



Office of Student Research
APPALACHIAN STATE UNIVERSITY

**23rd Annual
Celebration of Student Research and
Creative Endeavors
2020 Abstract Program**

Office of Student Research



APPALACHIAN STATE UNIVERSITY

Welcome to the 2020 Annual Celebration of Student Research and Creative Endeavors sponsored by the Office of Student Research. The Office of Student Research (OSR) was established in 2005 in order to expand the opportunities for undergraduate and graduate students to engage in research and mentored scholarship at Appalachian State University. We firmly believe that students who understand how discoveries are made in their chosen fields are well-prepared to address the unsolved problems of the future.

While we were unable to host an in-person on campus event due to the pandemic (COVID-19) we hope you find this program a source to see the amazing accomplishments of students engaged in research and creative endeavors. Additionally, we do want to recognize the contribution of the faculty on campus. Without the support and mentorship of so many faculty in so many disciplines across campus we would not be able to showcase the work of the students. We are pleased to honor the winners of our 4th Annual Undergraduate Research Mentorship Excellence Award.

We hope you browse the program for the many student presenters. The program includes the student Lead Author, whether they are an Undergraduate or Graduate student. Additionally, the Faculty Mentor and their home department are listed along with any co-authors.

Please visit the Office of Student Research website (www.osr.appstate.edu) to find out more about student research and creative endeavors on campus. We strive to support and assist students and faculty in their efforts to engage in research and creative endeavors. We are so very thankful to have the ability to fund such amazing work and that is in large part to the support from the following areas: Office of Academic Affairs, Office of Student Affairs, Cratis D. Williams Graduate School, Office of Research, Office of International Education and Development, and University College. Finally, a special thank you to the Advisory Board of the Office of Student Research and to the staff in the Office of Student Research which include Kathy Weaver Stevens our Graduate Assistant Michael Grant.

Rebecca A. Battista, Ph.D., FACSM
Director, Office of Student Research



Office of Student Research Staff

Director, Dr. Rebecca A. Battista

Research Programs Administrator, Kathy Weaver Stevens

Graduate Assistant, Michael Grant

Office of Student Research Advisory Board

The Office of Student Research would like to thank our past and present Advisory Board members for serving in this capacity. The Advisory Board works tirelessly reviewing grants and abstracts and assisting in promoting student research across campus.

Current Advisory Board Members

Dr. Francois Amet, Department of Physics and Astronomy

Dr. Billy Armstrong, Geological and Environmental Sciences

Dr. Andrew Bellemer, Department of Biology

Dr. Erin Bouldin, Department of Health and Exercise Science

Dr. Mike Hambourger, Department of Chemistry and Fermentation Sciences

Dr. Scott Marshall, Department of Geological and Environmental Sciences

Dr. Randall Reed, Department of Philosophy and Religion

Dr. Mark Zrull, Department of Psychology

Dr. Kevin Zwetsloot, Department of Health and Exercise Science

2020 Aportfolio Scholars Awards

This award honors and acknowledges an Appalachian State student who develops an outstanding, creative, scholarly, and professional Aportfolio. The winner of this award is selected as an exemplar and their ePortfolio will be added to the Aportfolio site in our top tier directory.

Aportfolio Students applying for the award were challenged to create an ePortfolio that shows awareness of profession audiences, uses intentional visual design, creates an invitational and intuitive navigational structure, honors the privacy, intellectual property, and copyrights of self and others, creates clear connections to learning and life experience and highlights samples from a variety of their best work by summarizing the impact, insights and integration of college learning and experiences.

More information regarding Aportfolios can be found at <https://aportfolio.appstate.edu/>

2020 Aportfolio Scholar winner

Dusty Roberts

Recreation Management Program

<https://appstate.digication.com/dusty-roberts-rockguy/somestuffaboutme>

2020 Aportfolio Honorable Mention - Runner Up

Sarah Childers

Nutrition and Foods Program

<https://appstate.digication.com/sarah-childers/menu-1>

Anna Wagner

Nutrition and Foods Program

<https://appstate.digication.com/nut3150-anna-wagner/menu-1>

Here are some quotes from Interim Provost Heather Norris on the winner and runner - ups:

Dusty Roberts has done a fantastic job capturing all of the many experiences he's had during his Recreation Management program of study in an easy to navigate, aesthetically pleasing way. I am so impressed by all that he has accomplished, from his professional certifications to his in-class experiences, all the way to his outdoor experiential education. Congratulations, Dusty!

Sarah Childers has created a beautiful display of her many accomplishments in her Nutrition & Foods program of study. She has developed easy-to-use nutrition guides for a wide range of individuals, from dancers, to college students, to high school athletes. I commend her on her outstanding work!

Anna Wagner has shared deep and meaningful reflections on her experiences during her Nutrition & Foods program of study. Her outreach to our community, through the Appalachian Student Dietetics Association, to the Wake County Animal Shelter, to her ongoing work at the F.A.R.M. Cafe and the Horse Helpers of the High Country, are commendable!

Office of Student Research

Undergraduate Research Mentorship Excellence Award

The Office of Student Research is pleased to announce the recipients of the Undergraduate Research Mentorship Excellence Award. Students were asked to nominate faculty and discuss the specific qualities that made their mentor a perfect candidate for the award and explain how their mentor affected their undergraduate education at Appalachian. Nominated Faculty members were then evaluated on their consistent track record of mentoring undergraduate students as well as supporting and encouraging students to present and publish their research or creative endeavors. Many of the Faculty nominated are often role models in their field.

In 2020 the Office of Student Research awarded two Mentorship Excellence Awards.

Dr. Howard Neufeld **Professor in the Department of Biology**

Dr. Neufeld has over 20 years of experience working with students in research. Not only does Dr. Neufeld encourage his students to “get their hands dirty” in research projects but he tries to also make research exciting and fun. One of his student’s stated, “He encourages students to challenge themselves in their research, yet always respects life's random circumstances and obstacles.” Additionally, the student discusses the importance Dr. Neufeld felt about the dissemination of research, “He always has encouraged our ability to not only conduct science but to be able to communicate it effectively, something I strongly carry with me into my future with science.”

Dr. Megen Culpepper **Assistant Professor in the Department of Chemistry and Fermentation Sciences**

In her relatively short career here at Appalachian, Dr. Culpepper has certainly started a strong mentorship program among her students. She has mentored 21 students since arriving at Appalachian in 2014. Dr. Culpepper believes students learn best by doing. One of her nominators stated, “She strives to make sure everything is learned correctly and then pushes you to always do better.” Dr. Culpepper does more than just mentor in the lab, she provides career advice. As her nominator also stated, “She's helped give me insight and advice about graduate schools and the application process, she's taught me laboratory techniques and the science behind them which has in turn made my classes that much easier”.

A point of pride for Appalachian is the number of faculty mentored student research and creative endeavors that occur on campus and the Office of Student Research is pleased to acknowledge the hard work of both of these faculty members and many others that were nominated.

Congratulations to Dr. Neufeld and Dr. Culpepper!

ABSTRACTS

COLLEGE OF ARTS AND SCIENCES

ART

Kiersten Staab, Art, Undergraduate Student

Faculty Mentor: Mira Waits, Arts and Sciences

Co-Author(s): Dr. Lyle Humphrey, NCMA

Title: SUB-SURFACE

This research project joins traditional connoisseurship with emerging technologies now applied to the analysis of art, centering around a fourteenth-century Italian triptych in the collection of the North Carolina Museum of Art with an indefinite attribution. Working with Dr. Lyle Humphrey of the NCMA, the project began by initially viewing and comparing the forms of punch motifs. Using this method, the initial thesis was formed that the artist behind the painting was Ambrogio Lorenzetti. Visual analysis of the work's additional details also pointed to the conclusion that the triptych was indeed created by the younger of the Lorenzetti brothers, however, the Christ child in the central scene presented an important contradiction, as it was obviously not painted by Ambrogio's hand. Our research culminated with the use of infrared, X-ray, and multispectral imaging, through which we were able to rethink our approach to this work. Using modern imaging techniques, we were able to find that the head of the Christ child had been heavily over-painted, and that the baby in its original form matched perfectly with those in Ambrogio's oeuvre. Also brought to our attention were the newer additions to the wings of the triptych, likely added after the painting had left the Lorenzetti studio. This presentation aims to further detail the process of reattribution through the use of technology and demonstrate the solidity of the conclusion that this painting was authored by Ambrogio Lorenzetti.

BIOLOGY

Amanda Wilkinson, Biology, Graduate Student

Faculty Mentor: Matt Estep, Arts and Sciences

Co-Author(s): R. Wayne Van Devender, Amy S. Van Devender, and Matt C. Estep

Title: TESTING THE UTILITY OF CURRENT PHYLOGENETIC MARKERS IN GENUS NEOHELIX (GASTROPODA: POLYGYRIDAE)

Despite their ecological roles as primary consumers and major detritivores, land snails are infrequently prioritized as models of evolutionary change. Consequently, poorly characterized taxonomic relationships are common among polygyrids. Typically, allele variant analysis is employed to elucidate interspecific relationships, however, universal DNA markers have previously produced ambiguous cladistic interpretations among Family Polygyridae. Before taxonomic analysis proceeds, current universal markers must be evaluated for resolution capacity. Genus Neohelix (Family Polygyridae) was selected as the model taxon for this study. Instances of homoplasy due to sympatric convergence are common among Neohelix species

and morphologically similar genera like *Mesodon*, making *Neohelix* a strong candidate for future phylogenetic inquiry. During this study, four genetic loci were PCR amplified with published primers and conditions to assess their utility for identifying polymorphisms: Cytochrome oxidase I (COI), large ribosomal subunits 16S and 28S, and histone 3 (H3). Due to inconsistent amplification, modified COI primers were developed based on polygyrid whole genome reference sequences (KX240084.1 and KX278421.1). Single gene trees were produced, compared to quantify the presence of coalescence or introgression, then concatenated and constructed into a consensus tree. Phylogenetic inference will be discussed as well as implications for *Neohelix* classification.

