were observed in riparian zones with noticeably saturated soil, perhaps indicating a selection for
a broadened soil tolerance, and (3) Holly thrived in disturbed forests and edge habitats where other common invasive species occurred. Determining whether an individual was sexually mature proved difficult when drupes were not present. However, a slight male bias in some populations was observed. Upcoming comparisons of populations using genetic tools will determine future directions of the study.

Jake Dixon ‘18, Jen Terry ’16
Faculty Mentor: Professor Mizuki Takahashi Biology
Funding Source: Bucknell University Department of Biology

Examining Nest Cleaning Behavior in the Japanese Giant Salamander (Andrias japonicus)

Building or modification of nesting sites prior to the breeding season is commonly observed among birds and fish but has not been reported in salamanders. Instead, parental care is largely limited to the attendance of eggs in salamanders. In the Japanese giant salamander, a fully aquatic salamander endemic to Japan, it is known that large males, known as den-masters, aggressively guard nest sites and care for the eggs laid within. In addition, a few observations on sand piles outside the nests along river banks suggest that paternal investment prior to spawning events may exist in the form of nest cleaning, which however has not been confirmed nor quantitatively described. Through collaboration with Asa Zoo in Japan, this study aims to examine the possibility of nest cleaning behaviors by male Japanese giant salamanders through video analysis of a den-master in captivity. We hypothesize that 1) males exhibit pre-spawning paternal care through the removal of sand and other debris from the nest, and 2) cleaning behavior intensifies as the breeding season approaches. We tested these hypotheses by reviewing a large number of video clips recorded at Asa Zoo in 2012, 2013, and 2015 and analyzing the den-master’s behaviors prior to the breeding season. Our results will provide novel insight into parental care behaviors in salamanders. Our study will also have implications in regard to the captive breeding as well as conservation of the declining giant salamander populations.

Mohammed Elnaiem ’16
Faculty Mentor: Professor Jennifer Thomson, History
Funding Source: Bucknell Institute for Public Policy

Who is the Subject of Militant Research, A Case Study and Dispatch from the Movement for Black Lives

With support from the Emerging Scholars grant provided by the Bucknell Institute for Public Policy, I was privileged to do some militant research in the struggle against Mass-Incarceration in Oakland, California. Militant research is in summation: knowledge building for and by the movement. I took up a different approach than traditional sociology i.e. what I call a subject/ object oriented approach. Traditional sociology presupposes a divide between the subject of research (a hypothesis) and the object of research (living people.) In other words, sociology relies on the objectification of real existing people. My research challenges these forms of knowledge building. It starts with the assumption that a subject/object divide needs to be subverted. My comrades and myself are in fact the subjects of research, and their feelings and expressions are privileged over any objective data that I can supposedly extract from them. To put it quite simply, my militant research privileges the lived experience of the queer sister on the block and does not preoccupy itself with graphs, charts and statistical data. It is not anti-positivist, but it is not positivist either; it is militant and its sole purpose is to deepen the struggle for human liberation.

Polly Englott ’16
Faculty Mentor: Professor Ann Tlusty, History
Funding Source: Bucknell University Library & Information Technology

Mapping Historic Taverns in Augsburg, Germany

Starting with a historical map of Augsburg, Germany, produced as a copper engraving in 1626, Professor Tlusty and I are creating a georectified map of inns and taverns extant in Augsburg between 1500 and 1750. The map presents a “birdseye” view of each individual building in the city and has been digitized and remastered with the help of a graphic artist. Thus each tavern can be outlined and linked to relevant descriptive data. The draft map includes: a basemap of modern Augsburg (for cross-referencing); the georectified Kilian map (attached to corresponding geographic points on the modern map); a draft shapefile layer of polygons covering the tavern locations, created by another student; a point layer with tavern locations that was geocoded using their modern addresses; and a shapefile layer with city monuments.

I have spent the past six months cross-referencing the 131 tavern points based on Professor Tlusty’s comprehensive address records. After confirming or adjusting the location of the points, I revised the polygon vertices to cover the building in a clear, aesthetically pleasing way. Although a number of tavern points did not geocode correctly, it was not difficult to adjust them because the seventeenth-century map matches up remarkably closely with the modern map of the city. The tavern map will eventually reside on the web as an open-access digital product that links historical information about each tavern (known years of operation, names of tavern keepers, incidents that occurred there, travelers known to have stopped there, etc.) to their map locations.

Max Fathauer ’18
Faculty Mentor: Professor Sheila Lintott, Philosophy

Tragedy: the Absurd Victory of The Greeks

In my paper I argue that Nietzsche’s account of Greek tragedy in “The Birth of Tragedy” and what it accomplishes for the Greeks in their culture is extremely analogous to Camus’ question of Absurdity that he outlines in “The Myth of Sisyphus”. More
generally, I talk about the significance of tragedy as a form of art in Greek culture and how it enabled “the Greeks” to affirm life in a reality where we inevitably experience suffering.

The question then becomes: How is Greek tragedy remotely relevant to my life in the modern world? We can only begin to understand just how much tragedy as an art form can influence us individually and culturally in light of Camus’ concept of absurdity. For Camus, there is an inherent divorce in our search for meaning in life given the abject reality of our very existence. I argue that for both Nietzsche and Camus, there is reconciliation in apparent paradox only though the profound acknowledgement and tackling of the disconnects at hand.

This has a few profound implications. Most notably, American culture can learn something from Greek culture in terms of accepting the unalterable. Additionally, we are given a glimpse into the power of art on an individual and cultural level- it can even go so far as to enable one with the very will to live. Finally, in so far as the absurd victory is the overcoming of a paradox, Greek tragedy as a device enables the Greeks to achieve the absurd victory in that they can desire to live given the circumstances of their reality.

Max Ferrer ’17

Faculty Mentor: Professor John Hunter, Comparative Humanities
Funding Source: Bucknell Program for Undergraduate Research

Authentication in Social Media Representations: Identity Multiplicity, Performativity, and their Effects on College Students

Existing scholarship on identity formation stresses information-sharing as a prime method of establishing one’s idea of self. When this theory is applied to social media usage, users, in essence, create multiple identities by sharing different sets of information with their friends, family, employers, and even strangers. Despite this variety in our personal identities, users expect other users to provide identities that they believe to be “authentic,” while simultaneously demanding a “curated” self-presentation. The paradox of “authentic” self-representation is well represented by both popular and scholarly sources designed for general consumption: how is an individual supposed to follow the unwritten rules of social media to present themselves in a positive light while simultaneously maintain the undefined, peer-enforced expectation of “authenticity?”

This study surveys students at Bucknell University in order to create a third dimension in an investigation into authenticity and online representation. The survey serves to gain insight into what students’ conception of “authenticity” is in relation to online representation, their attitudes about how online information-sharing affects their idea of self, as well as what attitudes and phenomena sustain this impossible standard of authenticity. This survey data, alongside psychological, anthropological, media, computer sciences, sociological and legal scholarship, among many more, on identity and popular sources guiding students in their online representation will add another lens to the existing discussion on the relationship between online and offline representation and the lack of a profound difference between the two.

Tony Flores ’16

Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics

Extracurricular Activities, Particularly Organized Sports

Extracurricular activities, particularly organized sports participation, have become an essential part of American childhood. Involvement in sports at a young age helps develop social skills and a sense of competition for individuals that ultimately benefits them in later stages in life. Despite this, there is a lack of Hispanic participation in sports. Hispanic athletes tend not to be represented at the collegiate level as much as their white counterparts and other minority athletes. Perhaps this is due to economic and social barriers that do not allow access to participation in organized sports at both the community and high school level. Using the NLSY97 data set, this research will look at the benefits of participation in sports, particularly how Hispanics can use this as a form of upward social mobility.

Emma Frawley ’17

Faculty Mentor: Professor Chris Martine, Biology
Funding Source: Wayne E. Manning Internship Fund, Bucknell University Department of Biology

Celebrating difference: Morphological comparison between a narrow endemic Australian species (Solanum eburneum) and a locally recognized variant

The monsoon tropics of northern Australia are home to many endemic species, including numerous spiny solanums (Solanum subgenus Leptostemonum). Solanum eburneum is an andromonoecious species restricted to clayey soils in the vicinity of the East Baines River, Northern Territory, with a range largely encompassed within Judbarra/Gregory National Park. For at least 30 years, regional botanists have recognized a subpopulation of S. eburneum as S. ’watneyi’ but no formal comparison between it and typical S. eburneum has been done. The current study represents the first rigorous morphological comparison between the two taxa using data garnered from seedlings through mature plants, including measurements of vegetative, floral, and fruiting characteristics. Using plants grown from wild-collected seeds, morphological analyses are combined with molecular phylogenetic comparisons, crossing experiments, and field observations to establish the distinctive nature of S. ’watneyi.’ The implications of recognizing the new taxon are explored, including potential effects on the conservation status of S. eburneum.
Denver Freeman ’17
Faculty Mentor: Professor Agnes Jasinska, Psychology

Potential Psychopharmacological Treatments for PTSD Patients: A Review

Post-Traumatic Stress Disorder (PTSD) is a mental disorder that develops in some individuals after exposure to a traumatic event. In the past, PTSD patients have been treated with selective serotonin reuptake inhibitors (SSRIs), but in recent times the use of these drugs has been challenged. Propranolol, a competitive beta-adrenergic antagonist, has emerged as an alternative and possibly better treatment for PTSD, especially when paired with behavioral therapy. However, the use of propranolol and similar drugs raises a number of ethical and societal concerns, as voiced by a number of reports published by the President’s Council for Bioethics and similar organizations.

In this review, I will critically examine the main ethical and societal issues related to two main uses of propranolol and similar drugs in individuals at risk of PTSD. The primary, traditional use is as treatment after exposure to trauma. The second, emerging use is prophylactic, before trauma exposure occurs. In addition to safety concerns related to the effects of these drugs on general stress response and cardiovascular function, these drugs raise a number of questions related to pharmacological memory manipulations. These questions range from societal concerns about access and regulation (distributive justice), to the more philosophical questions about personal identity, moral decision-making, authentic experience, and the society’s obligation to remember traumatic events.

Emily Fricke ’18
Faculty Mentor: Professor Charles Kim, Mechanical Engineering
Funding Source: The Dean’s Fund in Summer Undergraduate Research in STEM

Development of a Diagnostic Tool for Project for Sustainable Eyecare (ProSEC)

The research objective was to create a simple, cheap, and accurate diagnostic tool for eyeglasses. The creation of such a tool helps address the problem of eyecare and vision correction that is posed in the developing world, where many do not have access to life-altering corrective lenses which enable a child to gain an education or allow an adult to have a job. The methods were as follows: 1. Brainstorm different ideas and develop a few prototypes. 2. Pick one prototype and perform testing with it. 3. Improve the design based upon testing. All prototypes employed the Scheiner Principle. The basic idea behind the Scheiner Principle is that if one has a refractive error, looking through an opaque disk with two pinholes in it will cause one to see double. By exploiting this “double image,” an objective procedure can be created to determine whether or not a person needs vision correction. Testing with the initial prototype was done, and the results from the diagnostic tool were compared to prescriptions determined by an optometrist for the test subjects. The original prototype was not as accurate as desired, so design improvements addressing the specific problems encountered with the previous iteration were made. Preliminary gauges of the redesigned tool’s accuracy imply that the new design has the potential to become a viable product.

Nicole Fry ’18, Maya Martignetti ’16, Hanna Pedersen ’16, Christine Quinn ’17, Sara VanTilburg ’16
Faculty Mentor: Professor Kim Daubman, Psychology

The Effects of Third Party Forgiveness on the Transgressor

This study is part of an ongoing research program exploring the effects of being forgiven. Past research has shown that being forgiven by the victim increases empathy for the victim, increases taking responsibility for the harm, and decreases victim blame. The present study addresses whether being forgiven by a third party produces the same effects. We also investigate whether providing an apology is necessary for the forgiveness to produce these effects. We hypothesize that participants who write an apology about a harm they committed and whose apology is randomly determined to be deemed worthy of forgiveness compared to those who merely describe the harm or whose apology is deemed to be unworthy of forgiveness will express higher self-esteem, lower need to belong, more personal responsibility, less blaming of the victim, and more empathy for the victim. Female and male university students aged 18 to 22 complete the survey through Qualtrics. Participants are asked to think about a time they have harmed someone and either describe the event and/or write an apology to the researcher who then, based on their random assignment, forgives them, doesn’t forgive them, or doesn’t say anything at all. Then participants are asked to complete measures of self-esteem, need to belong, personal responsibility, victim blame, and empathy.

Tyler J. Fulton ’16
Faculty Mentor: Professor Michael Krout, Chemistry
Funding Source: ACS Division of Organic Chemistry, Bucknell University

The Development of Copper Mediated 1,4-Conjugate Addition Reactions toward Complex Molecule Synthesis

A new and general procedure for the efficient 1,4-conjugate addition of functionalized organozinc reagents to a,β-unsaturated carbonyls was developed. This optimized addition proceeds in high yields using catalytic quantities of copper(I) or copper(II) in the polar, aprotic solvent N,N-dimethylacetamide. A substrate scope of the addition reaction demonstrates tolerance for a variety of functional groups and the ability to efficiently form tertiary and quaternary carbon centers.
Abigail Garrett '17

Faculty Mentor: Professor Emily Stowe, Biology
Funding Source: Russo Family Fund for Undergraduate Research

Phylogenetic & Expression Analysis of Cyanobacterial TspO

TspO and TspO-like genes have been identified in various organisms, including cyanobacteria and humans. Although many species synthesize their own TspO proteins, the function and gene sequences are known to vary widely among different species. Some bacteria use TspO-like proteins to regulate pigmentation and protect against extreme light exposure. In humans, the TspO-like protein is involved in controlling cholesterol and iron in the body. This research attempted to understand more fully the functions and conditions that control the expression of the TspO gene in cyanobacteria. Using modern techniques in biotechnology, three strains of bacteria (Freymyella diplospihon, Nostoc punctiforme, and Anabaena variabilis) were studied under differing light conditions and at various time intervals. The research involved growing cultures in red or green light, and then measuring the expression of the TspO gene using qPCR in order to create the baseline data. The cultures originally grown in red light were then moved to green light and the expression of the TspO gene was measured at different time intervals. Light intensity was kept constant throughout the growth periods. In some of the bacterial strains, the baseline data showed some differences in the expression of TspO between the red light and green light conditions, while other bacterial strains had almost no variance in expression between the light conditions. Although baseline data was collected, further research is necessary to explore fully the expression of TspO in changing light conditions. Research such as this study on cyanobacteria may lead to more comprehensive research on different organisms.