Ty Brown, Biology, Graduate Student

Faculty Mentor: Matt Estep, Arts and Sciences

Co-Author(s): Jennifer Rhode Ward, Matt C Estep

Title: Chromosome Evolution in *Spiraea*

Spiraea virginiana Britton (Rosaceae) is a federally-listed rare, clonal shrub that inhabits riparian zones within the Ohio River drainage. The species often occurs in areas of high disturbance and predominantly uses asexual reproduction to propagate from populations upstream. Although the species' known range suggests that sexual reproduction played an important role in its evolutionary history, sexual reproduction is currently almost non-existent. Pollination studies have shown that the species can produce fertile seeds; however, this has not been witnessed in wild populations. Understanding the role of chromosome evolution within the genus may provide some insight towards understanding the sexual reproductive barriers experienced in this species. A consensus phylogeny was generated by combining several published phylogenies and chromosome number was mapped to identify patterns of chromosome evolution. The base chromosome number for the genus is $n=9$ and multiple independent polyploid events have occurred within the clade. Polyploidy events could be driving the reproduction patterns of the genus *Spiraea*. It is important to map chromosome number by species to try and identify relationships based on phylogenetic distance.

David Camp, Biology, Graduate Student

Faculty Mentor: Matt Estep, Arts and Sciences

Co-Author(s): Matt C. Estep, Dr. James F. Matthews, David Campbell

Title: Phylogenetic Resolution: Quantifying Variation in *Yucca flaccida*

Yucca flaccida (Haw) can be found across a broad range of habitats in Southeastern North America. This species is easily identified by its simple, unlobed leaves, showy white flowers, and tendency for the leaf margins to fray into threads. Morphological variation observed across its range and similarities with *Y. filamentosa* have led to taxonomic uncertainty. Based on our morphological observations, we hypothesize that *Y. flaccida* is a distinct species and that it is composed of two or more distinct morphological taxa. In order to test this hypothesis, we sampled 27 individuals across the range of North and South Carolina and sequenced two bar coding loci (*rps16-trnQ*, *rpl32-trnL*). Using this data, we have quantified genetic variation among individuals of *Y. flaccida*. Updates to the phylogeny of the *Yucca* genus are forthcoming.

Grant Buckner, Biology, Graduate Student

Faculty Mentor: Shea Tuberty, Arts and Sciences

Co-Author(s): Ed Boles, Jasper Yoke, Dave Penrose, Robert Creed

Title: DEVELOPMENT OF A RAPID BIOASSESSMENT FOR MONITORING WATER QUALITY IN WADEABLE STREAMS OF THE BELIZE RIVER WATERSHED

The Belize River Watershed (BRW) is located mostly in central Belize. It is impacted heavily by human development and agriculture. The BRW flows through two of the largest cities in Belize and experienced the highest rate of deforestation in Belize at 36.7% between 2010-12. The lack of forests and healthy riparian zones negatively impact river water quality by introducing pollutants while also increasing rates of sedimentation. Aquatic macroinvertebrates (AMI) are commonly used to monitor water quality because they are sensitive to water quality impairments but have not been used in Belize. We hypothesize that AMIs can be used in Belize to indicate water quality. 31 sites were sampled in the BRW over winter break and were preserved in ethanol. AMIs were collected using kick seines, D nets, sand samplers, and visual searches. AMIs were identified, cataloged, and placed in archival grade vials to serve as a reference collection. Over 3500 AMIs were collected from over 120 taxa. The project has the following goals: 1) describe the diversity, abundance, and pollution tolerances of AMIs for wadeable streams in the BRW; 2) establish a Multi Metric Biological Index (MMBI) and develop an RBA for Belize; and 3) uncover interactions of land cover and water quality on the BRW. The result of this project will be a standardized protocol for collecting AMIs and an MMBI to monitor water quality in Belize, which can be used to better regulate practices that negatively impact water quality.

Emily Xiong , Biology, Graduate Student

Faculty Mentor: Michael Opata, Arts and Sciences

Co-Author(s): N/A

Title: MODERATE MALNUTRITION DECREASE MALARIA-SPECIFIC CD4+ T CELLS DURING MALARIA INFECTION

It is estimated that 3 billion people live in regions of the world, declared at-risk for malaria, although most cases occur in sub-Saharan Africa. Addition, there are 462 million people who are underweight, with 45% of deaths among children under the age of five. Studies has shown that CD4+ T cells are important in the immune response to malaria due to their cytokine production and ability to help B cells produce antibodies. While malnutrition is known to predispose people to infections by affecting immune cell populations, it is not known how moderate malnutrition affect the development of long-lived effective memory CD4+ T cells that could be protective against chronic infections such as malaria. In our current study, we hypothesized that moderate malnutrition leads to poor expansion of malaria-specific CD4+ T cells resulting in decreased survival and lower numbers of memory cells. Using flow cytometry, we determined malaria-specific, effector and memory CD4+ T cells in the spleens, after *Plasmodium chabaudi* infection. We observed that moderate malnutrition does not decrease the total number of lymphocytes, CD4+, CD25+ T cells. However, using adoptive transfer, we found that moderate malnutrition decrease effector malaria-specific CD4+ T cells that express Thy1.2 molecule. These findings suggest that malnutrition does impair pathogen specific CD4+ T cell populations during chronic infection, which may have a significant effect on other immune cells.

Future studies will determine how this defect influence long term survival of memory CD4+ T cells.

Morgan Smith, Biology, Graduate Student

Faculty Mentor: Suzanna Brauer, Arts and Sciences

Co-Author(s): Sarah Carmichael, Katrina Godsey

Title: Manganese (II) Oxidizing Microbes and Mineral Induced Selection

Manganese oxidizing microorganisms are abundant in nature and play an important role in biogeochemical cycles in the environment. Cave and karst systems are important natural resources because they provide significant sources of the world's drinking water and support unique biological communities. The microbial ecology of Mn oxide deposits is not well understood, and even less is known about the factors that stimulate Mn-oxidizing microbes in situ. Previous studies suggest that biological Mn oxide minerals are strongly oxidative and have highly charged surfaces making them highly reactive. However, the microbes that generate these reactive Mn oxides show a strong preference for some rock/mineral surfaces over others, even when these surfaces are in direct proximity to each other. Based on field observations in a variety of cave, karst, and wetland environments, it is predicted that Mn oxidizers prefer to grow on quartz rather than calcite. The aim of this study is to identify which Mn oxidizing microbes within a local microbial community preferentially colonize some minerals instead of others. Predicting how and where Mn oxides will grow is a vitally important tool for the production of reactive mineral species, which can be used in a variety of water filtration and bioremediation technologies.

Noah Murr, Biology, Graduate Student

Faculty Mentor: Michael Opata, Arts and Sciences

Co-Author(s): Amari Smith

Title: MALNUTRITION LEADS TO DECREASED MUCOSAL INNATE IMMUNITY DURING MALARIA INFECTION

Malaria and malnutrition are two devastating factors that account for nearly 3.6 million deaths combined annually, both of which are exceedingly prevalent in resource limited countries. Malaria alone causes approximately 450,000 deaths annually, with increasing lethality in vulnerable populations, such as malnourished individuals. Malnutrition leads to lower lymphocyte counts which hamper the ability to fight infections. While adaptive immunity during malnutrition has been extensively studied, the effect of malaria on gut mucosal innate immunity in a malnourished environment has not been explored. In our current study, we hypothesized that malnutrition causes decreased mucosal innate immunity in the gut during a malaria infection. Using flow cytometry, we analyzed macrophages, dendritic cells, and myeloid cells in the small intestines, large intestines and cecum of both malnourished and well-nourished mice after *P. chabaudi* infection. We observed that mucosal tissues of *P. chabaudi* infected malnourished mice have considerably lower numbers of these cells when compared to infected well-nourished mice. These findings suggest that malnourishment does impair the innate immune response to a *P. chabaudi* infection. We also observed a reduction in the length of the malnourished infected mice compared to the well-nourished and uninfected controls in the small intestine, which may be a function of decremented epithelia regenerative ability. Future studies

will focus on determining the impacts of malaria and malnutrition gut leakage and its effect on other tissues like the liver and kidney.

Sylas Owen, Biology, Graduate Student

Faculty Mentor: Maryam Ahmed, Arts and Sciences

Co-Author(s): Megan Polzin, Darren Seals, and Maryam Ahmed

Title: A MATRIX PROTEIN MUTANT STRAIN OF VESICULAR STOMATITIS VIRUS ACTIVATES THE TYPE I IFN RESPONSE AND UPREGULATES M1 MARKERS IN THP-1 MACROPHAGES

Vesicular stomatitis virus (VSV) is a promising oncolytic agent as it directly kills cancer cells and modulates immune elements of the tumor microenvironment (TME). We are interested in how VSV affects tumor-associated macrophages (TAMs). TAMs exhibit phenotypic plasticity and may interconvert along a spectrum of polarization states that includes the pro-cancer M2 and anti-cancer M1 subtypes. Our preliminary studies have shown that model M2 THP-1 macrophages are susceptible to infection with VSV, resulting in the upregulation of M1 markers. This study seeks to determine the magnitude of these phenotypic changes and to test the hypothesis that the type I interferon (IFN) antiviral response pathway is involved in this response to viral infection. M2-polarized THP-1 macrophages were infected with a wild type strain of VSV (rwt virus) or with a matrix (M) protein mutant strain (rM51R-M virus) that activates the antiviral response. Expression and activation of key factors in both the antiviral response and M1 polarizing pathways was monitored. rM51R-M virus, but not rwt virus, infection resulted in an increase in expression of type I IFN, STAT1, IRF5, CD80, and MHC-II in M2 polarized THP-1 macrophages. Our data indicate that the stimulation of the antiviral response in M2 macrophages by rM51R-M virus induces expression of M1-related genes, thus providing a means in which to modulate pro-cancer TAMs to an anti-cancer phenotype.

Katie Krogmeier, Biology, Graduate Student

Faculty Mentor: Howard Neufeld, Arts and Sciences

Co-Author(s): Erica Pauer

Title: Impacts of Polyploidy on the Ecophysiology of *Solidago altissima*

Polyploidy in plants could be an evolutionary dead end or lead to the creation of new species. Goldenrod (*Solidago altissima*) is a North American herbaceous perennial with diploid, tetraploid, and hexaploid populations: diploids (MWD) and tetraploids are restricted to the midwest while hexaploids occur in both the midwest (MWH) and east (EH). Polyploids have larger cells, which affect stomatal densities, size, plant morphology, gas exchange, and plant hydraulics. At the ASU greenhouse, a drought experiment was performed on plants using a split-pot design. Gas exchange measurements were made using a Li-6800 and water potentials (ψ) with a Scholander Pressure Chamber. Prior to drought, photosynthetic rates (A) were higher in MWH and MWD, and lowest in EH. As the experiment persisted through June and July, A and stomatal conductance (gs) declined in both treatments, but droughted plant rates dropped 7 days after cessation of watering and were significantly lower than those for watered plants. By the end of the experiment, cytotype differences for A and ψ were absent in both treatments. However, gs remained higher in MWH for watered plants, which also had the lowest water use

efficiency among cytotypes. Why diploids do not occur in the east and why MWH and EH differ are currently being investigated.

Savanna Sheridan, Biology, Graduate Student

Faculty Mentor: Mary Kinkel, Arts and Sciences

Co-Author(s): N/A

Title: CINNAMON STIMULATES SMOOTH MUSCLE CONTRACTIONS IN THE INTESTINES

Gastrointestinal tract illnesses impact roughly 20% of the United State population. While the severity of these illnesses has a wide range, they can interfere with people's day to day lives. To help developed treatments we first need an in-depth understanding of how the GI tract develops and how its function is controlled. Zebrafish are a model organism that share ~70% of their genes with humans and have similar but simplified GI tract to that of humans. They also have a transparent body wall when they are larvae which allows their intestinal contents to be tracked through time. The receptor TRPA1 is known to be present in the human GI tract, to which cinnamon oil is an agonist. Zebrafish have two paralogs to TRPA1: *trpa1a* and *trpa1b*. Both have been shown to be present in the central nervous system of zebrafish; however, they have not been looked at in the zebrafish GI tract. When given shrimp as a meal I have shown that intestinal transit time is decreased by the addition of cinnamon oil. By utilizing the nonabsorbable fluorescent dye, Nile Red, solely *trpa1a* receptors can be activated by the addition of cinnamon oil. Preliminary experiments indicate that the presence of cinnamon oil is sufficient to decrease intestinal transit time. Additional experiments need to be conducted in order to show that there are *trpa1a* receptors present within the gastrointestinal tract of zebrafish.

Hollyn Franklin, Biology, Graduate Student

Faculty Mentor: Mary Kinkel, Arts and Sciences

Co-Author(s): N/A

Title: A GUT FEELING: THE ROLE OF HORMONE RECEPTORS DURING AND AFTER DIGESTION

The goal of this study is to understand how the ghrelin receptor and motilin receptor regulate normal gut motility. Previous work suggests that the ghrelin receptor is activated before a meal to cause hunger, and during a meal to cause stomach emptying. After a meal, the motilin receptor is activated and causes sweeping movements that clear undigested debris from the gut. Many diseases involve delayed stomach emptying or insufficient gut clearing. Therefore, both receptors are being studied in order to develop improved treatments for intestinal diseases. In our studies, we are using zebrafish as a model for human gut motility disorders. We developed and tested an assay that allows us to observe gut movements and emptying in live fish. We found that emptying the intestine after a meal required 4 hours (hrs). By contrast, when fish were maintained at 20°C to slow metabolism, emptying the intestine was delayed and required 7 hrs. Treatment with MgSO₄ to speed up gut movements resulted in faster emptying, within 3 hrs. This is proof-of-principle that our assay can detect decreases and increases in gut motility. In ongoing experiments, we are using small molecule agonists and antagonists to target each receptor. This approach will allow us to demonstrate the roles of these receptors in a

genetically tractable vertebrate model. In future studies, we will build on this work to investigate disorders such as irritable bowel syndrome and chronic constipation.

Austin Simmons, Biology, Graduate Student

Faculty Mentor: Maryam Ahmed, Arts and Sciences

Co-Author(s): Darren Seals

Title: FUNCTIONAL ALTERATION OF A TUMOR-PROMOTING MACROPHAGE POPULATION BY VESICULAR STOMATITIS VIRUS

Macrophages are phagocytes with broad physiological roles within the tumor microenvironment. M1 macrophages exhibit an anti-cancer phenotype by phagocytosing cancer cells as well as presenting their antigens for recognition by the adaptive immune system. M2 macrophages, in contrast, promote tumor progression by phagocytosing the debris of wounded cancerous tissue and secreting factors that support tumor growth and invasion. We believe vesicular stomatitis virus (VSV) has promise as a cancer therapeutic by differentially impacting these macrophage phenotypes. Preliminary data shows that a recombinant wild type strain of VSV (rwt) kills up to 70% of model M2 THP-1 macrophages, while an immunostimulatory strain of VSV (rM51R-M) promotes the upregulation of M1 markers in this macrophage population. In addition, phagocytosis by M2 THP-1 macrophages decreased to that of M1 levels upon infection with both rwt and rM51R-M viruses (91% and 43% over mock infection, respectively). Neither rwt or rM51R-M viruses significantly altered the phagocytic capacity of M1 macrophages. Further studies will determine whether the functions of M1 or M2 macrophages are altered by VSV in the context of a simulated breast tumor microenvironment in which THP-1 macrophage subtypes will be co-cultured with T47D or MDA-MB-231 breast cancer cells. By elucidating how macrophage and cancer cell types respond to VSV, we can gain a greater understanding of the benefit of using VSV as an anti-cancer agent.

Sydney Bear, Biology, Graduate Student

Faculty Mentor: Suzanna Brauer, Arts and Sciences

Co-Author(s): Nathan Basiliko, Michael Carson, James Seward

Title: METHANOGEN COMMUNITY ANALYSIS OF PEATLANDS IN NORTH AMERICA

Peatlands are unique wetlands that play a role in the storage and release of atmospheric carbon in the form of carbon dioxide and methane gas. These peatland environments are estimated to account for one third of Earth's terrestrial carbon. Peatland soil contains communities of archaea, bacteria, and fungi that interact with each other through nutrient cycling and competition. The methanogenic archaea in these peatland communities create methane gas as a product of their metabolism. A community analysis of these methanogen groups in varying peatland environments will give insight into their interactions and how the changing environment will affect them. Extracted DNA from peat samples of 19 sites of varying latitudes in eastern North America was analyzed through Illumina amplicon sequencing of the *mcrA* gene, as well as 16S rRNA, to observe changes in methanogenic community assemblages in varying environments. These data may provide insight into the community make-up and interactions of methanogen communities in peatlands and are important to consider in the face of climate change.

Paul Manuel, Biology, Graduate Student

Faculty Mentor: Cort Bouldin, Arts and Sciences

Co-Author(s): N/A

Title: CHARACTERIZING THE EFFECT OF A PROLONGED G1 PHASE ON NEUROGENESIS

The cell cycle consists of a synthesis and a mitosis phase interspersed with two gap phases, which allow for cell growth and preparation prior to division. Recent studies have provided evidence that the phase of the cell cycle can influence characteristics of a cell such as a cell's ability to differentiate into multiple cell types, also known as potency. Evidence suggests that cells with a shorter gap 1 (G1) phase have higher potency. In this work, we utilize embryonic zebrafish as an in vivo model to study how the cell cycle can affect neurogenesis. To determine the influence of the cell cycle on neurogenesis in zebrafish embryos, we have used a transgenic zebrafish line that extends the G1 phase of the cell cycle, and investigated the expression of neural fate patterning transcription factors, *sox2* and *sox3*. To date, we have seen that there is a consistent decrease of staining in the developing brain for *sox3* indicating fewer neural progenitors, while there is evidence to suggest an increase of *sox2* expression in the spine. The decrease in the number of neural progenitors may be either fewer progenitors produced or hastened neurogenesis. To address this, we are in the process of quantifying the number of neurons in the developing spine, using immunofluorescence and confocal microscopy. We hope to identify a statistically significant difference in the number of neurons in transgenic embryos with an extended G1 phase when compared to non-transgenic siblings.

Dalton Sizemore, Biology, Graduate Student

Faculty Mentor: Darren Seals, Arts and Sciences

Co-Author(s): Megan Polzin, Maryam Ahmed

Title: The Effects of Vesicular Stomatitis Virus on Matrix Degradation by Macrophage Podosomes

Tumor-associated macrophages (TAMs) are essential in cancer development. Cancers promote migration of TAMs to tumors where they are commonly polarized to the M2 phenotype stimulating tumor growth and metastasis. Because TAMs form invasive structures called podosomes, it is hypothesized that disruption may contribute to therapeutic efficacy. We are interested in developing vesicular stomatitis virus (VSV) as an anti-cancer agent. VSV selectively kills cancer cells and stimulates the immune system to anti-tumor immunity. VSV modulation of TAM podosomes to disrupt invasion has not been tested. Entry and exit of VSV can impact podosome proteins, thus VSV may interfere with podosome development and function. Model THP-1 monocytes were polarized to pro-cancer M2 or pro-inflammatory M1 macrophage subsets and infected with a wild-type VSV (rwt) or an M protein mutant VSV (rM51R-M) with the ability to induce innate immunity. M1s were resistant to infection by both viruses while M2s succumbed to cytopathic effects of VSV. M2s exhibited more podosomes than M1s but were less effective at degrading matrix. Both viruses were effective at reducing the number of podosomes in M2s, correlating with a decrease in degradation ability. These data suggest another means by which VSV may control cancer cell growth and progression is via disruption of TAM podosomes. Current studies are aimed at confirming these data and determining the mechanisms by which VSV alters TAM podosome development.