Lacey Gavala '18

Faculty Mentor: Professor Chris Martine, Biology
Funding Source: NSF STEM Program; Botanical Society of America Undergraduate Student Research Award; David Burpee Fund

Effect of Fire on Seed Germination in Solanum Beaugleholei, an Endemic Spiny Solanum of the Kimberley Region, Australia

Spiny solanums of the fire-prone Australian monsoon tropics are often assumed to be “fire weeds,” with increased levels of recruitment associated with frequent bush fires. During fieldwork on the Kimberley Plateau, seeds of the endemic Solanum beaugleholei were collected from a habitat where an intense fire had recently burned. Seeds were removed from fruits exposed to three qualitative levels of burning: scorched, partially burned, and unburned. Fruits/seeds were then collected from an unburned S. beaugleholei population ca. 25 km away. In the lab, half of the seeds of each of the four “fire treatments” were soaked and treated with gibberellic acid, while the other half were soaked in water only. To understand the effect of the fire on the seeds, time to germination and rates of germination were recorded. Seeds collected from the unburned population and unburned seeds from the fire site showed the highest germination rates and shortest time to germination, allowing us to infer that fire has a negative effect on seed germination in S. beaugleholei. As a means to further confirm and clarify these findings, the seedlings were grown into mature greenhouse plants and hand pollinated to establish a new seed source for experiments replicating fire conditions ex situ. Seeds were given pre-sowing treatments exploring the potential roles of various ecological correlates of fire exposure in hastening or promoting seed germination and seedling growth. Understanding the effect of fire on S. beaugleholei may be useful in conservation efforts. Because fire appears to hinder seedling recruitment in S. beaugleholei, frequent incidences of fire (including prescribed burns) on the Kimberly Plateau could result in declines of this uncommon endemic species in certain habitats.

Steven Grune Jr. '16

Faculty Mentors: Professors Craig Kochel, Geology & Environmental Geosciences; Jeffrey Trop, Geology & Environmental Geosciences
Funding Source: National Science Foundation – Geomorphology and Land Surface Dynamics

Geomorphic Evolution of Icy Debris Fans on the McCarthy Glacier, Wrangell Mountains, Alaska

Icy debris fans are the result of decoupling of a valley glacier and a high level icecap in an alpine region, a result of climate warming. Ice-dominated mass wasting processes degrade the icecap, delivering ice and sediments to the catchment above the icy debris fan and ultimately onto the fan. The valley glacier ice budget is heavily dependent on the amount of material coming through the icy debris fans. Time-lapse imagery was used to document these mass wasting processes from July 2013 – June 2015. This is the longest observation period for these landforms, allowing for quantification of material deposited on the fans and potentially added to the valley glacier. Imagery was used to interpret the location and nature of each depositional event, as well as examine their area and volume. The data was also examined in relation to local weather variations.

The three fans studied are the East, Middle, and West fans. The fans actively receive deposits throughout the year. Ice avalanches are the most common depositional process on all three fans, followed by slush flows, and debris flows. The East fan is the most active with 236 deposits, followed by the Middle fan (113 deposits) and the West fan (55 deposits). The East fan exclusively received ice avalanches and slush flows, while the Middle and West fans both had ice avalanches, slush flows, and debris flows. This is due to differences in catchment storage between the fans. There was no observed correlation between accumulated precipitation, temperature, snow depth, and solar radiation with frequency and total number of events. Percent area of fan covered over time showed a cyclic pattern of the size of events. The volume of material contributed to the fans is a significant portion of material added to the glacier budget.
Hang Thanh Ha ’18  
**Faculty Mentor:** Professor Michael Thompson, Electrical & Computer Engineering  
**Funding Source:** PPL Undergraduate Research Funds  

**Kinematic Data Capture Using Mobile Device**  
Kinematics measurement is one of the promising methods in diagnosing neuropsychiatric disorder such as ADHD. There are several ways to capture human movement data (ex: Vicon system…), however, those methods are rather expensive and require special experimental settings. Mobile computing device, with a set of sensors including accelerometer, gyroscope, and magnetometer is a useful tool to capture human movement data, due to its availability and essentiality to everyday life nowadays. The primary goal of my research is to research and develop a technology system that collects and stores human movements using a smartphone. To reach that goal, I developed an Android app that allows smartphone to capture sensors data and save those data as csv files. To validate the system, I performed some performance tests to make sure that the app optimizes the phone resources as well as provides usable data. Finally, I add some customizing features to the app so that it fits research environment. Researchers has used this framework to collect kinematics data from simple mechanics system as well as human fidgeting action and validate the data. The results of my research indicates that smartphone is a good tools to measure kinematic data given its capabilities and limitations.  

Kyle J. Haddock ’17  
**Faculty Mentors:** Abby Hare-Harris, Ph.D., Geisinger Autism and Developmental Medicine Institute; Christa Martin, Ph.D., Geisinger Autism and Developmental Medicine Institute  
**Funding Source:** Geisinger  

**Development of an Automated Algorithm to Identify Candidate Genes in Developmental Brain Disorders from Sequencing Data**  
Developmental brain disorders (DBDs) are a group of neurological disorders that are defined as a distinct disorders, but have significant overlaps in clinical features and underlying genetic etiologies. Copy number variants (CNVs) account for up to 20 percent of all DBDs. In this study, we identified 25 CNVs that had been previously associated with DBD phenotypes. As causative genes within these CNVs have yet to be identified, we sought to build supporting evidence for genes within these regions using whole exome sequencing (WES) studies of DBD cases. Using data from our previous phenotype-based literature review of WES studies of DBD cases, we identified 10 genes in 6 CNVs that were previously reported to have deleterious variants in DBD cases. In order to identify candidate genes in the remaining CNVs and provide additional support for our DBD genes, we then developed an automated pipeline to identify loss of function variants in a WES analysis of a hospital-based cohort. The algorithm first parses through an annotated variant call file and outputs variants annotated as resulting in a loss of function. The algorithm also filters variants that are present in >1% of the cohort of interest and identifies genes with an overall variant frequency of >1 percent of the cohort. Given the high amount of variation in these genes, these genes are unlikely to be causative of a disease phenotype and are removed from further analysis. The resulting list of candidate genes will be further investigated using WES data from a hospital-based cohort.  

‘James Hallam ’16  
**Faculty Mentor:** Professor Saundra Morris, English  
**Funding Source:** Douglas K. Candland Undergraduate Research Fund  

**Performative Emerson: “God the native of these bleak rocks”**  
My research on Ralph Waldo Emerson centers on Emerson’s assertion in “Self-Reliance” that “the soul becomes.” In other words, the individual is engaged in a dynamic process of growth throughout his or her lifetime. Concentrating predominately on three of Emerson’s main essays, my research explores the ways in which Emerson performs this process of growth within his essays. I argue that his inner struggles with himself and the world around him manifest themselves in various ways within his texts, both productively and unproductively. Productively, Emerson writes through his self-doubt and uncertainties, allowing him to arrive at new truths and new convictions. Unproductively, these struggles tend to create contradictions that undermine his message. My work raises questions about Emerson’s reasons for including these contradictions that not only undermine his message, but also seem to call into question his entire belief system. Ultimately, I argue that not only are both these manifestations of Emerson’s inner struggle, despite fracturing and confusing the text, crucial for his own inner growth, but also the inner growth of the reader. Emerson’s readers must struggle to navigate his confusing and contradictory language. Readers must rely on themselves, their own mental processes, to interpret the nonlinear essay, and seek their individualized solution to the text’s problems. This indirect way of promoting self-reliance and inner growth within the reader affords his work the organic unity denied by contradictions and lies at the heart of Emerson’s immortality and importance for casual readers and revolutionaries alike.  

Addison Haxo ’17  
**Faculty Mentor:** Professor Kathleen Bieryla, Biomedical Engineering  
**Funding Source:** Bucknell Program for Undergraduate Research  

**Use of Force Sensing Resistors to Determine Position within a Gastrointestinal Model**  
Most models of lower gastrointestinal (GI) track used for training provide little feedback on the potential harm to patients. Being able to collect force and position data concurrently would
allow for the forces applied to the model to be related to a specific position within the model. The purpose of this research was to implement force-sensing resistors (FSRs) into a model of the lower GI tract, thus allowing position and force data to be collected together while being related to time.

This model has the added functionality of collecting all necessary information on the front panel of the LabVIEW program, as well as the ability to save the data for further analysis. Novice endoscopists will be able to see where in the model they are applying the most force. With this knowledge, they may be able to refine their technique, reducing maximum force applied to the colon during a surgery. The FSRs and the load cell have the ability to be added to preexisting models of the lower GI track with little reconfiguring. This capability would allow for an endoscopist to use a model that doesn’t originally have the data collection capacity in a more affective manner.

The model is successful in collecting both force and position data and can be used for training. For training, an alternate version of the LabVIEW program exists which does not require the data to be saved. Future testing will examine the efficacy of this model to improve novice endoscopist training.

Daniel Hayes ’17

Faculty Mentor: Professor Chris Martine, Biology; Ingrid Jordon-Thaden, Biology
Funding Source: David Burpee Endowment, Botanical Society of America Undergraduate Research Grant

Flow cytometric seed screen of the apomictic alpine mustard, Draba oligosperma Hook., from the North American Cordillera

Draba oligosperma Hook. (Brassicaceae) has a unique distribution pattern and an unusual mode of apomixis. Preliminary data from one population showed this species to be apomictic, but historical herbarium sheets containing pollen suggests it is sexual in parts of its distribution. To determine if the species is apomictic throughout its distribution, seed collections from California, Nevada, Utah, Idaho, Montana, Wyoming, and the Yukon were made during 2012, 2013, and 2014 field seasons. A total of 29 populations were sampled with ~30 individuals per population. For the seed screen, we have analyzed approximately 50% of the samples (~4350 seeds). Using high throughput flow cytometric seed screening (FCSS), we determined the stability of apomictic reproduction for this species. The unique and large distribution of this species will allow for the role of apomixis in speciation to be better understood.

Branden Hing ’17

Faculty Mentor: Professor Laura Beninati, Mechanical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship

Modeling Velocity Flow Fields of a Marine Hydrokinetic (MHK) Array

To ascertain and quantify flow interactions between two model marine hydrokinetic (MHK) devices, this study focuses on performing a series of velocity measurements to display wake variations across the test section of a hydraulic flume facility. Varying the stream-wise spacing between the velocity profile measurement and the upstream turbine, a comprehensive analysis of wake propagation suggests that the performance of the downstream device was negatively affected by the presence of the upstream turbine. Velocity measurements were conducted in specific profiles, comprised of horizontal (span-wise), vertical, and circular paths. Comparisons between generated velocity data indicate that profiles circumscribing the diameter of the turbine blades are more practicable in characterizing wake flow than horizontal or vertical profiles alone.

Hejintao Huang ’16

Faculty Mentor: Professor Jeffrey Evans, Civil & Environmental Engineering
Funding Source: Bucknell Program for Undergraduate Research

Hydraulic Conductivity of Soil Bentonite Slurry Walls

Soil-bentonite slurry trench cutoff walls are the most common type of vertical cutoff walls used in the US. The hydraulic conductivity of bentonite slurry wall backfill is typically required to be equal to or below 1x10-7cm/s. Backfill is made by mixing excavated and/or borrow soils with bentonite slurry and, as needed, additional dry bentonite. Publications have provided guidance for mix designs to achieve the desired characteristic of low hydraulic conductivity. Previously, no systematic studies have been undertaken to investigate the hydraulic conductivity of soil-bentonite slurry wall backfill formulated with different grain size distributions and bentonite contents all as a function of stress. This paper describes the results of studies undertaken to evaluate the effects of grain size distribution, bentonite content and effective stress on the hydraulic conductivity of soil bentonite slurry trench cutoff wall backfill. Three base soils were used representing a range of soils found on typical construction projects along with four bentonite contents for each base soil. The hydraulic conductivity was measured in consolidometers adapted for falling head permeability tests at the end of each load increment. These experiments yielded the relationships between effective stress and hydraulic conductivity and allowed examination of the influence of base soil characteristics and bentonite content.


Adam Huff ’16

**Faculty Mentor:** Professor Emily Stowe, Biology  
**Funding Source:** Russo Family Fund for Undergraduate Research

**Gene Regulatory and Morphological Responses of Chromatically Adapting Cyanobacteria to High Light Stress**

Cyanobacteria are a diverse population of photosynthetic prokaryotes that occupy a wide range of habitats including freshwater and marine ecosystems. Their antenna complexes, called phycobilisomes which funnel energy absorbed by photons to the photosystem reaction centers, are comprised of various pigments. In most species, these pigments include phycocerythrin, phycocyanin, and allophycocyanin. Some species are capable of a phenomenon known as complementary chromatic adaptation (CCA) through which the pigment composition of the phycobilisome is altered depending on the most prevalent wavelength of light available. These species are divided into group 3 species, which alter their phycocyanin and phycocerythrin content, group 2 species, which only alter their phycocerythrin content, and group 1 species, which do not alter their phycobilisome composition. In addition to the alteration of the phycobilisome observed in CCA species, gene regulatory and morphological responses to high intensity light have also been documented in many species. To further characterize the responses of CCA species to high intensity light, expression of pmgA, observed to be differentially expressed under high light intensity in Synechocystis sp. PCC 6803, as well as changes in morphology and total pigment content were observed in cultures of the group 3 chromatic adapter Fremyella diplosiphon when grown under different light conditions. In F. diplosiphon, the gene pmgA was observed to be differentially expressed under high light intensity. Additionally, the total pigment composition of cells grown in high light intensity decreased while the incidence of cell death, altered cytoplasmic organization, and changes to cell shape and size increased.

Jon Hunsberger ’16

**Faculty Mentor:** Professor Stephanie Larson, Classics & Ancient Mediterranean Studies  
**Funding Source:** Kalman Fund for Undergraduate Research in the Sciences

**The Excavation of the Ismenion in Thebes, Greece**

My research in the summer of 2015 focuses on three areas: the periods of use of the Temple to Apollo Ismenion, architecture on the hill and time periods of its existence, and Byzantine Graves of the Early, Middle, and Late Byzantine periods, looking for distinctions, if any, that exist between burial practices within these three periods.