Katherine Machen, Biology, Graduate Student

Faculty Mentor: Andrew Bellemer, Arts and Sciences

Co-Author(s): Katherine Hoffman

Title: NOCICEPTOR SENSITIVITY AND PLASTICITY IN DROSOPHILA LARVAE IS REGULATED BY TRANSLATION INITIATION FACTORS

Chronic pain is a billion-dollar issue and current treatments on the market are not always effective. To develop better treatments, the molecular mechanism behind chronic pain must be understood. My research explores changes in the sensitivity of sensory neurons. This can occur via changes in the initiation of protein translation that leads to increased sensitivity. One such mechanism is the phosphorylation of the mRNA cap-binding protein, eIF4E. When eIF4E is phosphorylated it increases mRNA translation. My goal is to establish if eIF4E is the translational control used in the sensitization of nociceptors via the hedgehog signaling pathway. I use the model organism *Drosophila melanogaster* and genetic tools to knockdown eIF4E in the multidendritic sensory neurons. These knockdown flies are then tested to quantify the changes in thermal nociception. Thermal testing sees a heated probe placed onto the side of larvae then the latency from initial contact to the execution of an escape behavior is recorded. I have targeted a transmembrane protein, patched (ptc), thought to be involved with the onset of hypersensitivity via the hedgehog signaling pathway. Overexpressing dominant negative patched results in a hypersensitive phenotype. In a second study, I targeted eIF4E. Knocking down eIF4E results in partial loss of nociception, suggesting that eIF4E is needed in basal thermal nociception. Next, I plan to determine if eIF4E is downstream of patched via epistasis experiments.

Rachel Milkereit, Biology, Undergraduate Student

Faculty Mentor: Matt Estep, Arts and Sciences

Co-Author(s): N/A

Title: SURVEY OF TSUGA CANADENSIS (CANADIAN HEMLOCK) FOR THE PRESENCE OF ADELGES TSUGAE (HEMLOCK WOOLLY ADELGID) ON THE TATER HILL PLANT PRESERVE

Invasive species, such as the *Adelges tsugae* (Hemlock Woolly Adelgid) have tremendous impacts on native plants. In order to protect populations of *Tsuga canadensis* (Canadian Hemlocks) randomized population plots will be established on the Tater Hill Plant Preserve to map and record observations on the presence of *Adelges tsugae*. Surveying stands for the presence of *Adelges tsugae* will inform the North Carolina Plant Conservation Program if use of biological control is needed for management of the invasive species' population. All trees within the plot will be measured for diameter at breast height (DBH), approximate height, canopy density, GPS coordinates, and severity of *Adelges tsugae*. This data will establish a base for future research and monitoring of hemlocks on the preserve.

Samuel Brewer, Biology, Undergraduate Student

Faculty Mentor: Matt Estep, Arts and Sciences

Co-Author(s): N/A

Title: Assessing the Health of Gray's Lily (*Lilium grayi*) Populations with Demographic Monitoring

Lilium grayi S. Watson, Gray's Lily, is a threatened perennial herb endemic to high elevations in the Southern Appalachians of Virginia, North Carolina, and Tennessee. *L. grayi* is an iconic species in the grassy bald plant community, and also grows in mesic forests and meadows. *L. grayi* faces multiple challenges, including disease caused by a fungal phytopathogen and loss of genetic diversity due to potential hybridization with sister species *L. canadense*. Lily Leaf Spot (LLS) disease results in early senescence of aboveground tissues, and often prevents individuals from reproducing successfully. Early season collapse resulting from LLS is evident at a large scale in the remaining populations of *L. grayi*, with differing severity in different environments. Demographic monitoring of *L. grayi* is necessary to fully understand how the disease is affecting populations. During the summer of 2019, nine 25m² plots were established in different plant communities at the Tater Hill Plant Preserve, Watauga County, North Carolina, to monitor flowering *L. grayi* individuals for reproductive success. Data was collected on plant size, severity of disease infection, shading strata, and reproductive output. The Tater Hill data was analyzed in concert with similar data collected from individuals at Grandfather Mountain, North Carolina. For all individuals, an average of 27% of flowers successfully produced fruit, compared to 33% at Tater Hill and 8% at Grandfather Mountain. When considering plant community, 63% of flowers in the grassy bald community produced fruit compared to 9% of flowers in forest communities. These results suggest that reproductive output is low for all members of the species, especially for individuals in communities with a closed canopy cover. Demographic monitoring will continue during the summers of 2020 and 2021 to collect additional data, in addition to sampling individuals to perform a survey of genetic diversity.

Zachary Vegso, Biology, Undergraduate Student

Faculty Mentor: Jon Davenport, Arts and Sciences

Co-Author(s): N/A

Title: A RE-EXAMINATION OF BODY SIZE REDUCTION IN PLETHODON YONAHLOSSEE POPULATIONS DUE TO CLIMATE CHANGE

Climate change is rapidly altering Earth's natural systems. Some organisms, such as amphibians, are particularly vulnerable to these detrimental effects. One documented response to climate change by some taxa is to reduce body size. Recent research has found evidence for reduction in body sizes of several salamander species from the genus *Plethodon*, including one of the largest species, *Plethodon yonahlossee*. However, the sample size for *P. yonahlossee* was small (n=36) relative to the other *Plethodon* species examined. Therefore, we re-examined the possibility of body size reductions in *P. yonahlossee* populations from North Carolina over time. We measured Snout-Vent Length (SVL) and head morphology of 203 specimens collected from 1979-2004 in North Carolina. We were also able to account for museum shrinkage when data was available. Contrary to previous research, we did not find evidence for declines in SVL over time. We did find significant differences in head morphology; however, site rather than time was significant. We also found original SVL measurements made at or near the time of preservation was significantly larger than measurements made in 2019, indicating museum shrinkage had taken place. Local climate data from the same collection period indicates no significant change in mean daily temperature or annual precipitation from this period. Our

results may therefore be the result of a lack of environmental pressure to change in body size for these populations.

Ali Montazeri, Biology, Undergraduate Student

Faculty Mentor: Jon Davenport, Arts and Sciences

Co-Author(s): Logan Suchniak, Robert P. Creed

Title: THE EFFECTS OF DETRITIVORES ON LEAF LITTER BREAKDOWN IN EXPERIMENTAL PONDS

Caddisfly larvae and crayfish can play a major role in stream food webs by having strong negative effects on leaf litter breakdown. However, less is known about their role in pond food webs and subsequent impacts on ecosystem function. To evaluate the effects of two common species inhabiting ponds in the NC mountains (the caddisfly *Platycentropus* spp. and the crayfish, *Cambarus bartonii*), we conducted a mesocosm experiment. We deployed four different food webs (1 large crayfish, 2 small crayfish, 11-15 caddisflies, or no detritivores) to determine the effects of these detritivores on a common leaf litter type (Oak) over 6 weeks. To standardize detritivore biomass, treatments had different densities. We found a marginally significant effect of detritivore treatment on leaf litter decomposition relative to leaf litter controls. Leaf litter biomass did decline through time but was dependent on detritivore identity. Specifically, the effects of two small crayfish caused the greatest decline by the conclusion of the experiment. Our results indicate that detritivores can have effects on pond leaf litter but that this effect may be limited based on species and body size. Future studies should expand and explore the greater range of conditions (detritivore densities, top predator presence, resource availability) that could explain the role of caddisflies and crayfish in pond food webs.

Haley Towne, Biology, Undergraduate Student

Faculty Mentor: Jon Davenport, Arts and Sciences

Co-Author(s): Katherine Sutcliffe, Kenzi Stemp, Thomas Anderson, Jacob Burkhart

Title: ADULT BREEDING PHENOLOGY POTENTIALLY INFORMS LARVAL COMPETITIVE ENVIRONMENTS OF TWO POND-BREEDING SALAMANDERS

Phenology, or the timing of life history events, can vary depending on seasonal abiotic variation and site-level differences. In amphibian communities, timing of breeding events and arrival order of species to breeding sites can indirectly influence larval competitive interactions and ultimately, whole pond community structure. To better understand the variability of arrival times and the indirect effect of this variation on larval community composition, we monitored breeding phenology and larval size of two fall-breeding salamander species, the Marbled Salamander (*Ambystoma opacum*) and the Ringed Salamander (*Ambystoma annulatum*) in central Missouri. We used drift fences to partially enclose approximately 50% of three wetlands. Each fence had an entry point with a wildlife trail camera mounted above. Cameras operated in the fall of 2017 and 2018. For larval densities and size, we surveyed the same three wetlands in the spring of 2018 and 2019 following camera deployment; mesh minnow traps were deployed for 2 trap nights, and all captured larvae were photographed. All photographed larvae were measured for snout-vent-length using ImageJ. In 2017, we captured images of 37 *A. opacum* and 139 *A. annulatum* migrating to or from wetlands, while in 2018 we captured images of 63 *A. opacum* and 46 *A. annulatum*. At two sites in fall 2018, more adult *A. opacum* than *A. annulatum* entered

each pond. At those same sites in spring 2019, *A. opacum* larvae were smaller than *A. annulatum* larvae, indicating intraspecific competition may have occurred. Additionally, we captured images of 17 other species of herpetofauna and 11 species of non-herpetofauna, suggesting that camera traps may be a useful and non-invasive tool for monitoring amphibian movement and predator presence at wetlands. Our results highlight the seasonal variation in amphibian communities, and the potential importance of competitive interactions within the larval stage.

Seth Drake, Biology, Undergraduate Student

Faculty Mentor: Jon Davenport, Arts and Sciences

Co-Author(s): Fishback, LeeAnn

Title: EFFECTS OF SEDIMENT ON THE FORAGING SUCCESS OF SUBARCTIC STICKLEBACKS: A PRELIMINARY STUDY

Little is known about factors influencing the feeding ecology of Stickleback fish (*Pungitius pungitius*, Ninespine stickleback; *Culaea inconstans*, Brook stickleback) within Subarctic wetland ecosystems. Habitat complexity has been hypothesized as one of the major influences on foraging success of fish. Therefore, we evaluated the effects of habitat complexity (either organic or sand sediment) on the feeding ecology of both species of sticklebacks. We conducted a short-term mesocosm experiment with both pelagic (copepods) and benthic (midge larvae) prey during September 2019. Based on field data, we hypothesized that Ninespine sticklebacks would have greater foraging success on both open water and benthic based prey relative to Brook sticklebacks, regardless of habitat complexity. We also hypothesized that benthic prey would have higher survival compared to pelagic prey with both fish species and this would be enhanced by organic sediments. Our experiments ran for 24 hours using 37.8 L tanks in which sediment type (either organic or sand sediment) was crossed with fish presence (Ninespine alone, Brook alone, or no fish predator). Midge larvae abundance was significantly affected by fish presence, but the strength of fish presence was reduced with the presence of organic sediment. Copepod and total prey abundance was only negatively affected by fish presence with no difference between the two stickleback species. It also appears that only the benthic prey species may benefit from different pond sediment types. Overall, our results indicate that both stickleback species can be voracious predators on aquatic invertebrates.

Chloe Dorin, Biology, Undergraduate Student

Faculty Mentor: Lynn Siefferman, Arts and Sciences

Co-Author(s): Michael Gangloff

Title: RELATIONSHIP BETWEEN A REPRODUCTIVE POLYMORPHISM IN THE SPOTTED SALAMANDER, *AMBYSTOMA MACULATUM*, ITS UNICELLULAR ALGAL SYMBIONT, *OOPHILA AMBLYSTOMATIS*, AND BREEDING POND PHYSICOCHEMISTRY

The spotted salamander, *Ambystoma maculatum*, exhibits a unique reproductive polymorphism wherein some females lay clear egg masses while others lay opaque masses. *A. maculatum* symbioses with a unicellular algae, *Oophila amblystomatis*, that lives intracellularly within the egg envelopes of *A. maculatum* and provides embryos with supplemental oxygen via photosynthesis. Clear and opaque egg masses often co-occur in breeding ponds, but proportions of egg mass types vary spatially. Our previous work shows that predators

preferentially consume clear egg masses so it is perplexing that they persist. Clear jelly may be an adaptation to low dissolved oxygen environments, possibly by allowing for higher light transmittance and thus increased photosynthesis by *O. amblystomatis*. Here, we investigate the relationship between jelly polymorphism, algae symbiosis, and dissolved oxygen through both observational and experimental designs. We sampled *A. maculatum* breeding sites for egg mass proportions, predators, and water physicochemicals. Additionally, we raised clear and opaque egg masses under two different light treatments, sampled embryonic respiration at two developmental stages, and quantified algal growth. Our study elucidates some heretofore unknown differences between the two mass types, such as differential algal growth, clutch sizes, and hatchling viability. Finally, our data suggest that dissolved oxygen may be one selective pressure responsible for maintaining this polymorphism.

Kristopher Gupton, Biology, Undergraduate Student

Faculty Mentor: Matt Estep, Arts and Sciences

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Title: BREEDING CBD-TYPE CANNABIS AS A CASH CROP IN WESTERN NORTH CAROLINA

The recent decline in tobacco sales and the increased costs of pest management associated with Christmas tree farming have left many smallholder farmers in Western North Carolina without a viable cash crop. As American attitudes towards industrial hemp (*Cannabis sativa*) change, an opportunity for a new cash crop in Western North Carolina is an exciting area of research. Some natural products of the Cannabis plant are compounds called cannabinoids. These compounds account for many of the reported medical and psychoactive effects of Cannabis and have been shown to have antiepileptic, neuroprotective, and antipsychotic qualities, among others. Plant breeders have developed a series of Cannabis varieties that increase the yield of CBD to ~20% of plant biomass. However, not all of these varieties comply with federal guidelines mandated with the signing of the US 2018 Farm Bill. In order to identify which varieties will yield the highest CBD content in Western NC and meet legal statutes, a comparative study has been conducted. Over the course of three years, eighteen varieties were cultivated in Caldwell County, NC. During this trial, cultivars were examined for species dominance (*C. sativa*, *indica*, and *ruderalis*), plant spacing, harvest yield, any unique adaptation, and cannabinoid percentages. Once identified, a hybridization program was developed to breed a cultivar specifically for local farmers. Following Mendelian inheritance principles, we have predicted a cultivar adapted to Western North Carolina's climate patterns, a 22:1 CBD/THC cannabinoid percentage, and multiple harvest per year. These foundational experiments are critical steps towards constructing a new economic engine for local small-scale farmers.

Hannah Vrooman, Biology, Undergraduate Student

Faculty Mentor: Ece Karatan, Arts and Sciences

Co-Author(s): N/A

Title: EFFECTS OF SPERMIDINE IMPORT AND BIOFILM FORMATION ON COLONIZATION EFFICACY OF *V. CHOLERAE* IN ZEBRAFISH INTESTINES

Vibrio cholerae is an aquatic bacterium that causes the disease cholera. *V. cholerae* forms biofilms in response to environmental cues. The expression of *Vibrio* polysaccharide (*vps*)

genes is required for biofilm formation. Biofilm formation is also highly regulated, and one regulatory system in *V. cholerae* is the PotABCD1 transport complex. This complex imports the polyamine spermidine, which impairs biofilm formation. Previous studies have shown that deletion of any component of the transporter leads to an increase in biofilm formation. *V. cholerae* must colonize the intestinal tract of its host. The purpose of this study was to investigate whether spermidine import impacts the efficacy of *V. cholerae* colonization in zebrafish intestines. I have compared the colonization efficacy of wild-type bacteria with the mutant strains $\Delta vpsA$, which is deficient in biofilm formation, $\Delta potC$, which is deficient in spermidine import, and $\Delta vpsA\Delta potC$, which is deficient in both processes to delineate the effects of spermidine import and biofilm formation on colonization efficacy in zebrafish. The results show that deletion of *potC* generates a trend towards disadvantage, deletion of *vpsA* leads to a competitive advantage and deletion of both produces competitive disadvantage. These results suggest that spermidine import is of more importance to *V. cholerae* colonization of zebrafish intestines than biofilm formation.

Kadra Ibrahim, Biology, Undergraduate Student

Faculty Mentor: Michael Opata, Arts and Sciences

Co-Author(s): Jennifer Pilotos

Title: MORINGA OLEIFERA PROMOTE ACTIVATION OF BOTH MACROPHAGES AND NATURAL KILLER CELLS DURING MALARIA INFECTION.

Malaria affects 198 million people world-wide, and caused about 445,000 deaths in 2016 alone. Vaccines against malaria is complicated by the fact that many malaria cases occur in resource limited regions where malnutrition is common. Furthermore, there is growing resistance to the available antimalarial drugs. Whereas many people use herbal medicine to treat malaria and other illnesses, not much is known on the effect of herbal medicines to immunity or malnutrition. In our current study, we investigated the effect of Moringa on the innate immune response to *Plasmodium chabaudi* infection in mice. Using a food restriction model to induce malnutrition, we gave a group of mice 4 hours access to standard mouse chow, and another group with 4 hours access to standard chow, and 20 hours access to moringa, while the control group had 24 hours access to normal mouse chow. We found that the number of macrophages (CD11b+/F480+), were higher when moringa was supplemented in the malnourished mice. These cells also produced more inflammatory cytokines (TNF and IFN-). The numbers of natural killer (NK) cells (CD49b+) were also increased, accompanied by increased expansion and functionality upon moringa supplementation as measured by CD25 and perforin. Taken together our results indicate that Moringa enhances innate immunity in malnourished mice during a malaria infection. Future studies will investigate if the phagocytic and cytotoxic cells are high during the peak of the infection.

Luke Bennett, Biology, Undergraduate Student

Faculty Mentor: Jennifer Geib, Arts and Sciences

Co-Author(s): Paul Super

Title: BLUE RIDGE PARKWAY FLOWER FLY (SYRPHIDAE) INVENTORY

Flies of the family Syrphidae (a.k.a. hover flies or flower flies) may be second only to native bees as important pollinators of native plants. There are over 6,300 described species in this

family world-wide and about 300 species that are possible along the Blue Ridge Parkway. This family includes small to fairly large flies, many of whom are excellent mimics of bumblebees, yellow jackets, honeybees, and wasps, though some look more like small house flies. In addition to adult flower flies pollinating flowers, some flower fly larvae help decompose logs or improve water quality in ponds and wetlands; some even feed on common plants pests such as aphids, mites, and mealybugs. Despite their importance there has been limited Syrphidae fly inventories conducted, leaving questions about their relative abundance and species diversity. Members of Dr. Jennifer Geib's bee laboratory have processed and preserved all non-bee species collected the past two summers in way packs filled with ethanol. My project involved revisiting the non-bee way packs and searching for Syrphidae flies. Using the Field Guide to the Flower Flies of Northeastern North America and a compounds microscope I was able to identify different species belonging to the Syrphidae family. All Syrphidae flies found in the way packs were washed, pinned, and separated by location collected on the parkway. Starting in the spring season of 2020 surveys will be conducted of areas on the parkway thought to have high hover fly diversity. Surveys on the parkway will involve traveling to target habitats and setting imitation flower traps to collect Syrphidae flies. The collected hover flies will be washed, processed, and identified down to their species in the lab to further develop an understanding of hover fly diversity and abundance on the Blue Ridge Parkway.