From the temple blocks that exist on the hill, there are thought to be three separate phases of use with respect to the temple: the Archaic period, the Classical period, and potentially another use after that.

To see when the area stopped being used as a temple sanctuary and began being used as a Christian cemetery will take more excavation within the bounds of the temple.

In terms of architecture on the hill, a large, rectangular, plaster-lined water feature was uncovered in 2015. Within this feature are two tunnels. One leads out and one leads in. The tunnel leading in enters from the east of the feature and the tunnel going out exits through the bottom. Having in mind that this is a water feature lends to the expectation of some sort of fountain house existing on the hill. Further excavation of this water feature and on the hill in general is necessary to make any definitive claims.

Lastly, Byzantine graves exist on the hill from three periods: Early, Middle, and Late. Overall, there is no evident distinction between the burial practices of these three periods. The grave goods found within graves from each of these periods do not differ in content, but only in quantity. This is most likely a reflection of the status of the person buried and not a relevant distinction in the practices of different periods of burial.

Peter Jahl ’16

**Faculty Mentor:** Professor Rob Jacob, Geology & Environmental Geosciences  
**Funding Source:** Kalman Fund for Undergraduate Research in the Sciences

**Establishing a procedure to delineate defects in a soil-bentonite slurry wall using electrical resistivity**

Soil-bentonite slurry walls are underground barriers commonly built to protect sensitive environments from groundwater contamination. The structures are simple to construct, however in order to inspect and repair them, they must be excavated manually. The goal of this project is to determine a method of non-invasive inspection, which would simplify the process of evaluating the integrity of a slurry wall. The initial step is to plan the construction of a test wall, which will be located in the buffer zone between the Montandon Wetland and the active Central Builders Supply quarry. Planning this construction involves taking surveys of the proposed area in order to best approximate what the subsurface looks like. The Sting R1 resistivity unit was used to conduct these surveys, and the data was compared to borehole drill logs at five points along the line. It was found that the observations seen in the non-invasive resistivity data resembled that of the invasive borehole data, which confirms the usefulness of resistivity as a method to use to monitor slurry walls. This project is ongoing, and the next step is to design a two-dimensional array of electrodes to be placed within the slurry wall during construction that could accurately detect defects in the wall. The wall is currently scheduled to be constructed during the summer of 2016.
Coping with Regret: How College-aged Students Cope with Inter- and Intrapersonal Everyday Regrets

The goal of the investigation was to explore how college students cope with everyday regrets. Whereas the regret literature is reasonably mature and theoretically rich, only limited work has been published that focuses on exploring everyday, common regrets. Investigators sampled 116 undergraduate participants. Data were collected anonymously using an online survey via Qualtrics. Participants were randomly assigned to recall a regret involving harm to self (n=60) or harm to others (n = 56), write a brief description of this regret, and then complete measures of regret appraisal and coping.

Self-reported regrets in intra- and interpersonal harm conditions were coded into two categories by the primary investigators. These included regrets of action or inaction and regrets of planned or reactive nature. Type of regret correlated with the extent to which individuals utilized four coping strategies. These strategies were active coping, instrumental social support, acceptance, and denial. In addition, regret appraisal was correlated with multiple coping strategies. Regret appraisals significantly correlated with 13 coping methods. Significant rs ranged from -.30 to .40. Mediation analyses were also run to assess how regret type affected appraisal and coping.

As opposed to the majority of studies where researchers indexed major life regrets or experimentally induced regrets in the lab, this study provides insight into the nature of regrets occurring on an everyday basis. In addition, our study allowed researchers to assess the relationship between regret type, perceived severity of the regret, and coping strategies.

Samantha Kelly ’17, Brandon Nelson, Graduate Student

Faculty Mentor: Professor Michael Krout, Chemistry
Funding Source: Kalman Fund for Undergraduate Research in the Sciences, Graduate Summer Research Fellowship

Development of a Stereoselective Synthesis of Allolithocholic Acid

Recent studies have found that bile acids, in addition to serving for regulation and absorption of lipids and other fat-soluble compounds in the gastrointestinal tract, can also function as cell signaling molecules. Specifically, allithocholic acid (alloLCA), a structural derivative of the naturally occurring bile acid lithocholic acid (LCA), has shown potential to activate regulatory T cells found in the GI tract. Due to the high cost and limited access to commercially available alloLCA and derivatives thereof, we have explored methods of chemical synthesis to produce alloLCA from the inexpensive, commercial LCA. Because alloLCA is epimeric at C(5) relative to LCA, this conversion is not trivial. After a two-step oxidation process to convert LCA into an α,β-unsaturated ketone, our efforts have focused on the stereoselective reduction of the substrate using various methods.

Madeline Kling ’17

Faculty Mentor: Professor Chris Boyatzis, Psychology
Funding Source: Douglas K. Candland Undergraduate Research Fund

The Roles of Religion, Yoga, and Meditation on College Women’s Body Image and Eating

Higher religiosity in college women is related to better body image and less disordered eating in experimental (Boyatzis, Kline, & Backof, 2007) and correlational work (Boyatzis & McConnell, 2006; Homan & Boyatzis, 2012). However, at a national level young adults’ religiosity is plummeting, with a third claiming to not identify with any religion (Pew Center, 2014). We tested whether healthy links between body image/eating and religion continue today and explored yoga participation and meditation, non-religious mindful practices that may be relevant to body image. Prior work (Watterson & Boyatzis, 2013) suggested that yoga would have complex links to body image.

Bucknell women (150) completed online measures of Body Esteem—Weight and Appearance scales, the Eating Disorder Inventory, and the Attachment to God Inventory and questions on worship attendance and importance of religion. Women also answered questions about their meditation and yoga practices.

Few significant relationships emerged between religiosity and body image/eating, though importance of religion and worship attendance were marginally related to women feeling worse about their appearance (r = -.15, p = .06; -.13, p = .09). Our data do not support the previous healthy link between religion and body image. However, using yoga to feel better about oneself was related to using yoga to grow religiously and in connection to God (r = .21, p = .02) and frequency of meditation was related to using yoga to grow religiously (r = .19, p = .02). Our study suggests links between religion, yoga, meditation, and body image are complex.

Jesse Klug ’16

Faculty Mentor: Professor Ron Smith, International Relations

Satyagraha and Sexuality: Applying Nonviolent Direct Action to the Queer Movement

This article explores how nonviolence theory and strategy can be applied to the Queer Liberation Movement. I investigate nonviolence theory in conjunction with concepts from queer theory, using historical lessons from Mahatma Gandhi, the queer movement, previous nonviolent campaigns, and Martin Luther King Jr. and the Civil Rights movement. In doing so, I seek to illustrate how nonviolent activism can benefit the queer
Donald Koepp ’18
Faculty Mentor: Professor Jeffrey Trop, Geology & Environmental Geosciences
Funding Source: Presidential Fellowship; Bucknell University Department of Geology & Environmental Geosciences

Documentation of Undescribed Alaskan Sedimentary Formation
This study seeks to better understand the undescribed formation to the north of the Tonoloway spur fault of the Denali Fault in Alaska. To better understand the geological significance of this formation, we are conducting a study to: (1) reconstruct the depositional environment of the sandstone formation, including paleoecological data derived from fossiliferous strata in the formation, and (2) identify the source for mineral grains within this rock, in order to estimate the displacement of the Tonoloway fault. This includes identifying fossil flora from Cretaceous species, and proposed ecological associations between organisms. It also provides analysis of differing grain sizes in strata throughout the formation in order to identify proposed depositional environment (alluvial fan deposit) through the use of thin section optical mineralogical techniques, X-ray powder diffraction, and Scanning Electron Microscope (SEM) to identify the mineral composition of the rock.

Jillian Korn ’16
Faculty Mentor: Professor Julie Gates, Biology
Funding Source: Fellows Program of the Kalman Fund for Biomedical Education

Investigating the function of Arf79F in actin cytoskeleton regulation during dorsal closure in Drosophila
During Drosophila melanogaster embryonic development, a hole on the back of the developing embryo must be closed through a process called dorsal closure. The cell shape changes that enable this process are mediated by the actin cytoskeleton, a dynamic network of criss-crossing actin filaments that underlie the cell membrane. Highly regulated changes in the length and organization of actin filaments cause the cell membrane to stretch around growing filaments, facilitating the cell shape changes that drive processes like dorsal closure. Enabled (Ena) is an actin regulatory protein required for dorsal closure that actively promotes actin polymerization and prevents the binding of proteins that inhibit filament elongation. Previous studies have shown that Ena functions with the Garz protein during dorsal closure. Garz is an ArfGEF that activates Arf, a small GTPase, by replacing GDP with GTP. Arf79F, the Drosophila Arf homologue, may be the target of Garz during dorsal closure. In order to gain insight into how Garz functions with Ena during this process, I studied whether Arf79F is required for dorsal closure. To do this I compared dorsal closure phenotypes of embryos carrying mutations in both ena and arf79F to embryos only carrying a mutation in ena. I found the frequency of dorsal closure defects was altered in embryos carrying mutations in both arf79F and ena when compared to embryos only carrying a mutation in ena, suggesting Arf79F functions with Ena during dorsal closure in Drosophila. This supports the hypothesis that Arf79F is the target of Garz during dorsal closure.

Zach Kozick ’18
Faculty Mentor: Professor Judy Grisel, Psychology
Funding Source: Bucknell University Department of Psychology Emerging Scholars

Negative Genetic Correlation Between Alcohol Consumption and Reward in Selected Lines of Mice
Research indicates that alcohol consumption is a complex trait, impacted by many environmental and genetic factors. In order to investigate genetic substrates of alcoholism, high alcohol preffering (HAP) and low alcohol preferring (LAP) mice were selectively bred from common progenitors. After about 12 generations, the difference in voluntary consumption is profound: HAPs readily voluntarily consume 12 g/kg/day, while LAPs barely exceed 2 g/kg/day. Our research is aimed at exploring the relationship between consumption and the pleasure associated with the drug effects. We assessed initial subjective reward to different doses of alcohol using a conditioned place preference (CPP) paradigm. This paradigm allows us to measure the preference that mice have for a context associated with alcohol effects compared to one associated with saline. We tested HAP and LAP mice following a range of doses and our results indicate that LAP mice are more sensitive to the rewarding effects of alcohol than HAPs, as they show CPP to lower concentrations of the drug. These data support the contention that high drinking may reflect an attempt to compensate for reduced reward sensitivity. A better understanding of the factors that contribute to excessive alcohol consumption may lead to more effective treatments and intervention for alcoholism.
Darren Kusar ’16

Faculty Mentors: Professors Bernhard Kuhn, Languages, Cultures & Linguistics (Italian); Annie Randall, Music

Giacomo Puccini and Luciano Berio: Dealing with Contrasting Musical Aesthetics through Turandot

Giacomo Puccini is considered by many to have been the final great Italian opera composer. Straddling the nineteenth and twentieth centuries, he, like his predecessors, composed with a mind to interpreting past aesthetics to inform his own work. What made this task exceedingly difficult was a rapidly changing musical aesthetic, developed by composers such as Arnold Schoenberg and modernist movements, such as the Italian Futurists. I argue that Puccini attempted to deal with these changing aesthetics in his final opera, Turandot (1924), and ultimately failed completing it. His failure is not only the result of his untimely death before the opera’s completion, but also the result of having great difficulty connecting his artistic past with the aesthetics of the 1920s. At the beginning of the 21st century, Luciano Berio attempted to complete the opera Turandot (2001). After examining Berio’s musical philosophies and style, this thesis seeks to find out why he chose to compose an ending for Puccini’s Turandot and how Berio’s ending relates to Puccini’s beginning. By looking at Puccini’s and Berio’s fragments together, I will be able to determine whether or not, with Berio’s addition, the contrasting aesthetics of the nineteenth and twentieth centuries were finally reconciled in the 21st century.

Mae Lacey ’18

Faculty Mentors: Professors Christopher Martine, Biology; Elizabeth Capaldi, Biology

Funding Source: David Burpee Endowment; Wayne E. Manning Internship Fund; Botanical Society of America Undergraduate Research Award

Exploring the Potential for Solanum Fruit Ingestion and Seed Dispersal by Rock-dwelling Mammals in the Australian Monsoon Tropics

Little is known about the methods of seed dispersal employed by rock-specialist spiny solanums (Solanum subgenus Leptostemonum) in the monsoon tropics of northern Australia. Previous studies infer that endozoochory may play a role, but no specific animal taxa have been identified as effective seed dispersers. The elusive rock macropod species co-occurring with solanums are potential candidates, particularly species of Petrogale (rock wallabies) and Macropus (wallaroos). To assess the potential of these animals as seed dispersers, a study is underway to determine whether rock macropods might ingest Solanum fruits and pass seeds intact. Eight Solanum taxa endemic to northern Australia were grown from wild-collected seeds hand-pollinated at flowering maturity, and then used as sources of fruit. Ripened fruits will be presented to rock macropods in captivity to determine the following: a) Will rock macropods consume Solanum fruits, and which species?, and b) Do the seeds consumed with the fruits survive gut passage? Intact seeds were removed from scats and sown to test for germinability compared with uningested seeds. Determining whether co-occurring species of mammals participate in successful endozoochorous Solanum seed dispersal has implications for conservation efforts by highlighting the importance of plant-animal interactions among narrowly endemic species. Here we present preliminary data, including experiments on seed gut passage time and germination rates following ingestion by captive rodents as proxy subjects.

Corinne Leard ’18, Allie Schrock ’18

Faculty Mentor: Professor Reggie Gazes, Psychology

Funding Source: Griffith Fellowship to RPG; Emerging Scholars in Psychology Fellowship to CL

Dominance Rank and Social Relationships in Capuchin Monkeys (C. apella)

It has been hypothesized that the development of complex cognitive abilities in primates may have been partially driven by the evolution of complicated social networks and the need to remember social group dynamics. In a study by Silk et al. (2009), social relationships among female yellow baboons (Papio cynocephalus cynocephalus) were found to have fitness consequences. These results revealed that the infants of females with more and stronger social bonds had a higher survival rate than infants with mothers who had fewer social ties. This has further implications that, as least for primates that live in social groups, there is a great advantage to being highly social. Since our group of captive brown capuchins (Cebus apella) has access to veterinary care and each female has roughly the same infant survival rate, infant survival would be a poor measurement of success in this instance. To adapt to these differences, the measurement for success was adjusted from infant survival to attained dominance ranking because dominance rank confers possible evolutionary advantages such as priority access to food and mates. By measuring sociality and dominance ranking through focal observations of all the capuchins, we found that sociality and rank are positively correlated in our capuchin group. The direction of this relationship is yet to be determined: it may be that more social animals are more adept at rising in the dominance hierarchy or that more dominant animals have more freedom to engage in social interactions.