Kabryn Mattison, Biology, Undergraduate Student

Faculty Mentor: Jon Davenport, Arts and Sciences

Co-Author(s): Blake R. Hossack, LeeAnn Fishback, Kelly L. Smalling, Collin A. Eagles-Smith

Title: A PRELIMINARY ASSESSMENT OF HG AND MEHG BIOACCUMULATION IN SUBARCTIC WETLAND FOOD WEBS

Northern latitudes are warming at a rate twice that of the global average. This warming is melting permafrost in many areas, causing the release of stored mercury (Hg) which can become methylated into neurotoxic methyl-mercury (MeHg). Release of mercury into Arctic and Subarctic ecosystems suggests the possibility of bioaccumulation up the food web to humans. To date, there are limited records of Hg accumulation in the Subarctic region. To investigate potential mercury bioaccumulation of MeHg in the Subarctic, we collected sediment and animal tissues from wetland ecosystems of the Hudson Bay lowlands near Churchill, Manitoba and analyzed them for MeHg and total Hg (THg). We collected tissue samples from Wood frog (*Rana sylvatica*) embryos and larvae, Boreal Chorus frog (*Pseudacris maculata*) larvae, and Stickleback fish (*Pungitius pungitius* & *Culaea inconstans*). We hypothesized that MeHg would be present in all species, but in higher concentrations at higher trophic levels. We found that MeHg in Wood frog larvae was strongly correlated with MeHg of Boreal chorus frog larvae in the same wetlands. Both species of stickleback fish had the highest levels of MeHg. The highest two values of MeHg in tadpole tissues were from two thermokarst (i.e. melting permafrost) wetlands. Additional samples were taken in summer 2019 to test additional habitat types and expand our samples. Our study is the first to measure baseline levels of Hg in amphibians in the subarctic, so future research can build upon our foundational data to track changes in Hg through time.

Erica Pauer, Biology, Undergraduate Student

Faculty Mentor: Howard Neufeld, Arts and Sciences

Co-Author(s): Katie R. Krogmeier

Title: AN ANALYSIS OF VESSEL ELEMENTS AND THEORETICAL HYDRAULIC CONDUCTIVITY OF SOLIDAGO ALTISSIMA STEMS

The hydraulic conductivity (Kh) of a plant depends on the diameter distribution of vessels, porosity and density of pit pores in the sidewalls, vessel length, and number of vessels in the stem. The Haagen-Poiseuille Law (HPL) states that volumetric flow-rate through a circular vessel is proportional to the fourth power of vessel radii, meaning a small increase in radius yields large increases in flow. The research reported herein was part of a physiological study on three cytotypes of goldenrods that includes eastern (EH) and midwestern (MH) hexaploids and midwestern (MD) diploids. Since polyploids often have larger cells than diploids, we undertook a study to determine whether theoretical Kh would be higher in the hexaploids. Stem cross sections were taken from 5 individuals/cytotype, 1m above their base. To assess vessel size, we measured the major and minor axes and area of 50 vessels within a single ray/plant, and % vessel area within a randomly chosen 0.04 mm² area. We used a modified form of HPL that adjusted flow for elliptically shaped cells, since most xylem cells were noncircular. We summed all 50 cells to obtain a stem Kh for each cytotype. Kh was highest in EH (8.85x10⁻⁹ m³/s), followed by MH (4.72x10⁻⁹ m³/s) and MD (4.45x10⁻⁹ m³/s). Very large vessels in EH, some 2x the area of the largest vessels in MH and DH, contributed greatly to the high EH flowrate. We plan to conduct further studies to elucidate the relationships between polyploidy, Kh and gas exchange.

Regina Javier, Biology, Undergraduate Student

Faculty Mentor: Howard Neufeld, Arts and Sciences

Co-Author(s): Alexander Gustafson

Title: EFFECT OF LIGHT AND LEAF AGE ON THE PIGMENT COMPOSITION AND GAS EXCHANGE CHARACTERISTICS OF CROTON PETRA, A SHRUB WITH MULTI-COLORED LEAVES

Croton petra is an ornamental shrub native to Indonesia, Malaysia, Australia, the Western Pacific Ocean islands and India which displays various colors on its leaves. We characterized the progression and pattern of color change from young to old leaves on Croton petra plants. Young leaves are typically yellow, containing little chlorophyll. As leaves age, they produce more chlorophyll, carotenoids, and anthocyanins. Leaves transition from yellow, to green, orange, red, and finally a deep purple. The variations in the colors of Croton petra suggest that as leaves age, they become sensitive to high light and leaf pigments protects leaves from high light stress. We measured photosynthesis at saturating light in leaves of varying colors using the Li-6800 gas exchange system. Rates were negative in the youngest, red leaves (-0.2 μmol m⁻² s⁻¹), and increased for dark green leaves with yellow veins (0.6 μmol m⁻² s⁻¹) to dark green leaves with red veins (2.1 μmol m⁻² s⁻¹). Rates of stomatal conductance paralleled those for photosynthesis. To determine how light intensity affects pigment, plants will be grown under varying light conditions of full sun and 50%. Rates of photosynthesis and pigment levels will be determined for young and old leaves for plants in each of these treatments. Light and CO₂

response curves will be done to determine how age responses to these parameters. We will test our light stress hypothesis by exposing leaves to high light and measuring Fv/Fm.

Alexis Lynn, Biology, Undergraduate Student

Faculty Mentor: Andrew Bellemer, Arts and Sciences

Co-Author(s): N/A

Title: THE ROLES OF RNA-BINDING PROTEINS, ELAV AND FIN, IN DROSOPHILA NOICEPTION

Chronic pain affects millions of Americans and those affected often have reduced abilities to function. It is important to understand the molecular mechanisms of chronic pain so that better treatments can be developed. *Drosophila melanogaster*, the common fruit fly, is a model organism for studying nociception, the nervous system's process of detecting noxious stimuli. This is because fly larvae exhibit rolling behavior in response to noxious stimuli that can be quantified and its easy to manipulate the genome. My major goal is to understand how RNA-binding proteins regulate nociception as previous studies have demonstrated that RNA-binding protein regulate the form and function of larval sensory neurons. I am studying embryonic lethal abnormal vision (*elav*) and found in neurons (*FIN*) which are RNA-binding proteins that are important for the proper development and maintenance of neurons. In one set of experiments, I reduced the function of these genes to see if the noxious thermal sensitivity of *Drosophila* larvae was changed. I used a thermal probe to measure the response time of larvae, with different response times suggesting a change in sensitivity. Currently, the results show that altering the function of *elav* does not have a significant impact on nociception, but I will extend this using larvae in which *FIN* function has been manipulated. In a second set of experiments, I am using bioinformatics to scan nociceptor-enriched genes for the *elav* protein binding site.

Mills Kamryn, Biology, Undergraduate Student

Faculty Mentor: Mark Venable, Arts and Sciences

Co-Author(s): N/A

Title: Inhibition of Secreted Phospholipase A2 by a Blood Lipid Extract

Research has found that a particular blood lipid extract displays inhibitory activity against the venom of pit viper snakes which normally causes extensive tissue damage in mammals. The venom contains various proteases as well as a secretory phospholipase (sPLA2) that cause the destruction of cells leading to myotoxicity, hemolysis and necrosis. The blood lipid extract has been found to inhibit the Group IIa PLA2 from the Eastern Diamondback rattlesnake. Humans also have a Group IIa phospholipase that is very similar in structure to the one contained in the snake venom. The GIIa human PLA2 enzyme is a secreted/extracellular phospholipase that plays a role in the body's inflammatory response to tissue damage and infectious diseases. Discovering a new GIIa inhibitor may lead to a new treatment for pit viper snake bite as well as some inflammatory diseases.

Christian Brown, Biology, Undergraduate Student

Faculty Mentor: Jennifer Geib, Arts and Sciences

Co-Author(s): N/A

Title: MODELING POPULATION DYNAMICS AND MANAGEMENT OF AN INVASIVE JAPANESE BARBERRY POPULATION IN THE SOUTHERN APPALACHIAN MOUNTAINS

Through transportation by humans, plant species are able to travel once impossibly far distances in a short period of time. These species can establish themselves in foreign environments and may become detrimental to the native species or to crops cultivated by humans. *Berberis thunbergii*, is one such plant which disrupts the ecology of native ecosystems in the United States. The aim of this project was to create an ecological stage-based model which can aid in elucidating the ideal method of elimination for an invasive population of Japanese barberry. Using data found in the literature, I created a Lefkovich matrix model in order to predict the growth rate of a Japanese barberry population located in ASU's nature preserve. Elasticity analyses were used on this model which yielded the proportional contribution of each life stage to the growth of the population. I found that 3 stages had the greatest influence on the growth of the population. I simulated four management method by altering values in the original stage-based matrix model. The first three simulations targeted each of three stages individually and the fourth combined all three of the alterations made in the previous simulations. Only the simulation which targeted all three influential life-stages of the Japanese barberry population produced a negative growth rate for the population. These results can be used to inform management strategies aimed at eliminating the invasive Japanese barberry population.

Breana Cook, Biology, Undergraduate Student

Faculty Mentor: Jennifer Geib, Arts and Sciences

Co-Author(s): Drew Milavec, Sierra Harwood

Title: Species Inventory and Monitoring of Pollinators Along the Blue Ridge Parkway

Pollinators are needed to sustain ecosystems and are significant environmental servicers. Recent studies provide evidence of declines and range contractions among some species sparking the need to inventory native species for future conservation work. The Blue Ridge Parkway Pollinator Project aims to inventory native pollinators, particularly bee species, along the roadway throughout North Carolina and Virginia. Sixty inventory sites along 469 miles of roadway were managed by teams comprised of Appalachian State students (15 sites) or Citizen Scientists (45 sites). Specimens at each site were collected every other week from April through mid-October 2019, using passive glycol traps and optional netting surveys. This inventory is the most extensive of its kind in Southern Appalachians. Preliminary processing of specimens indicates a diverse array of native species; non-native *Apis mellifera* are also abundant in most areas. We expect to see location-specific species as well as generalists who can be found throughout the parkway. Data from the project will allow mapping of species distributions and abundances, population genetic studies, identification of species of interest and/or concern for conservation targets, and educational outreach.

Joel Smith, Biology, Undergraduate Student

Faculty Mentor: Cara Fiore, Arts and Sciences

Co-Author(s): Christina Strobel, Nile Crump, Taylor Strobe,

Title: FRESHWATER SPONGE IDENTIFICATION

Freshwater sponges are sessile, filter feeding animals that inhabit a variety of freshwater systems including streams, lakes, rivers and ponds globally. Many species are endemic and specifically adapted to their geographic region. One of the goals in our lab has been to identify sponge species native to the Southern Appalachian Mountains. We have obtained numerous sponge samples from two main river systems in the region: New River and Jacob's Fork. Due to the lack of distinguishable morphological features, taxonomy for sponges is based upon the morphology and arrangement of the skeletal make up, specifically spicules. With the use of Sulfuric Acid, we were able to dissolve the sponge tissue and isolate the spicules. Under a stereomicroscope, we were able to visualize and separate individual spicules into two categories: megascleres and microscleres. Length measurements of the two types of spicules were obtained for further species identification. In addition to morphological analysis, we further supported our findings with a molecular analysis. DNA extractions and PCR to amplify a taxonomic gene (28S rRNA gene) were performed on each sample, followed by DNA sequencing. We identified several species within two main genera (Ephydatia and Eunapius) as common inhabitants of the two stream systems sampled. In the future, we plan to continue sampling sponges from regional rivers and develop a sponge identification key for Southeastern United States species.

Clay Langfeldt, Biology, Undergraduate Student

Faculty Mentor: Mark Venable, Arts and Sciences

Co-Author(s): Dalton Sizemore, Dr. Darren Seals

Title: ANALYSIS OF A BLOOD LIPID EXTRACT EFFECTS ON INHIBITION OF PLA2

Today the only treatment for snakes' venom is an antivenin produced from the serum of animals subjected to the venom. This process is not only costly but limited. One of the main components of snake venom is phospholipase A2 which is responsible for venom-induced cellular membrane degradation in tissues. It was observed that a blood serum lipid extract can be used to inhibit the functions of the PLA2. The hypothesis is now to test if this inhibition of the PLA2 can be observed in vitro. Experiments are done using THP-1 cells. The cells are first treated with the PLA2 until enough cell damage is observed. Other cells are treated with the blood serum lipid extract followed by the PLA2. The cells are then compared in a ratio of live vs dead as well as the morphology of the cells is noted. The hope is that the lipid extract will be able to slow or stop the inhibition of the PLA2.

Vanessa Gremler, Biology, Undergraduate Student

Faculty Mentor: Annkatrin Rose, Arts and Sciences

Co-Author(s): N/A

Title: ISOLATION OF ENDOPHYTES FROM SHINING CLUBMOSS (HUPERZIA LUCIDULA)

The objective of this research is to isolate and characterize endophytic fungi found in Shining Clubmoss (*Huperzia lucidula*), a plant that depends on fungal symbionts to complete its life cycle. Endophytes are fungi or bacteria that live symbiotically within healthy plant tissue. In contrast to pathogens, the presence of endophytes is harmless or even beneficial to the plant. In this project, endophytes were isolated from surface-sterilized shoot tips, stems, and roots placed on fungal growth medium (potato dextrose agar- PDA) to encourage them to grow out of the plant tissue onto the medium. Endophytic fungi were further isolated by transferring samples

from initial plates with a mixture of strains to individual PDA plates. This process was repeated until each plate contained only one strain of endophytic fungus, resulting in over 50 strains being cultured and isolated from *H. lucidula* plant tissue. These were characterized by their morphology, growth rates, and antimicrobial properties. The results from this project provide insight into the symbionts associated with *H. lucidula* and a first step towards identifying which endophytes the plant requires. Some endophytes of related plants are capable of producing secondary metabolites that are of special interest to medicinal research. Therefore, we will further analyze our isolated endophytic fungi for metabolite content and specific enzyme inhibition properties to characterize their medicinal potential in future experiments.

John Holladay, Biology, Undergraduate Student

Faculty Mentor: Jon Davenport, Arts and Sciences

Co-Author(s): Justus Hargett, Susan L. Cragg, Kenzi Stemp, Katy M. Sutcliffe, Zack T. Vegso, Joshua R. Ennen, Kristen K. Cecala

Title: SEINING FOR STREAM SALAMANDERS: SEASON AND SITE MATTERS BUT NOT TIME OF DAY

Sampling for salamanders in streams can be challenging as different techniques can lead to biased estimates of populations. One type of stream sampling that has been underutilized for assessing salamander abundance is kick-seine sampling. Currently it is unknown if kick seining is a viable method for estimating salamander abundance and salamander body condition. Therefore, we conducted a study to investigate how stream salamander abundance and body condition changed across seasons and during the time of sampling (day versus night) using kick seining. We sampled six streams in western North Carolina every three months over a 12-month period in 2019-2020. Each stream had a 10-m stretch that was sampled during diurnal and nocturnal sessions on the same day. We found that salamander abundance significantly differed by site but not by time of day and season. Salamander body condition varied also by site and season but not time of day. Our study indicates that kick-seine sampling is a viable technique to estimate stream salamander abundance. It also suggests that kick-seining sampling yields similar abundance estimates regardless of the time of day but that seasonal variation does exist. Overall, future work should consider comparisons of kick seining to other stream salamander sampling techniques.

Catherine Anderson, Biology, Undergraduate Student

Faculty Mentor: Steve Seagle, Arts and Sciences

Co-Author(s): N/A

Title: CONSERVATION PLANNING IN THE PIEDMONT OF NORTH CAROLINA: CONNECTIVITY AMONG LARGE REGIONAL NATURE PRESERVES AND COUNTY PRESERVES IN MECKLENBURG COUNTY

Biodiversity conservation requires maintaining habitat connectivity among nature preserves. However, nature preserves vary in ownership (national, state, county, etc.), size and surrounding land use change that can negatively impact connectivity. This project examines connectivity of small nature preserves in Mecklenburg County, NC, with large regional state/federal preserves. Specifically, we examine the impact of urban expansion in the Charlotte/Mecklenburg metro area as it impacts connectivity for forest-dwelling species between

2001 and 2016. South Mountain State Park, Uwharrie National Forest and Sumter National Forest are large federal/state preserves that triangulate nine small preserves in Mecklenburg County. Circuitscape software and least cost path analyses were used to model the impact of land use change on connectivity of the regional preserves with the smaller county reserves. Connectivity of the three regional preserves was conserved from 2001 to 2016, though least cost paths changed considerably and did not include any of the Mecklenburg preserves. Least cost paths from larger preserves to the smaller preserves contracted from 2001 to 2016 due to urban sprawl in the Charlotte metro region, with multiple pinch points being identifiable and representing priority areas for conservation of connectivity. These results can inform regional planning for urban and suburban growth that can maintain connectivity and preserve biodiversity of forest species.

Ethan Tobin, Biology, Undergraduate Student

Faculty Mentor: Cortney Bouldin, Arts and Sciences

Co-Author(s): Joey Manuel

Title: STRESSED OUT: COMPARING TWO SOURCES OF STRESS AND THEIR EFFECTS ON EMBRYONIC ZEBRAFISH

Cells induce protective pathways in response to physiological stress. Heat stress results in misfolded proteins, triggering the heat stress response and a transient cell cycle arrest to allow time for the cell to respond. Osmotic stress causes cells to change cell volume and restore intracellular ion homeostasis. Embryonic tissue would be expected to be particularly sensitive to physiological stress, yet less is known about how embryonic tissues respond to physiological stress. Zebrafish are fecund, external fertilizers whose environments can be readily manipulated during embryonic development. This study aims to leverage the advantages of embryonic zebrafish to compare the response to heat stress and osmotic stress. In other systems, these stressors have been shown to trigger protein kinase cascades to mitigate detrimental effects on protein folding. In zebrafish, heat stress and osmotic stress have been observed to induce delayed defects in somite formation, suggesting a failure of the cellular stress response during embryonic development. Because of an immediate connection between physiological stress and the cell cycle in other systems, we are working on identifying changes to the expression of two cell cycle regulatory factors, *cdc25b* and *ccnd1*, after stress in zebrafish. Following heat shock, *cdc25* expression changes, but *ccnd1* expression does not. We are currently exploring changes to *cdc25* and *ccnd1* following osmotic shock.