*Jonathan Leung ’17

Faculty Mentor: Professor Michael Thompson, Electrical & Computer Engineering

Funding Source: PPL Undergraduate Research Fund

Cell Phone Accelerometer Accuracy

As mobile technology continues to advance, the presence of ‘smart’ devices is constantly increasing. According to the Pew Research Center, 64 percent of American adults own a smartphone. The capabilities of these devices reach far beyond accessing the internet, taking photos, and posting to social media. Within this project, the Nexus 5, a commercial
Android smartphone, recorded acceleration values for a series of movements. These values were then compared with data from Vicon cameras, which track position in three dimensional space. This project is part of the KICR System (Kinematic Information Capture and Reporting), a collaborative effort between Bucknell and Geisinger Health System to deliver quantitative information to aid diagnostic techniques for neuropsychiatric disorders, namely Attention Deficit Hyperactivity Disorder (ADHD).

After several rounds of testing, several conclusions were drawn from the data. First, neither the Nexus 5 nor the differentiated Vicon values were completely at zero while the phone was stationary. Secondly, a fair amount of filtering must be completed in order to gain insight from the data. A significant amount of noise is included in both the phone and Vicon data sets. Thirdly, there is no current threshold of accuracy the accelerometer must meet, and finally, results from experiments are encouraging in terms of accuracy of a commercial smartphone accelerometer.

Hannah Litwa ’18
Faculty Mentor: Professor Mark Haussmann, Biology
Funding Source: NSF STEM Grant

A Metabolic Buffer in the in ovo Environment of Japanese Quail (Coturnix japonica) Regulates Exposure to Maternal Glucocorticoids

Maternal effects, the nongenetic changes in offspring due to the maternal environment, can have a large influence on offspring phenotype. Glucocorticoids (GCs), steroids involved in the stress response, can be passed from mother to offspring and influence development. Recent evidence suggests that embryos can regulate their exposure to maternal GCs. Given this active regulation of the early endocrine environment, we examined how site of injection (yolk vs. albumen) and dose affected the embryonic exposure to corticosterone (CORT). We injected eggs of Japanese quail (Coturnix japonica) with a low or medium dose (within physiological range) or a high dose (pharmacological) of [3H]-CORT, and then collected eggs after 6 or 9d of development. Eggs were then separated into albumen, yolk, and embryonic tissue to identify the presence of free and conjugated steroids while CORT and its metabolites were identified through thin layer chromatography (TLC). We found that both site of injection and dose influenced embryonic exposure to CORT. Yolk-injected eggs had more free and conjugated steroids in the yolks compared to albumen-injected eggs at both days of development. The level of free steroids in the yolk were lower at lower doses and decreased during development, while the conjugated steroids in the yolk increased with dosage and during development. In addition, the level of free and conjugated steroids in the embryonic tissue were highest early in development and at higher doses. TLC analysis detected a number of CORT metabolites along with CORT in the embryo which suggests that while a buffer plays an extensive role in metabolizing steroids, this buffer can be overwhelmed at higher maternal steroid levels.

Patrick Long ’18
Faculty Mentor: Professor Eric Martin, Management for Sustainability

The Project for Sustainable Eye Care

Billions of people worldwide need, but cannot afford, vision correction. The vast majority of them have Uncorrected Refractive Error, easily treatable with simple eyeglasses. However, the poor in developing countries often cannot even access proper diagnosis, let alone purchase eyeglasses. Well-meaning outsiders often provide professionals, set up clinics, send equipment, and collect used glasses for distribution. However, these short-term solutions rely on foreigners to continuously provide goods and services and do not employ culturally grounded, long-term sustainable solutions.

Bucknell’s Project for Sustainable Eye Care (ProSEC) seeks to empower local entrepreneurs to create profitable social businesses that prescribe, manufacture, and distribute eyeglasses using local talent and materials, retaining local control, and thereby directly contributing to local economic development while addressing eye care needs.

Currently in its sixth year, ProSEC now partners with the Bucknell Brigade and will travel to the Jubilee House Community in Nicaragua to prepare and run a fully operational eye care facility, from diagnosis of patients and manufacture of affordable eye care, to the final fitting and distribution of glasses. Based on years of pilot work in Guatemala, this new phase will use Bucknell-designed diagnostic equipment and affordably sourced frames and lenses in order to equip the clinic to serve several hundred people with affordable glasses and gather valuable information about the process flow, effectiveness across different demographics, venture sustainability, and stylistic preferences. Ultimately, ProSEC aims to create a replicable economically and socially sensitive model for eye care distribution that fosters local entrepreneurship.

Erik Giesen Loo ’16
Faculty Mentor: Professor Ronald Ziemian, Civil & Environmental Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship

Design of Steel Structures by Advanced 2nd-Order Elastic Analysis – Background Studies

Design by advanced second order elastic analysis is based on the simple premise that the need for approximate means for accounting for parameters in design is eliminated by directly modeling these parameters in the analysis. Current analysis methods often rely on equations based on buckling lengths to determine the axial capacity of beam-columns; however, complex systems may not possess clearly defined unbraced lengths or the axial force may vary significantly within such unbraced lengths. By employing a rigorous geometric nonlinear or second order analysis that explicitly models system and member initial geometric imperfections and reduces member
Funding Source: Research Fellowship

separatist communities.

be it through spectacle, challenging social roles, or establishing
operation of patriarchal power in the context of everyday life,
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of consciousness-raising. This alteration in subjecthood provided
from self-objectification to active subjecthood via various forms
the 1960's and 1970's. I have observed that the radical feminists
objectives of radical feminist organizing in the United States in
a kinetic understanding of social struggle to the tactics and
In my study of radical feminism as social arrest, I seek to apply
a kinetic understanding of social struggle to the tactics and
objectives of radical feminist organizing in the United States in
the 1960’s and 1970’s. I have observed that the radical feminists
of the 1960’s and 1970’s sought to effect women’s transition
from self-objectification to active subjecthood via various forms
of consciousness-raising. This alteration in subjecthood provided
the platform upon which radical feminists sought to arrest the
operation of patriarchal power in the context of everyday life,
be it through spectacle, challenging social roles, or establishing
separatist communities.

Samuel Loomis ’18

Faculty Mentor: Diane Jakacki, Comparative Humanities
GIS Mapping and Dynamic Autobiography

For my project, I am using GIS (geospatial information systems) Digital Mapping methods to consider an event in my life in relation to a global context- a form of spatially analyzed autobiography. When I was a child I took a yearlong sea voyage with my family. I have physical logs and journal information that my family gathered, as well as snapshots of memory. In addition, I will gather historical data such as weather patterns, storm movements, and historical and political events that occurred in the regions surrounding us as we traveled.

At the symposium, I will present a dynamic digital story map focusing on part of our three-month journey in the Mediterranean. Digital humanities, the analysis of research questions using computational methods, are helping me to reclaim an important childhood experience. By using the information recorded by my family, as well as historical data and memories that my family recalls, I hope to be able to find the intersection of the data and my memory and reshape the way that I look at the places we traveled and the memories that I have, to form a digital autobiography.

Audrey Love ’16

Faculty Mentor: Professor Mehmet Dosemeci, History
Funding Source: Professor Ellen Herman, Geology
& Environmental Geosciences; Molly McGuire, Chemistry
Research Fellowship

Radical Feminism as Social Arrest

In my study of radical feminism as social arrest, I seek to apply a kinetic understanding of social struggle to the tactics and objectives of radical feminist organizing in the United States in the 1960’s and 1970’s. I have observed that the radical feminists of the 1960’s and 1970’s sought to effect women’s transition from self-objectification to active subjecthood via various forms of consciousness-raising. This alteration in subjecthood provided the platform upon which radical feminists sought to arrest the operation of patriarchal power in the context of everyday life, be it through spectacle, challenging social roles, or establishing separatist communities.

Meredith Lutz ’17

Faculty Mentor: Professor Peter Judge, Animal Behavior
Funding Source: Bucknell University Animal Behavior Program Summer Research Fellowship; Bucknell University Presidential Fellowship; SIT Study Abroad Independent Study Grant

A Comparative Perspective on Play Behavior and the Training for the Unexpected Hypothesis in Papio hamadryas hamadryas and Propithecus diadema

Although play is thought by some as behavior that appears purposeless, several hypotheses have suggested a variety of potential evolutionary functions for play. Most recently, the training for the unexpected hypothesis proposed that play provides opportunities for individuals to learn how to cope with unexpected circumstances. If this hypothesis is accurate, then animals should choose to play in a way that minimizes unnecessary risks, since unexpected circumstances already represent a potential risk. Specific sources of investigated risk included (1) environmental conditions, such as rainfall, temperature, and humidity, and (2) locational conditions, such as the locations of behaviors or height in trees of the behavior. Such predictions were evaluated using over 126 hours of continuous recording focal samples of captive Papio hamadryas hamadryas (n = 3) and 84 hours of focal samples of wild Propithecus diadema (n = 9). In P. hamadryas, whether or not the animals played as well as the amount that animals played was affected by only the humidity; however, the presence and amount of play in P. diadema was independent of all tested environmental variables. Both groups showed a preference for playing on the ground, especially when engaging in high-intensity play fighting. In total, these results provide moderate support for mitigating risks during play. Risks associated with locations were mitigated; however, play continued despite potentially risky environmental situations. Collecting further data across a larger range of environmental conditions will aid in further understanding a possible relationship between play and the environment.

Alexandra Mackay ’16

Faculty Mentors: Professors Ellen Herman, Geology & Environmental Geosciences; Molly McGuire, Chemistry
Funding Source: The Katherine Mabis McKenna Environmental Internship Program

Characterization of the Colloidal Phase of Abandoned Mine Drainage in Pennsylvania Streams

This project compared the compositions of colloids and settled sediment in order to understand the chemical and physical evolution of abandoned mine drainage (AMD) waters over time. Preliminary laboratory mixing studies used a ferrous sulfate solution to simulate AMD in order to understand the basic variables affecting the formation and evolution of AMD colloids and settled sediment. I analyzed the resulting solids
and colloidal phase particles of both the simulated AMD water and natural samples from Sterling Discharge, Shamokin, Pennsylvania. The main method of analysis was attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR) to identify the mineral composition. X-ray diffraction (XRD) was also performed. The analyses of the simulated and field-sampled AMD displayed mineralogical commonalities that suggest that our method of AMD simulation is feasible. Schwertmannite was found in all samples, which was expected given that schwertmannite is metastable to goethite, which was only found in natural field samples. Jarosite or nattojarosite was found in all but one sample (the natural precipitate analyzed by XRD).

**Julia Mammone '17, Ben Skalla '18**

**Faculty Mentor:** Professor Morgan Benowitz-Fredericks, Biology  
**Funding Source:** Bucknell University Department of Biology  
**Differentiation between two possible sources of yolk testosterone in chickens (Gallus gallus) using treatment with PMSG**

Yolk testosterone produced in hens (Gallus gallus) impacts aspects of offspring phenotype such as growth rate and survival. The amount of testosterone that is deposited in the yolk varies significantly between individuals, however the mechanism of deposition is unclear. Eggs develop in structures called follicles that contain yolk and surrounding (granulosa and theca) cells. In avian ovaries, follicle-stimulating hormone (FSH) and luteinizing hormone (LH) stimulate the granulosa and theca cells to produce testosterone. The levels of testosterone found in an individual yolk could be driven by localized production from the granulosa and theca cells associated with that follicle, or more generally reflect circulating testosterone levels. To differentiate between the two potential sources, we took advantage of the fact that 6-8 mm follicles produce low levels of testosterone in response to FSH and LH compared to 9-12 mm follicles, which are significantly more responsive. If yolk testosterone deposition comes from the cells of each individual follicle, then we would expect that compared to controls, hens treated with PMSG (which mimics FSH and LH) to show similar amounts of yolk testosterone in 6-8 mm follicles but substantially more testosterone in 9-12 mm follicles. If deposition of testosterone in yolk depends on the general ovarian testosterone concentration, we expect PMSG-treated hens to show substantially higher yolk testosterone concentrations in both 6-8 mm and 9-12 mm follicles compared to those of control hens. To test these hypotheses, we are quantifying testosterone from samples of yolk from 6-8 mm and 9-12 mm follicles from control and treated birds.

**Cristobal Manzanares '17**

**Faculty Mentor:** Professor Indranil Brahma, Mechanical Engineering  
**Funding Source:** Helen E. Royer Undergraduate Research Fund  
**Effect of Variable Operating Conditions on Small Diesel Engine Emissions**

Emissions of a 5 HP Yanmar diesel motor were measured to investigate the effect of differing loading conditions on the emission profile. The experiment is focused on varying the air to fuel ratio, torque, and rpm individually to look at a wide range of emission behavior. Loading conditions were varied through a control box that managed the RPM and torque. For differing air to fuel ratios, the engine was subjected to direct injection of pressurized air. Exhaust concentration for the varying sizes of particles were measured with a spectrometer when the engine entered steady state. The number of particles per centimeter cubed for all loading conditions was compared on a case-by-case basis. Results show a general increase in total particles in cases with higher air to fuel ratios, however emission behavior varies significantly at each torque. The best running condition would depend on the application, and power needed for the task. In terms of the lowest number of particles for the smallest air to fuel ratio, six and nine foot-pounds of load produced the best running conditions. This experiment bestows knowledge on exhaust particle concentrations under various loading conditions for small industrial diesel engines commonly used around the world.

**Kortney Marshall '16**

**Faculty Mentor:** Professor Elizabeth Durden, Sociology  
**Funding Source:** The Brawley Fund  
**Depression in Black and White: Racial Disparities in Mental Health within the United States**

Racial disparities in mental health became a popular research topic during the 1980s, and it has continued to be a topic of interest over the years. Although Blacks have consistently reported more experience with depressive symptoms, it is Whites who overwhelmingly receive actual diagnoses of depression. Using data from the 2011-2013 National Health Interview Survey (NHIS), the current research explores the main relationship between race and serious psychological distress. Cross-tabulations and multinomial logistic regression models are ran on the data to interpret the levels of distress across three different racial groups: Whites, Blacks, and Non-White Hispanics. Aside from examining the main relationship between race and psychological distress, the impact of demographic and socioeconomic variables is controlled for. Results show that regardless of the addition of the demographic and socioeconomic controls, race is significantly correlated with levels of psychological distress, such that Whites are more likely than both Blacks and Hispanics to have serious psychological distress, even though more Blacks and Hispanics experience more
Maya Martignetti ’16, Christine Quinn ’17, Sara VanTilburg ’16

Faculty Mentor: Professor Kim Daubman, Psychology

Self Esteem Moderates the Positive Effects of Being Forgiven

The needs-based model of reconciliation (Shnabel & Nadler, 2008, 2010) posits that when someone harms another, they are likely to experience shame, thoughts of unworthiness, and a threat to their need to be socially accepted, especially if they have low self-esteem. To defend the self, offenders may justify their actions, minimize the harm created by their actions, and deflect blame onto others (Exline & Baumeister, 2000). Being forgiven for one’s transgression, however, may satisfy one’s need for social acceptance thereby reducing these defense strategies. Therefore, we hypothesized that being forgiven will decrease victim blame and increase feelings of personal responsibility and empathy and lead to greater reconciliation behaviors, especially among those low in self-esteem. There were 44 female and 36 male university students (64 white) aged 18 to 22 who completed the survey through Qualtrics; half were randomly assigned to forgiveness the other to non-forgiveness. Participants were asked to imagine a scenario where they were either forgiven or not forgiven by the person. Then participants were asked to complete more measures of empathy, personal responsibility, victim blame, and reconciliation attempts. ANOVAs and planned comparisons supported each of the hypotheses. When self-esteem was high, forgiveness did not affect any of the dependent variables. However, when self-esteem was low, those who were forgiven compared to those who were not forgiven expressed greater empathy, t(37)= 5.36, p<.001; expressed more responsibility, t(37)= 2.28, p=.03; blamed the victim less, t(37)= -2.56, p=.02; and engaged in more reconciliation behaviors, t(37)= 2.69, p=.01.

Keith Mattern ’16

Faculty Mentor: Professor Brandon Vogel, Chemical Engineering

Funding Source: Helen E. Royer Undergraduate Research Fund

Synthesis of Pyrrolidone-Containing Polyanhydrides for Controlled Drug Delivery

As part of our ongoing interest to create new polymers for controlled drug delivery, we want to produce polyanhydrides that contain the pyrrolidone functional group. Such polymers would possess both the labile hydrolytic degradation property of anhydrides and the hydrogel bonding capabilities of pyrrolidones. Combined, these molecules give promise for a controlled drug delivery method that maintains constant drug concentration within the body while also stabilizing drugs to maximize the efficiency and efficacy of a pharmaceutical. To explore the effect of different functional groups on the final polymers we have been conducting this reaction with three different primary amines: hexamethylenediamine, jeffamine, and p-phenylenediamine. Current work in our group is focused on the synthesis and purification of the final polyanhydride polymers. Intermediate molecules have successfully been synthesized with purities > 98 percent and some preliminary results show formation of polymer molecules through methods of melt condensation polymerization. Future work aims at developing robust synthesis and purification procedures to yield highly pure polyanhydrides.
Connor McLaughlin '16
Faculty Mentor: Professor Tristan Stayton, Biology
Funding Source: National Science Foundation
Convergent Evolution Provides Evidence of Similar Radiations in Shell Shape in the Turtle Families Emydidae and Geoemydidae
This study investigates phenotypic diversification in the species-rich and ecologically-diverse turtle families Emydidae and Geoemydidae. In particular, we are interested in whether these groups, with many ecologically and morphologically similar species, show similar patterns of evolutionary radiation. We focused on directions of evolution and evolutionary allometry; we also quantitatively investigated whether two supposed morphological analogs shared within the two groups (e.g., “box turtles” and “wood turtles”) show evidence of convergence. A set of 53 three-dimensional landmarks were digitized on 1029 turtle shells representing 50 emydid species and 62 geoemydid species. These data were analyzed using standard geometric morphometric techniques. Evolutionary patterns were assessed using tests for phylogenetic signal, and the relationship between size and shell shape was determined via phylogenetic regression. Significant phylogenetic signal was detected for shell shape, while tests for allometry also showed significance. Three hypothesis testing methods were applied in order to determine whether the supposed morphological analogs in the emydid and geoemydid families exhibited convergence. While there was no evidence of shared adaptive peaks among either box turtles or wood turtles, it was determined that both of these groups have evolved to be more similar to one another relative to their ancestors than would be expected by chance; they have, indeed, converged. Although each family shows some unique patterns of diversification, overall there is an impressive array of similarities between the Emydidae and Geoemydidae radiations.

Elyse McMahon, Graduate Student
Faculty Mentor: Professor Mark Haussmann, Biology
Funding Source: The Biology Department and NSF
Oxytocin Mitigates Some of the Negative Consequences of Chronic Social Isolation in Prairie Voles (Microtus ochrogaster)
Chronic stressors, such as chronic isolation in social mammals, can elevate glucocorticoids, which may affect cellular aging mechanisms such as increasing levels of oxidative stress and shortening telomere lengths. Prairie voles (Microtus ochrogaster) are a useful model species to study chronic isolation due to their social and pair-bonding behaviors. Recent work in prairie voles suggests that oxytocin and social support may mitigate some of the negative consequences of social isolation, possibly by reducing glucocorticoid levels. We investigated the influences of isolation, oxytocin or social support on stress physiology, behavior, and cellular aging. Voles were divided into six groups: isolated (I), paired (P), isolated (IV) and paired (PV) with daily vehicle injections, and isolated (IO) and paired (PO) with daily oxytocin injections. Blood samples were collected at the start of the study, then again after 3 and 6 weeks. Acute stress tests were conducted using the resident-intruder paradigm at 6 weeks to determine if treatment had any effect on stress responsiveness. Anhedonia, a behavioral index of depression, was measured using sucrose solution preference tests to determine depression-like symptoms throughout the study. We found that daily oxytocin injections in isolated individuals prevented anhedonia as compared to those who were isolated with and without daily vehicle injections. The effect of social isolation and oxytocin treatment on GC levels, oxidative stress, and telomere length will also be discussed. Overall our findings suggest that oxytocin appears to mitigate some of the negative consequences of social isolation.

Sean McMahon '16
Faculty Mentor: Professor Katharina Vollmayr-Lee, Physics & Astronomy
Single Particle Jumps in Sheared SiO₂
We study the dynamics of a sheared glass via molecular dynamics simulations. Using the BKS pair potential to model the potential energy between molecules, we simulate a system of glass silica that is initially well equilibrated at a high temperature. The system is then quenched to a temperature below the glass transition and kept at a desired low temperature for a set period of time before the system is sheared with a constant strain rate. We present preliminary results of an analysis of single particle trajectories in the sheared glass. In particular, we identify single particle jumps, meaning particles that have traveled farther than the typical fluctuations of the molecules.

Mary Medure '17
Faculty Mentor: Diane Jakacki, Comparative Humanities
The Murder of William Desmond Taylor
This semester I am doing a research project on the death of William Desmond Taylor. William Desmond Taylor was a famous actor and producer in the early 1900’s. His murder was left unsolved. For this project I am using text analysis methods to try to analyze aspects of his murder and the way it was reported in the press. More specifically, the two text analysis tools I am working with are Jigsaw and Voyant. My original interest in this subject is related to ways in which the media portrays victims of violent crimes, typically blaming the victim instead of the aggressor. Using these tools, I am addressing two related research questions: first, does the public opinion on Taylor change before, during, or after his murder? Second, do these tools provide new ways to more deeply analyze potential suspects in his murder? The main source of information regarding this research is from the database called “Taylorogy”. Taylorogy is a compilation of articles that are relevant to Taylor’s life and death that Bruce Long gathered from various newspapers and entertainment sources.
Kerra Mercon ’17

Faculty Mentor: Professor Christine Buffinton, Mechanical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship

Changes in Myocardial Wall Stiffness in a Mouse Model of Persistent Truncus Arteriosus

Introduction: Persistent truncus arteriosus (PTA) is the failure of the outflow tract of the heart to septate into aorta and pulmonary artery. We hypothesized that the altered loading pattern will affect the passive mechanical properties of the ventricles and outflow tract, which may cause problems despite surgical repair. Myocardial stiffnesses measured by pipette aspiration (PA) in normal and mutant mouse hearts were compared, with method validity provided by measurement of the evolution of myocardial stiffness in embryonic chick.

Materials and Methods: Wild type (WT) mice and chick hearts were placed in a chamber and a 100-μm-ID glass pipette was lowered to the surface. The PA system applied negative pressure to the interior of the pipette, aspirating a small section of the myocardial wall. Pressure Δp was plotted versus aspirated height L normalized to pipette inner radius ri, and a strain energy (SE) measure calculated as the area under the Δp vs L/ri curve for L/ri ranges of 0-0.2 and 0-0.4.

Results: SE, a measure of material stiffness, was significantly higher (p<0.05) in right ventricles of PTA mice compared to WT in both ranges (Fig. 1a). SE in left ventricle in PTA mouse was more than double that of WT from 0-0.2 L/ri (p=0.08). In chick, ventricular stiffness increased with developmental stage.

Conclusions: This is the first demonstration that hearts developing PTA show early changes in ventricular tissue properties. Thus, the effects of PTA on tissue stiffness may cause lasting problems despite early surgical repair of the primary defect. The results from developing chick provide a benchmark against which effects of interventions such as left atrial ligation can be compared.

Greg Miller ’18

Faculty Mentor: Professor Abby Flynt, Mathematics
Funding Source: Presidential Fellowship

Improved Expected Points and Win Probability Models for NFL Coach and Player Evaluation

Expected points added (EPA) and win probability added (WPA) are common approaches to evaluate the effect that individual plays/players have on the outcome of National Football League games. However, popular existing models used for EPA and WPA can be improved upon, both in calculation and in use. Many of these models are limited in scope by their assumptions, in that they negate the use of key situational data ranging from the 2nd & 4th quarters to instances of large score disparities. In observing other sport literature, (e.g. McCurdy, 2014 - hockey) where controlling for score situation and using data from all parts of the game has proven advantageous, we have used all data from all situations to build our model. Using our revamped EPA and WPA metrics, we provide an empirical evaluation of NFL coach decision making, independent of actual outcomes of plays they call. Similarly, we provide an easily interpretable measure of NFL player value, grounded in common currency of points/wins, for both offensive and defensive players. With these two statistical advancements, we hope to offer insight as to how NFL organizations can use this information to evaluate coaches and players alike.

Will Miller ’17

Faculty Mentor: Professor Kevin Gilmore, Civil & Environmental Engineering
Funding Source: Bucknell Program for Undergraduate Research

Using Metabolic Selectors to Facilitate the Development of Activated Sludge Granules

The use of granular activated sludge technology within sequencing batch reactors (SBRs) is an important and effective method of treating wastewater and recovering resources for reuse. Research performed primarily in the Environmental Engineering and Science Lab (EESL) focused on improving sludge settling characteristics and removing nutrients in such metabolic reactors at the Gregg Township water resource reclamation facility (WRRF). Collection and detailed analysis of samples at various stages of wastewater treatment within the SBRs took place in the effort to understand the granulation process and develop operating criteria to enhance it in the future.

Testing results yielded average total nitrogen levels of 39.5 milligrams per liter (mg/L) as nitrogen for influent and 4.68 mg/L for effluent, both appropriate concentrations for wastewater and important for minimizing environmental impacts to the watershed. Inconsistencies in total phosphorus data and total nitrogen data, however, led to the ongoing reevaluation of appropriate analytical methods. Testing mixed liquor for intrinsic settling classes (ISC) allowed for the determination of the percentage of fines, flocs, and granules in biomass samples. Biomass consisted primarily of small aggregates, which comprised 47 percent of the sample’s TSS. As a result, operational changes will be required to drive the development of granular biomass at this facility.

Compilation and interpretation of data led to proposed changes to the WRRF in Gregg Township. The implementation of new mixers has been suggested to achieve better mixing during anaerobic and anoxic periods of treatment. The PA Department of Environmental Protection is currently reviewing proposed changes at the plant and communicating with consulting engineers, placing research progress temporarily on hold. Discussion of research and analysis of data continues to take place at other sites for this project, including across the U.S. and also in Denmark.

KERRA MERCON ’17

FACULTY MENTOR: PROFESSOR CHRISTINE BUFFINTON, MECHANICAL ENGINEERING
FUNDING SOURCE: JAMES L.D. AND REBECCA ROSER RESEARCH FELLOWSHIP

CHANGES IN MYOCARDIAL WALL STIFFNESS IN A MOUSE MODEL OF PERSISTENT TRUNCUS ARTERIOSUS

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GREG MILLER ’18

FACULTY MENTOR: PROFESSOR ABBY FLYNT, MATHEMATICS
FUNDING SOURCE: PRESIDENTIAL FELLOWSHIP

IMPROVED EXPECTED POINTS AND WIN PROBABILITY MODELS FOR NFL COACH AND PLAYER EVALUATION

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WILL MILLER ’17

FACULTY MENTOR: PROFESSOR KEVIN GILMORE, CIVIL & ENVIRONMENTAL ENGINEERING
FUNDING SOURCE: BUCKNELL PROGRAM FOR UNDERGRADUATE RESEARCH

USING METABOLIC SELECTORS TO FACILITATE THE DEVELOPMENT OF ACTIVATED SLUDGE GRANULES

The use of granular activated sludge technology within sequencing batch reactors (SBRs) is an important and effective method of treating wastewater and recovering resources for reuse. Research performed primarily in the Environmental Engineering and Science Lab (EESL) focused on improving sludge settling characteristics and removing nutrients in such metabolic reactors at the Gregg Township water resource reclamation facility (WRRF). Collection and detailed analysis of samples at various stages of wastewater treatment within the SBRs took place in the effort to understand the granulation process and develop operating criteria to enhance it in the future.

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In contrast, our research looks into developing non-invasive techniques of detecting this chemical in real time. We plan to simulate the functioning of a Pulse Oximeter by analyzing light absorbed by BNP. The proposed device would substantially reduce screening costs and time, thereby improving healthcare facilities.

With limited resources and research on BNP, we have been able to finalize a protocol for our preliminary tests to understand which wavelengths of light BNP is most susceptible to and how absorption changes with BNP concentration. Although there can be a huge noise in our solution which may result in unexpected results, we hope to stay positive and proceed to our next step of prototyping our device if we are able to extract good information.

James Moran, Graduate Student

Evidence for Pro-cuckoldry Tactics in Heterosexual Males: The Psychology of an Interloper

Recent literature on cuckoldry has focused on anti-cuckoldry tactics such as sperm competition and testes size (e.g., McKibin et al., 2011). However, there is a dearth of research examining pro-cuckoldry tactics. The current research explored whether males instinctively target certain mated females for short-term affairs, hence cuckolding certain males. Thirty-eight heterosexual males (18-23, x=19) participated from two northeastern universities. Participants answered hypothetical questions regarding if someone they knew, or if they would cheat with a female who is in a committed long-term relationship. The stimuli that were paired up with the question consisted of photos of attractive, moderately attractive and unattractive males and females. There were statistically significant results from seven of the nine questions. These results suggest that males do have an underlying evolved psychological mechanism that allows them to pick out females to pursue for a short-term affair. The focal cue to identify this couple appears to be the facial attractiveness of the female’s partner in comparison to her facial attractiveness. We found that males do exhibit pro-cuckoldry behavior, by choosing a female to hook-up with when her partner is significantly lower in attractiveness than she.

Leah Murphy '17

The “Other” War: Public Sphere Complications in 1950s Gay and Lesbian Literature

My research explores 1950s gay and lesbian literature fixed on the social ramifications of Cold War hysteria. Specifically, it focuses on how United States’ national policy complicated life for non-normative individuals by challenging “deviant” political and sexual behaviors thought to threaten the welfare of the state. With many “contradictory influences” resulting from this movement, I focus primarily on public sphere issues that developed as homosexuals were targeted by nationwide “corrective” campaigns (D’Emilio 42). Problematically, these legislative tactics often presented gays and lesbians with the dilemma of either conforming to mainstream values or deviating from them. With neither option appealing, this dilemma compromised non-normative identities as individuals developed unhealthy tactics to better cope with oppressive social norms.

These tactics are particularly apparent in 1950s gay texts, such as James Baldwin’s Giovanni’s Room and Carson McCullers’ The Member of the Wedding, in which narrators David and Frankie face many complications. Having internalized the negative stigma attached to unconventional mentalities, both display evidence of compromising their identity for acceptance into gay and straight social orders. It is for this reason that both texts provide an excellent exploration of public sphere complications since both investigate the lesser-realized consequences of mainstream heteronormative influence on developing homosexual identities. Ultimately, I argue that public space works negatively in both texts by delegating David and Frankie to a liminal existence in which they remain unable to fully adopt a linear, heterosexual way of life, as well as incapable of fully committing to non-linear, homosexual relationships.

Peter Murray ’16, Marissa Young ’16

Socioeconomic Barriers: Recruitment for Women’s Swimming and Diving in the Patriot League

This paper addresses the relationship between socioeconomic class and women’s collegiate swimming and diving. We look to offer valuable insight into understanding the challenges associated with socioeconomic status and barriers to entry that potential athletes face in being successful in women’s
swimming and diving at the collegiate level. Following Bourdieu’s theoretical analysis of the relationship of social class and the body, we analyze how this relationship is reflected in the median household income of recruits for Patriot League Women’s Swimming and Diving as access to training facilities is correlated with socioeconomic factors. We will be testing our hypothesis, that women’s collegiate swim and dive recruits are predominantly from socioeconomically well-off areas, using a paired-samples T-test. We created the data set using the median household income of each athlete’s high school’s school district. Data on each school district’s racial demographics was also included in the data set. Median household income and demographic data of the school districts was taken from the Education Demographic and Geographic Estimates (EDGE) program.

James Mynott ’17, Megan Schlosser ’17
Faculty Mentor: Professor Tom DiStefano, Civil & Environmental Engineering
Funding Source: The Katherine Mabis McKenna Environmental Internship Program; Heinemann Family Professorship in Engineering

West Branch Regional Authority Wastewater Characterization

West Branch Regional Authority (WBRA) is a recently commissioned wastewater treatment plant that discharges into the Susquehanna in Muncy, PA. WBRA receives the majority of influent from two municipalities and leachate from a local landfill. In order to treat their incoming wastewater in the most efficient manner, WBRA must understand completely the chemical contents and quality of the incoming streams. This investigation focused on five water quality parameters and determined the extent to which landfill leachate inhibited biological removal of ammonia in the wastewater. Because microbial degradation requires an oxygen input, oxygen demand for treatment was calculated using the characterization data. The oxygen demand was then used to calculate electricity consumption and estimate CO2 emissions using the energy requirements and information regarding Pennsylvania energy sources. Based on analysis of the samples, projection of full-scale operation indicate that the two domestic influents posed similar oxygen demand (~305 ton/year), electricity requirements (~220 MWh/year), and CO2 emissions (40 metric tons/year). Whereas projections for landfill leachate suggested that electricity and carbon footprints are considerably less, nitrogen loading (17.6 lb/yr) from leachate represented 30.7 percent of the total nitrogen input to the treatment system.

Brandon Nelson, Graduate Student
Faculty Mentor: Professor Michael Krout, Chemistry
Funding Source: Bucknell University Department of Chemistry; Graduate Summer Research Fellowship

Development of a Stereoselective Synthesis of Allo Bile Acid Derivatives

Recent studies have found that bile acids, in addition to serving for regulation and absorption of lipids and other fat-soluble compounds in the gastrointestinal tract, can also function as cell signaling molecules. Specifically, allolithocholic acid (alloLCA), a structural derivative of the naturally occurring bile acid lithocholic acid (LCA), has shown potential to activate regulatory T cells found in the GI tract. Due to the high cost and limited access to commercially available alloLCA and derivatives thereof, we have explored methods of chemical synthesis to produce alloLCA from the inexpensive, commercial LCA. Because alloLCA is epimeric at C(5) relative to LCA, this conversion is not trivial. After a two-step oxidation process to convert LCA into an α,β-unsaturated ketone, our efforts have focused on the stereoselective reduction of the substrate using various methods. By implementing a hydrogen atom transfer (HAT) reaction utilizing a manganese catalyst, high stereoselectivity (>97:3) has been achieved during a key step in the overall synthesis of alloLCA. With the total synthesis of alloLCA in hand, attention has been turned to other bile acid derivatives with regard to forming the epimeric products at the C(5) position.

Kim Nidah ’16, Rich Saunders ’16
Faculty Mentor: Professor Rhonda Sharpe, Economics
Funding Source: Bucknell University Department of Economics

CIAA Basketball Players’ Performance In and Out of Conference

The Central Intercollegiate Athletic Association (CIAA) was established as an African American athletic conference in the United States. We want to examine the performance of CIAA basketball players in conference and out of conference play. Once we find the results to this question, we will evaluate the performances of each - CIAA basketball players in conference and out. In evaluating performance, we will examine total points for each game. For our examination, we will look at all 12 teams in the CIAA and look at their performances against in conference and out of conference teams. By looking for each team, our sample size will be 36. We will be obtaining our data from the CIAA website.

We’re looking at the most updated and recent results - the 2015/2016 season and calculating the total box scores. Our null hypothesis is that the performance of in conference play is not equal to out of conference play. By performing a hypothesis test, we will either reject or accept the null hypothesis.

H0 - Performance of in conference play is not equal to out of conference play; Ha- Performance of in conference play is equal to out of conference play
Cassidy Nyfield ’16, Alexander Romango ’17

Faculty Mentor: Professor Rhonda Sharpe, Economics

Funding Source: Bucknell University Department of Economics

Title IX and the Implications Toward Track and Field

Track and Field has become one of the most participated in high school sports; in 2009-10 alone participation increased by 25,561 students, accounting for the most combined participation amongst high school sports (USTFCCA). Although high school participation in sports has increased for the 21st consecutive year, with track and field having the most combine participation, funding has been continually cut in various college programs for track and field. In addition, in order to be compliant with Title IX, the amount of Track and Field scholarships available to men are far less than those available to women within division I schools (12.6 vs. 18) (Athnet). The difference in scholarships between men and women may cause increased competition for male track and field athletes. The low number of scholarships for males in track and field may be influenced by the large number of scholarships given out for football, in addition to complying with Title IX. Therefore, the purpose of our research is to examine how the distribution of scholarships among men and women in track and field impacts male track and field athletes. Additionally, we will simulate the impact of redistributing football scholarships by allowing athletes to participate in two sports. We use regression and descriptive analysis of data from the NCAA and from various college athletic programs to examine the issues of this study.

Maree O’Bryan ’16

Faculty Mentor: Professor Jennie Stevenson, Psychology

Funding Source: Douglas K. Candland Undergraduate Research Fund

Alcohol Alter Oxytocin Expression and Activation in the Paraventricular Nucleus of the Hypothalamus of Prairie Voles

This study examined the effect of alcohol on the oxytocin and vasopressin expression in the paraventricular nucleus of the hypothalamus (PVN). Oxytocin and vasopressin are involved in behaviours and conditions that are central to health and well-being, including social bonding, reproductive and parental behaviour as well as feelings of safety, and responses to stress. In our study prairie voles were subjected to either acute or chronic exposure to alcohol, followed by the performance of immunohistochemistry (IHC) on the brain tissue to measure oxytocin and vasopressin expression.

We also determined how acute alcohol affected the activation of oxytocin and vasopressin neurons in the PVN by analysing a protein called c-Fos that is expressed in recently activated cells only. We found that chronic alcohol consumption reduced expression of oxytocin but not vasopressin in the anterior PVN. In the posterior PVN there was a significant negative correlation between alcohol consumption and oxytocin expression. Based on the analysis of c-Fos activation, we found that chronic exposure to ethanol decreases the total average activation of OT cells in the posterior PVN. This finding is complimentary to a study that demonstrated AVP and OT neuron degeneration in the PVN was induced by chronic ethanol exposure (Silva, 2001). A lack of significant findings regarding vasopressin indicate that this system is not a major target of this moderate level of exposure to alcohol. The above oxytocin findings suggest that oxytocin expression and activation are altered by exposure to alcohol, and are the first to suggest that even moderate alcohol consumption can alter this hormone system that is critical to social behaviour and health.

Jahi Omari ’17

Faculty Mentor: Professor Mizuki Takahashi, Biology

Funding Source: Bucknell University Department of Biology

Effects of predatory wood frog tadpoles (Lithobates sylvaticus) on growth of larval spotted salamanders (Ambystoma maculatum)

Predator presence can trigger phenotypic changes in prey species. While Lithobates sylvaticus (wood frog) tadpoles are normally filter feeders. They also consume animal products including egg masses of Ambystoma maculatum (spotted salamanders). The presence of tadpoles during larval stage of spotted salamanders has been shown to reduce larval growth. However, no studies tested how the presence of predatory tadpoles during the embryonic stage affects growth and development of spotted salamanders. We tested a hypothesis that exposure to wood frog tadpoles during both embryonic and larval stage would have a synergistic negative effect on growth and development of spotted salamander larvae. We collected spotted salamander egg masses in spring 2015 and conducted an outdoor mesocosm (artificial pond) experiment with a 2x2x2 factorial design; three main factors were 1) coloration of spotted salamander egg masses (white or clear egg masses), 2) embryo history (presence/absence of tadpoles during embryonic stage), and 3) larval environmental (presence/absence of tadpoles during larval stage). We measured body mass and snout-vent length (SVL) of spotted salamanders at metamorphosis in July 2015. ANOVA results suggest that the presence of tadpoles during larval development had a negative effect on body mass and SVL. In addition, there was an interactive effect between egg color and presence/absence of tadpoles during embryonic history on both body mass and SVL at metamorphosis. The presence of tadpoles during embryonic history tends to affect larvae of clear egg masses positively while affecting those of white egg masses negatively.
Maximilian Ororbia '17

Faculty Mentor: Professor Jeffrey Evans, Civil
& Environmental Engineering

Funding Source: James L.D. and Rebecca Roser
Research Fellowship

Soil-Bentonite Cutoff Wall: Site Wall Design and Investigation

Presently soil-bentonite cutoff walls are not well understood and have many unanswered short term and long term performance questions. Over the summer of 2015, we drilled test borings, obtained samples for testing, and determined site characteristics for a soil-bentonite cutoff wall that will be constructed in Montandon, PA. The borings and samples were used to characterize the subsurface and tested in the laboratory, which allowed us to define the slurry wall’s alignment stratigraphy. There were two major components to the research conducted over the summer: on site investigation and laboratory testing. On site we used an Acker Soil Scout track-mounted drilling rig to collect continuous spoon and Shelby tube samples at three locations along the wall’s alignment. In addition to the borings, multiple geophysical surveys were taken to map the surface and subsurface designated for the soil-bentonite cutoff wall. For example, we aided in surveying the surface topography to understand the trench’s elevations. Laboratory testing included organic content, grain size distribution, Atterberg limits (i.e. liquid and plastic limits), and moisture content tests. From the data collected and analyzed we wrote a baseline geotechnical report, which included detailed boings logs of each drilling location. Understanding soil-bentonite cutoff walls’ short term and long term integrity, hydraulic conductivity, and general effectiveness will further justify their use and identify potential deficiencies that may exist.

Christian Ouellette ‘18

Faculty Mentor: Professor Peter Jansson, Electrical
& Computer Engineering

Funding Source: Comcast Tech Fund

Environmental Impact of Electrical Vehicle Use in Conjunction with Residential Microgrid

The project aims to use data from Dr. Jansson’s smart home prototypical system to analyze charge times and rates and compare them to the energy production from the home’s photovoltaic system and the utility grid. Based on the charge amounts and time we can calculate the emissions created from any power that was pulled from the electric utility grid based on its production method (coal, natural gas, nuclear, etc.). After completing this process, we analyze driving behavior and environmental conditions (distance, temperature, etc.) and compile this data with the total emissions data, including emissions created from the vehicle’s onboard supplemental engine. We cross-reference this with the environmental impact of a conventional vehicle which uses strictly gasoline and see the total benefit, both in terms of cost and amounts of CO2 produced. This analysis further provides total estimated benefits over the lifetime of the vehicle, which includes environmental impact of maintenance, use and initial manufacture. This provide rationale for determining whether or not the lifetime benefits of a hybrid vehicle will offset its larger environmental impact at the time of manufacture (compared to a typical gasoline powered vehicle). Finally, we analyze the smart residential microgrid and the driving and charging habits of the Chevrolet Volt owner to get a better idea of how to minimize environmental impact and increase overall utilization efficiency. A secondary objective during the project was to document how battery performance (charge time and efficiency and vehicle range) changes due to both age and environmental conditions.

Matthew Panzarino ‘18

Faculty Mentor: Professor Peter Jansson, Electrical
& Computer Engineering

Funding Source: Comcast Tech Fund

Cost benefit of switching to LED lighting in a Smart Residential Microgrid

LED lighting is becoming a more affordable and environmentally friendly substitute to incandescent lighting. For the same light output, an LED lamp consumes significantly less energy than the equivalent incandescent lamp. However, LED lamps often cost multiples of the equivalent incandescent. The goal of this research is to demonstrate the long term cost benefit that comes from retrofitting incandescent lamps with LEDs, due to their decreased power and energy requirements. To complete this analysis a residential home (Bucknell’s smart residential microgrid made possible by the ComCast Tech fund) that has a mixture of LED, CFL, and incandescent lamps was used as the test bed. In this home, an inventory of all of the lamps in use and estimates of approximate times that each lamp is on were determined based upon a site survey and input from the occupants. These estimates were then verified by analyzing evening data for the microgrid to assure the model of usage closely matches actual energy expended on lighting. Calculations of the current power usage in the home due to lighting is then prioritized based upon theoretical energy savings and a replacement strategy developed for retrofitting incandescent lamps with the equivalent LEDs. This strategy will be rank ordered for lamps with a 1 year or less payback period, a 1-2 year payback period, 2-3 year payback, etc. This research demonstrates that LED lamp retrofits will save the homeowners money on their electric bill and reduce their carbon footprint and provide significant returns on investment in many usage scenarios.
Precision Conservation Mapping of Buffalo Creek, Union County, Pa.

Precision Conservation is the application of high resolution geographical data within a Geographic Information System (GIS) to identify key sites to conserve or restore. It can be used to identify locations within a watershed that are likely to contribute unusually large sediment or other pollutant loads into local streams and eventually into the Chesapeake Bay. J. Allenby and C. Phelan from the Chesapeake Conservancy have pioneered a technique to do this.

In this project, researchers at Bucknell University worked closely with the Chesapeake Conservancy to apply the technique to Buffalo Creek, a 124 square-mile tributary to the West Branch of the Susquehanna River. Its watershed is mostly forested and agricultural. High resolution (approximately 1 m) remotely-sensed elevation and Land Use / Land Cover (LULC) datasets are used. Using GIS, each cell in the watershed was analyzed to determine the contributing runoff area for the cell. LULC is incorporated by assigning different weights to different land use classes, based on the likelihood that the land use will contribute high pollutant loads. Thus forests have a low weight (2), and crops (7) and parking lots (10) have high weights. A “weighted” contributing area for each cell is found by adding up the weights (rather than just the number) of cells contributing flow to a given cell. The original (un-weighted) and weighted contributing areas are combined into a single metric, the Normalized Difference Flow Index (NDFI).

NDFI ranges from -1 to 1. Smaller values correspond to cells with low potential for contributing pollutants and larger values to high potential. NDFI can be visualized on maps by displaying it only for cells having an un-weighted contributing area exceeding a certain value. These cells indicate concentrated flow paths. At these locations water quality can likely be improved through practices like buffer/filter strips and grass swales.

Xiaoqing Pu '17
Faculty Mentor: Professor Evan Peck, Computer Science
Funding Source: The Dean's Fund in Summer Undergraduate Research in STEM

Improving Decision-making via Wearable Biosensors

We tend to make bad decisions when they are under stress or high cognitive load. Wearable technologies can readily and unobtrusively provide computers with previously inaccessible information about our stress level. This human-computer interaction (HCI) study works towards building an “attentive” computing system that can detect our state of mind, and mediate our decision-making in an intelligent way. With the Empatica E-4 wristband, we collect heart rate, electrodermal activity and skin temperature from the users. The data are centralized and filtered by FlyLoop, a real-time physiological computing framework. From FlyLoop we construct a personalized model for each user, and classify the data into high or low workload states in real time. To train our model, we use the n-back, a well-validated cognitive task, to induce high or low workload in the user.

Currently, our study focuses on validating the classification of the user states using the E-4 data. We design a decision-making scenario that includes a primary and secondary task. The primary task requires the user to make a binary decision on a computer. The secondary task, digit span, is concurrent with the primary task and manipulates the user’s workload level. We compare the recorded decision-making processes (movement of the mouse) and outcomes under different workload conditions; if successful, the system can determine when we are susceptible to making bad decisions. For future work, the system will respond to the high workload state of the user, and help counter the non-optimal decisions that the user might make.

Eli Raeker-Jordan '17
Faculty Mentor: Professor Kathleen Bieryla, Biomedical Engineering
Funding Source: Bucknell Program for Undergraduate Research

Movement Detection with Smart Phone Accelerometers

Motion capture devices are widely used to detect human body movements. This process usually requires time consuming testing methods, along with expensive equipment. Smart phones possess the ability to capture similar data through built-in accelerometers. The purpose of this study was to determine the ability of a smartphone accelerometer to detect movements similar to those seen in people with attention deficit hyperactivity disorder (ADHD), and evaluate the location (ankle, hip, upper arm) of the devices. Twenty participants (aged 18 to 21 years) were asked to perform a series of ten movements for 30 second each, from a seated position in front of a table. Three Android smart phones were attached to the participants to collect acceleration data from the right upper arm, right hip, and right ankle.

The accelerometers were able to detect movement from multiple tests across multiple locations. The only left-side body movement detected by the accelerometers on the right side of the body was left arm flexion and extension. Finger tapping was unable to be detected at the upper arm, due to the small movement. Right-side upper body movements were detected with a right-upper arm mounted phone, right-side lower body movements were detected with a right ankle mounted phone, and movements that involve the trunk movements were detected with right upper arm, right hip, or right ankle mounted phones. Future work includes exploring other dependent measures based on accelerometer data to detect movements similar to those seen in people with ADHD.
be direct DNMT1 inhibitors, having IC50 values within 100-fold inhibitors of DNMT1 activity. Two compounds were found to molecules with variable substituents were screened as potential DNMT1. Fifteen lesser substituted, anthraquinone-like small anthraquinone, is a direct, DNA-competitive inhibitor of cancer, making DNMT1 an important drug target. Previous patterns have been linked to the initiation and progression of silencing of gene expression. Changes in genomic methylation for this maintenance methylation by preferentially catalyzing the transfer of a methyl group from S-adenosylmethionine to DNA is the primary method of preserving this epigenetic information through multiple rounds of DNA replication. In vertebrates, DNA methyltransferase 1 (DNMT1) is responsible for this maintenance methylation by preferentially catalyzing the transfer of a methyl group from S-adenosylmethionine to the 5' carbon of CpG cytosines. DNA methylation results in the silencing of gene expression. Changes in genomic methylation patterns have been linked to the initiation and progression of cancer, making DNMT1 an important drug target. Previous research has found that laccaic acid A (LCA), a highly substituted anthraquinone, is a direct, DNA-competitive inhibitor of DNMT1. Fifteen lesser substituted, anthraquinone-like small molecules with variable substituents were screened as potential inhibitors of DNMT1 activity. Two compounds were found to be direct DNMT1 inhibitors, having IC50 values within 100-fold of the IC50 exhibited by LCA. Understanding how these LCA-like compounds inhibit DNMT1 will help to elucidate which substituents of LCA most contribute to the potent inhibition observed in vitro. This could lead to the development of an anthraquinone-like pharmacaphore for DNMT1 inhibition to aid in future synthetic efforts to obtain novel DNMT1 inhibitors.
Kalman Symposium

investigate this study. I believe the documentary Professor Milofsky and I created can make the conflict a difficult topic to understand. However, there are a countless number of perspectives and viewpoints one learns about the conflict, the more confused they become. Even experts on the conflict in Northern Ireland believe that more research tools.

Specific objectives of this research was to analyze existing video from the Bucknell Digital Commons, make the footage directly led to the widespread manifestation of sectarianism. The model is based on the underlying physics of the electrode fabrication process. Results of the model include the effect of formulation parameters such as ceramic particle size, ceramic particle morphology, electrical conductivity in the backbone, etc. on cell performance characteristics such as TPB density and electrical conductivity.

Jack Robinson ’17
Faculty Mentor: Professor Carl Milofsky, Sociology & Anthropology
Funding Source: Bucknell Program for Undergraduate Research

Conflict in Northern Ireland Provoked by Differences in Neighborhood Structures

The Troubles and conflict in Northern Ireland can be held accountable to differences in the grassroots physical and social structures of Loyalist and Nationalist neighborhoods, which directly led to the widespread manifestation of sectarianism. I took existing footage of interviews, lectures, and tours from the Bucknell in Northern Ireland Program to highlight how geography and structures like flags, walls, and housing projects helped cause and exacerbate the struggle. The end result was a thirty-minute documentary hypothesizing these claims, along with interviews with people who experienced The Troubles firsthand.

Specific objectives of this research was to analyze existing video from the Bucknell Digital Commons, make the footage more accessible and useful to students, as well as convey the importance of visual mediums like documentaries as viable research tools.

Even experts on the conflict in Northern Ireland believe that more one learns about the conflict, the more confused they become. There are a countless number of perspectives and viewpoints that make the conflict a difficult topic to understand. However, I believe the documentary Professor Milofsky and I created can be utilized in a way that makes the issues more manageable and presentable to anyone in the Bucknell Community who wants to investigate this study.

Lindsey Ruff ’16
Faculty Mentor: Professor Bill Flack, Psychology
Funding Source: Bucknell Department of Psychology

Bucknell Sexual Assault Survey: 2016

Although much is known about prevalence rates of U.S. campus sexual assault victimization and their association with alcohol consumption among female students, very little research has been devoted to understanding other contextual factors and psychological outcomes in this domain. In the current study, we used the Revised Sexual Experiences Survey (RSES; Koss et al., 207) in an anonymous online survey to examine victimization prevalence and perpetrator tactics, alcohol consumption, hooking up, and PTSD symptoms based on the new DSM-5 criteria. We also included a measure that we designed, which examines “codes of silence” within Bucknell student groups. This measure will be used to examine whether there are pressures on Bucknell students to not report their peers’ illegal or untoward behavior, and if these pressures have a relationship with victimization. Bucknell Students were randomly invited to participate in an online survey. Of those students, data was obtained from approximately 300 female students. We are still in the process of data collection, so the results of the survey have yet to be determined.

Dominique Ruszala ’17
Faculty Mentor: Professor Mizuki Takahashi, Biology
Funding Source: Bucknell Department of Biology

Spotted Salamander Egg (Ambystoma maculatum) and Wood Frog Tadpole (Lithonates sylvaticus) Interactions

Predator and prey often coevolve together in nature. Defensive mechanisms of prey species evolve in response to predatory pressures. Without the presence of common predators, however, having such defensive mechanisms may decrease fitness of the prey species. For example, spotted salamanders (Ambystoma maculatum), a pond breeding amphibian, wrap their embryos with thick jelly layers to protect them from predators. Our preliminary experiment revealed surprisingly low hatching rates of A. maculatum eggs (30-40 percent) without the presence of predators. The hatchlings appeared to get stuck in the thick jelly coat and died. The most common predator across its distribution range is the wood frog tadpole (Lithonates sylvaticus), another pond breeding amphibian. Thus, we hypothesized that some predation by L. sylvaticus tadpoles would thin the jelly layer and allow for a greater hatching rate than if there was no predation. We collected A. maculatum eggs from a local pond and reared them in the lab under various conditions with three main factors being jelly layer color (A. maculatum lay both white and clear eggs), predation level, and the presence or absence (artificially removed) of jelly layers. We recorded the number of larvae that hatched each day to calculate survivorship. We found no significant difference in survivorship between white and clear eggs, but found that the survivorship sharply decreased with increased predation without protective jelly layers. In contrast,
the survivorship with jelly layers remained constant regardless of predation level. While the results rejected our hypothesis, the trend is worth further investigation.

Kelsey Salerno, Graduate Student

Faculty Mentor: Professor Joel Wade, Psychology
Funding Source: Summer Graduate Research Fellowship; Bucknell University Department of Psychology

Synergistic Effect of Facial Attractiveness, Facial Expression, and Vocal Pitch on Mating Assessments

There are a multitude of factors that contribute to the mate selection process (Buss 1989, 2006). This selection process has likely evolved over time, resulting in preferential mating strategies. These evolved preferential mating strategies were to help ensure maximum reproductive benefits. The current study seeks to examine how the combination of facial and vocal cues affects assessments for short term and long-term mating. The purpose of study 1 is to elucidate if participants will match a higher pitched female voice with a more attractive female face. The purpose of study 2 is to examine how a different combination of faces and voice pitches affect personality ratings of evolutionarily significant traits when evaluating both short and long-term mates, while study 3 will attempt to determine if a smiling face would alter perceptions of different personality characteristics when combined with two voices of different pitches. Given that higher pitched female voices are associated with a more attractive face (Collins & Missing, 2003), if people match these two attributes, it is likely that people are using vocal cues as a link to facial cues. These cues are likely the result of an evolutionary adaptation to choose a mate with qualities that suggest higher levels of estrogen, which likely indicates more genetic variety and a better immune system; which in turn would likely increase one’s own fitness by improving the chances of having healthy offspring. These evolutionary preferences help explain why bimodal cues to attractiveness are associated with overall perceived higher levels of attractiveness.

Christopher Schwake '16

Faculty Mentor: Professor Marie Pizzorno, Biology
Funding Source: Bucknell University Department of Biology

Expression of the Deformed Wing Virus Capsid Proteins in Bacteria

Infection of pupating honeybees with Deformed Wing Virus (DWV) leads to wing deformities, paralysis, and death after emergence. DWV is a member of the *Iflavirus* family, and uses a single-stranded RNA genome of positive sense similar to other Picornaviruses. The DWV capsid is composed of four proteins, VP1, VP2, VP3, and VP4. The goal of this project is to investigate the binding interactions of the DWV capsid proteins, which will help elucidate the structure of the virion and the assembly pathway. I have cloned the DNA sequence encoding the three major capsid proteins (VP1, VP2 and VP3) into the maltose binding protein (MBP) expression plasmid (pET-27b). Each plasmid will then produce a MBP fusion for each individual capsid protein. A C-terminal his tag was added to the fusion to allow for nickel affinity purification, and a protease site was engineered into the sequence to allow separation of the MBP moiety and the viral capsid protein.

Nickel affinity chromatography has been used to successfully purify small quantities of soluble MBP fusion protein, and further refining of the purification protocol is currently ongoing in order to increase protein yield. This project is ongoing and we hope to obtain large quantities of fully folded capsid proteins to begin further experimentation, such as pull down experiments and *in vitro* virion assembly assays. A potential future direction for this project is to express the structural proteins as the native polyprotein, as folding might be influenced by neighboring capsid proteins. This could allow for a more native conformation of the capsid proteins and could greatly increase their solubility. However, purification of the individual capsid proteins would prove challenging using this strategy. This work will provide to a better understanding of the DWV virion and possibly lead to strategies to combat infection of honeybees.

Danielle Selzer '16

Faculty Mentor: Professor Douglas Gabauer, Civil & Environmental Engineering
Funding Source: Michael Baker Undergraduate Research Inc.

Investigation of Motorcycle-to-Barrier Crashes on Exit/Entrance Ramps

According to vehicle registration statistics in 2012, motorcycles made up 3 percent of all registered vehicles in the United States and accounted for only 0.7 percent of all vehicle miles traveled, yet the fatalities due to motorcycles were approximately 15% of total vehicle fatalities. Motorcycle-to-barrier crashes are not as frequent as other motorcycle crash types but are usually more fatal. Previous research suggests that motorcycle-to-barrier crashes are over-represented at exit and entrance ramp locations.

The goal of this research was to determine the characteristics of highway entrance/exit ramps for the state of Washington that experienced at least one motorcycle-to-barrier crash, with a total of 138 ramps investigated. Specific objectives were to compare characteristics of the highway ramp including curvature, barrier type, speed limit, shoulder width, lane width, and other parameters in order to determine when ‘motorcycle-friendly’ barriers on highway entrance and exit ramps would be beneficial. The results of this research show patterns between the design of the roadway and its affect on motorcyclists.
Christopher Serfass ’17
Faculty Mentor: Professor Brandon Vogel, Chemical Engineering
Funding Source: Bucknell University Department of Chemical Engineering

The Effects of Silica Nanoparticle Loading on Injectable Hydrogel Mechanical Properties

Polyethylene Glycol (PEG) based hydrogels have the potential to serve as excellent temporary scaffold supports for bone tissue engineering if their mechanical strength can be increased to suitable levels. One way to improve the mechanical properties of such materials is to create particle reinforced composites. We hypothesized that hydrogel mechanical strength can be increased with the addition of silicon oxide particles to create hydrogel composites. We varied the weight fraction of silica nanoparticles in hydrogels produced by crosslinking PEGDA with ETTMP to determine the effect of silicon oxide filler on the composite storage moduli. Preliminary results from mechanical property testing with dynamic mechanical analysis show that the addition of silicon oxide nanoparticles to the hydrogels produces an inconsistent effect on mechanical strength. Confounding the effect of silicon oxide particle addition was the potential hydrolytic degradation of one of the hydrogel precursor components, ETTMP. Another issue could have been poor mixing of the silicon oxide nanoparticles leading to inadequate dispersion of particles in the final hydrogel. Future research will focus on developing better methods to disperse the nanoparticles in the hydrogel and use of fresh ETTMP.

Vikram Shenoy ’16
Faculty Mentor: Professor Michelle Johnson, Anthropology
Funding Source: Tom Greaves Fund

Eco-Spirituality: A Case Study of Hinduism and Environmentalism in Contemporary India

India, with its population of 1.3 billion people, is one of the world’s fastest growing countries both in terms of population and economy. One consequence of such rapid growth is that India now has levels of environmental pollution that are unprecedented in scale. Hinduism, India’s majority religion, is the primary focus of this research. Hinduism is a religious tradition whose roots lie in the ancient Sanskrit Vedas. The Vedas, along with the Upanishads and Puranas, hold teachings of nurturing, caring and protecting all aspects of the natural world. The cultural dynamics of India have drastically changed over the past two centuries causing a diminishing importance of doctrines for environmental protection embedded within Hindu scripture. In my honors thesis, I specifically research conflicts between secular and religious institutions as people understand and attempt to combat pollution.

This research project is based on anthropological fieldwork carried out in New Delhi, Varanasi, Ranikhet, and Naina Devi during the summers of 2014 and 2015. In conducting my research I conducted participant-observation, as well as 9 semi-structured interviews. I found that Hindus understand the current environmental problems dualistically through Hindu scripture and scientific concepts. The conflict arises when religious and secular institutions attempt to combat the environmental problems using only one ideology. In my Honors thesis, I argue that if India is to successfully mitigate the widespread environmental problems, it is necessary for both secular institutions, religious institutions and environmental activists must to come together to provide a pluralistic solution that all contemporary Hindus can understand and embrace.

Reilly Sonstrom ’16
Faculty Mentor: Professor David Rovnyak, Chemistry, Cell Biology & Biochemistry
Funding Source: Kalman Fund for Undergraduate Research in the Sciences

Enhanced biosynthetically directed fractional carbon-13 enrichment of proteins for backbone NMR Assignments

Routes to carbon-13 enrichment of bacterially expressed proteins include achieving uniform or positionally selective (e.g. ILV-Me, or $^{13}C^\text{'}$, etc.) enrichment. We consider the potential for biosynthetically directed fractional enrichment (e.g. carbon-13 incorporation in the protein less than 100 percent) for performing routine n-(D)dimensional NMR spectroscopy of proteins. First, we demonstrate an approach to fractional isotope addition where the initial growth media containing natural abundance glucose is replenished at induction with a small amount (e.g. 10% $u^{13}$C-glucose) of enriched nutrient. The approach considered here is to add 10 percent (e.g. 200 mg for a 2 g/L culture) $u^{13}$C-glucose at the induction time (OD $\text{600}=0.8$), resulting in a protein with enhanced $^{13}$C incorporation that gives almost the same NMR signal levels as an exact 20 percent $^{13}$C sample. Second, whereas fractional enrichment is used for obtaining stereospecific methyl assignments, we find that $^{13}$C incorporation levels no greater than 20%$^{w/w}$ yield $^{13}$C and $^{13}$C-$^{13}$C spin pair incorporation sufficient to conduct typical 3D-bioNMR backbone experiments on moderate instrumentation (600 MHz, RT probe). Typical 3D-bioNMR experiments of a fractionally enriched protein yield expected backbone connectivities, and did not show amino acid biases in this work, with one exception. When adding 10 percent $u^{13}$C-glucose to expression media at induction, there is poor preservation of $^{13}$C-$^{13}$C spin pairs in the amino acids ILV, leading to the absence of $\tilde{C}$ signals in HNCACB spectra for ILV, a potentially useful editing effect. Enhanced fractional carbon-13 enrichment provides lower-cost routes to high throughput protein NMR studies, and makes modern protein NMR more cost-accessible.
Sune Swart '17

Faculty Mentor: Professor Thomas Beasley, Classics & Ancient Mediterranean Studies
Funding Source: Mellon Research Grant

Visualizing Networks in the Ancient Mediterranean (VNAM)

Visualizing Networks in the Ancient Mediterranean (VNAM) is a web-based application that can be used to visualize a variety of networks in the ancient Mediterranean and to explore the primary evidence on which they are based. By specifying a time period, geographical center (where applicable), network type (economic, religious, political, colonial, etc.), and evidence type (literary, inscriptional, material), users will not only be able to dynamically generate a visualization of their desired network, but also explore the evidence on which any given network “edge,” or link between places, is based. Users will also be able see information about the places when they click on the place’s marker. Since it is possible to access and cross-reference many different types of data, users will be able to map literary and mythological journeys onto their real-world referents. Apollo’s travels, for example, will result in an overlay of places mentioned in the text of the Homeric Hymn to Apollo against a map of cities with temples to the god.

Eric Todd '17

Faculty Mentor: Professor Kelly Salyards, Civil & Environmental Engineering
Funding Source: Helen E. Royer Undergraduate Research Fund

Dynamic Characterization and Modeling of Varying Support Configurations of a Cantilevered System

When subjected to dynamic, crowd-induced loading, a structure may vibrate or shake due to the nature of the loading. This may raise a concern about the safety of the structure or cause discomfort to the occupants. To analyze the relationship between this crowd-induced excitation and the resulting dynamic response of the structure, a cantilevered laboratory structure with variable supports is used. An electrodynamic shaker excites the cantilever, and piezoelectric accelerometers located along the span measure the acceleration in the structure. The goal of this study is to determine the dynamic properties of the structure for each of the variable support configurations. The study aimed to identify the lowest three fundamental modes of vibration (and associated frequencies) for each support configuration. This thorough characterization of the structure enables it to be more useful for future experimental work. The experimental testing yielded results that align with the underlying dynamic theory.

Kevin VanDelden '17

Faculty Mentor: Professor Peter Stryker, Mechanical Engineering
Funding Source: James L.D. and Rebecca Roser Research Fellowship

Measurement of In-Cylinder Pressure in a Small Diesel Engine

The purpose of this research was to measure the fast change in pressures that occur in a diesel cycle piston-cylinder system while knowing the relative crank-angles of the shaft itself to create Pressure-Volume (P-V) diagrams to help understand the
Icy Debris Fans

Icy debris fans are a result of the decoupling of distributary glaciers, followed by rapid avalanches, rock flow and icy debris flow. This form of mass wasting exposes escarpments and creates a wide array of dynamic, geohazardous landforms which is why these types of landscapes are particularly dangerous (Trop and Kochel, 2012).

The primary objectives of this research project were to analyze GPR and GPS data in order to correct for field errors, add topography and apply filters and gain to raw data in order to better resolve surface features. This analysis and correction of the data aided ongoing icy debris fan research that was already being conducted by Bucknell’s Geology Department. Other goals of this project included gaining better understanding the function of GPR in a lab setting, how to use complex geophysical computer programs, what non-invasive subsurface data collection can reveal about geological structures, and observing the formation and maturation of icy debris fans in New Zealand.

From the images created by the New Zealand 2014 and 2015 GPR and GPS data collections, it was clear that on all icy debris fans (Mueller, La Perouse, and Douglass) there were many subsurface layers that indicated falls and deposits of new icy material and debris over time. This indicates that icy debris fans withstand immense amounts of icy material from its contributing glacier and supports that change in the volume and shape of icy debris fans can occur rapidly.

Katherine Wagner ’18
Faculty Mentor: Professor Rob Jacob, Geology & Environmental Geosciences
Funding Source: James L.D. and Rebecca Roser Research Fellowship

Characterization of even dicarboxylic acid particle morphology using Monodisperse Droplet Evaporation

Organic molecular particles play an important role in many different applications including foods, specialty chemicals, and pharmaceuticals. Three characteristics that strongly influence performance of organic molecular particles are size, morphology (shape) and internal structure (arrangement of the molecules in the solid state). The morphology refers to the surface properties and the specific shape that a particle exhibits, and affects particle functionality and its ability to be processed. Using different methods to produce particles can result in unique morphologies. In this work, particles with uniform size and shape are produced from solutions using monodisperse droplet evaporation technology. Monodisperse droplet evaporation is achieved using a Vibrating Orifice Aerosol Generator (VOAG). The VOAG produces monodisperse droplets from a solution, which then rapidly evaporate in a collection column, leaving particles to be examined. In these morphology experiments, the solution includes a pure organic dicarboxylic acid as a solute in an organic solvent. The solute acts as a model active pharmaceutical ingredient. Many factors affect the morphology of a particle, but this experiment focuses on the choice of solute and solvent. In this work, the surface morphology and internal structure are examined for several even dicarboxylic acids such as Suberic Acid (C8) and Sebacic Acid (C10). Solvents tested include Isopropanol, Acetone, Methanol and Ethanol. A Scanning Electron Microscope (SEM) is used to examine shape and surface morphology as well as internal structure and morphology once particles are cracked open. The crystalline nature of the particles is confirmed using an X-Ray Diffractometer (XRD).

Julia Wigginton ’18
Faculty Mentor: Diane Jakacki, Comparative Humanities
Digital Spatial Analysis

My research this semester focuses on a digital spatial analysis of historic Lewisburg. I am analyzing a map of Lewisburg from 1884; using digital archive and spatial analysis tools including Omeka and Neatline to create new knowledge about a snapshot in Lewisburg’s history.

Lewisburg was a powerful town in pre-industrial 19th century Pennsylvania. The map I am using for the basis of my research was drawn in the peak economic moment of the town. Not only am I considering the physicality of the town at the end of the 19th century; I am employing spatial thinking to ask questions about how maps can have political implications, how what is presented in a visual such as this can emphasize one aspect of a town’s personality at the expense of another, and what this map can tell us about the relationship between Lewisburg and the University.
Natural Language Search of Sensor Data

As sensors become more affordable, sensor networks are increasingly deployed to monitor diverse environments. However, these sensor network deployments often utilize different standards for communication and data storage. As a result, it is challenging to build large-scale pervasive systems able to find, query, and analyze information across a diverse set of sensor networks. Additionally, aggregating sensor data from various sources is difficult because data can be sampled using different levels, units, rates, and resolutions. To address these challenges, we have developed a pervasive sensor network search environment based on natural language processing and the semantic web. By using natural language, we can understand the context of the query and use semantic rules about the data to aggregate and transform data to more useful results. We also use technologies from semantic sensor networks such as ontologies to accommodate different sensor networks. To demonstrate the system, we have deployed the environment in two application domains. In each domain, the system successfully answers domain-specific natural language queries.

* Abroad Spring Semester 2016
^ Attending Association of Writers & Writing Programs (AWP) Conference
+ Competing in Athletic Event