David Reyes, Biology, Undergraduate Student

Faculty Mentor: Matt Estep, Arts and Sciences

Co-Author(s): N/A

Title: VIRTUAL TOUR OF THE TATER HILL PLANT PRESERVE

This project is aimed at incorporating the practice of media production in the field of biology as a potentially viable method to benefit the conservation of ecosystems with significant value. The objective of this project was to capture aerial and ground footage of the Tater Hill Plant Preserve, located in Watauga County, North Carolina (NC). With the goal of providing the public with visual access to this protected location, highlighting the important indigenous flora. Footage recorded for the film was captured with the use of an unmanned aerial vehicle (UAV) and a

DSLR camera. Adobe Premiere was the editing software used to compile the footage to create the final product. The film will hopefully be used as a tool to teach audiences about conservation practices and why they should take an interest in the preservation of this ecosystem and its inhabitants.

Liliana Rangel-Parra, Biology, Undergraduate Student

Faculty Mentor: Howard Neufeld, Arts and Sciences

Co-Author(s): Megan E. Buzard, Hannah N. Houston, Howard S. Neufeld

Title: ENVIRONMENTAL CHALLENGES FACING A BROADLEAF EVERGREEN ANGIOSPERM IN WINTER

Evergreen plants in the southern Appalachian Mountains endure great ecophysiological challenges during the winter. Most evergreen winter ecophysiology research focuses on conifers, with a lack of research in broadleaved angiosperms; leaf morphology differences may influence winter coping strategies. In addition, we are unsure of ecophysiological effects from warmer winter temperatures correlated to climate change. We are investigating the winter ecophysiology of the holly, *Ilex x 'Nellie R. Stevens,'* a broadleaved evergreen angiosperm. We are measuring diurnal gas exchange, water potential, chlorophyll fluorescence, and leaf, soil, and air temperatures throughout winter. We found positive photosynthetic rates coupled with low transpiration at air temperatures slightly below or at 0°C and soil and leaf temperatures slightly above 0°C. Chlorophyll fluorescence measurements indicate substantial photoinhibition under high light at low temperatures, but can achieve high gas exchange rates on subsequent warmer days. Although rates are higher on warm winter days, cold soils may constrain the degree to which this species can take advantage of these days, due to an inability to transport water. Under sunny, winter conditions, low transpiration may reduce latent heat loss to better cope with photoinhibition. This research can improve our understanding of how other broadleaved angiosperms may respond to natural as well as anthropogenically-influenced seasonal trends.

Isaac Ogden, Biology, Undergraduate Student

Faculty Mentor: Michael Opata, Arts and Sciences

Co-Author(s): Noah Murr

Title: MALNUTRITION LEADS TO DEFICIT IN INNATE IMMUNE RESPONSE DURING MALARIA INFECTION

Malaria is a parasitic infection endemic to southeast Asia, sub-Saharan Africa, and South America. According to UNICEF, in 2017 malaria infections resulted in 435,000 deaths, the majority of which were concentrated in sub-Saharan Africa. Malnutrition is a complicating factor in the fight against malaria, as malnutrition is common in these regions as well. Malnutrition is known to reduce lymphocytes and increase macrophage susceptibility to apoptosis, thus depressing immunity to malaria. However, whether this effect is beneficial or not remains unclear. In our study, we hypothesized that malnutrition would depress macrophage and dendritic cell populations, hamper their activation, and reduce secretion of important inflammatory cytokines (IFN γ and TNF α). We observed that well-nourished mice infected with *Plasmodium chabaudi* had a lower percentage of macrophages compared to malnourished infected mice, but a higher percentage of activated macrophages compared to malnourished

infected mice. Well-nourished mice had higher numbers of activated macrophages, followed by malnourished mice following infection. There was no difference in dendritic cell numbers in all groups. Interestingly, malnourished infected mice had higher numbers of IFN γ - and TNF α -producing macrophages. This may indicate that malnutrition during a malaria infection depresses immune function while promoting inflammation.

CHEMISTRY AND FERMENTATION SCIENCES

Tom Williams, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Brett Taubman, Arts and Sciences

Co-Author(s): N/A

Title: Bypassing the Malting Process with Koji

Barley is an important ingredient in the production of beer and other grained-based beverages, contributing fermentable sugars, flavor, and aroma. For barley to be of use in the brewing process, enzymes that break down starches in grain must be accessible in order to develop a medium that yeast can ferment. These enzymes are activated via the malting process, which takes between 9-11 days, and consumes up to 1,140 gallons of water and 800kWh of energy on an industrial scale. *Aspergillus oryzae* is a filamentous fungi used in the production of many Asian foods and beverages where it is used to saccharify a host of substrates. In addition to enzyme production, it yields unique flavors and aromas not found in traditional malted barley. The goal of this research was to determine if *A. oryzae*, commonly referred to as Koji, can be used on unmalted barley to bypass the malting process and produce fermented beverages comparable to those that use malted barley. This research also set out to quantify and characterize the organoleptic and sensory characteristics in a beverage produced using Koji barley. It was predicted that Koji barley would produce an appreciable level of enzyme activity as well as a host of sensory characteristics. To test this, pearled barley was inoculated with different strains of *A. oryzae* and saccharified using a mash test to determine its yield of enzymes and soluble sugars in beer wort. This wort was fermented with standard brewer's yeast and its attenuation and ethanol content were quantified. The presence of organic acids in the fermented wort were then quantified using HPLC. Finally, a sensory analysis was conducted to characterize its flavors and aromas. The results supported the prediction and demonstrated new potential applications for Koji barley in the brewing industry.

Tyler Harris, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Brooke Christian, Arts and Sciences

Co-Author(s): Aaron Hall

Title: INCREASED SOD2 EXPRESSION AFFECTS OXPHOS COMPLEXES IN HIGH FAT DIET-INDUCED NAFLD

Reactive oxygen species (ROS), such as superoxide, are produced as byproducts of cellular respiration. Natural antioxidant enzymes such as superoxide dismutase II (SOD2 or Mn-SOD) degrade these byproducts into molecules that can be more easily removed from the cell, such as hydrogen peroxide. Increased genetic expression of SOD2 provides cells and mice with a higher capacity to detoxify ROS and could prove beneficial in physiological scenarios of

oxidative stress. Increased ROS production is a characteristic of high fat diet (HFD)-induced non-alcoholic fatty liver disease (NAFLD) and obesity. In NAFLD, cells produce ROS faster than they can break them down and remove them, causing damage to proteins, nucleotides, and lipids, which results in oxidative stress. Our preliminary research shows that upregulation of SOD2 in mice may disrupt the stability of OXPHOS complexes, leading to decreased activity compared to mice with normal SOD2 expression. In this experiment, mice that overexpress SOD2 were challenged with an HFD to induce NAFLD. OXPHOS enzyme activity assays were then completed on the HFD challenged mice to determine whether extra antioxidant capacity alleviates phenotypes of NAFLD-induced oxidative stress. By comparing these results to those of wild type mice, the effects of SOD2 overexpression during increased oxidative stress can be determined.

Zachary Reynolds, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Aruna Weerasinghe, Arts and Sciences

Co-Author(s): Yajie Cai, Coryn Gilmer, Anna Rich, Dale E. Wheeler, Jefferson E. Bates, Aruna Weerasinghe

Title: Investigating the importance of binding pocket size for nerve gas binding to rhodamine-B derivatives

Nerve gas agents are colorless, odorless toxic compounds. Detection of these compounds at low concentrations is very important. Here, we have synthesized four rhodamine-B derivatives with varying sizes of binding pockets to study the mechanistic aspect of nerve gas binding with rhodamine-B based sensor molecules. Rhodamine-B derivatives are good candidates for chemosensors due to their high quantum yield and high molar extinction coefficients. The equilibrium between the non-fluorescent colorless form and the highly fluorescent pink form of rhodamine-B derivatives provides a better model for the development of turn-on sensors for various analytes. The binding of nerve gas mimics (diethyl chlorophosphate, dimethyl methylphosphonate and demeton-S) with these sensors was studied using UV-Vis, fluorescence and ¹H NMR spectroscopic techniques. All rhodamine derivatives except the compound without amine group in the binding pocket, bind selectively with diethyl chlorophosphate. This observation confirms the importance of an amine group in the binding site. The binding of diethyl chlorophosphate caused the appearance of a new absorbance band at 555 nm confirming the formation of ring open form of rhodamine-B derivatives. Analyte binding was also studied using ¹H NMR to identify products. Computational studies on binding between the sensors and diethyl chlorophosphate also confirmed the importance of amine in the binding site.

Julio Derteano, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Jefferson Bates, Arts and Sciences

Co-Author(s): N/A

Title: EXPLORING ELECTRON CORRELATION THROUGH TWO ELECTRON MODELS

The interactions between electrons greatly influences the chemistry around us, from bond formation and 3D structure to thermodynamics and kinetics. Instead of studying electrons in real atoms and molecules where exact results are difficult to obtain, we propose to use a small model of electrons confined in a spherical potential to investigate the interactions between

electrons. Rather than solve the Schrodinger equation exactly for this model, two approximate methods will be used to tackle this problem: Hartree-Fock and a truncated coupled cluster approximation, CCSD. Our model system contains two electrons and is analogous to the helium atom where two electrons are attracted to the nucleus. In order to tackle this problem, Mathematica was used to construct a basis of one-electron orbitals analogous to the s, p, d, and f orbitals of the hydrogen atom. Maximum principal and angular quantum numbers were chosen to determine the basis set and all available orbitals up to the specified maxima were included. The kinetic energy is then calculated and added to the potential energy due to electron repulsion to form an approximate Hamiltonian. This data was then imported into PySCF to evaluate the Hartree Fock and CCSD energies for the chosen basis set. Literature values for Hartree Fock from a previous study have been used to determine our method's validity. The goal of the project is to investigate the convergence of CCSD with respect to increasing angular momentum. These results will yield insight for developing new approximate electronic structure methods in future work.

Maria Santiago, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Lauren Wood, Arts and Sciences

Co-Author(s): Allie Orgnon

Title: TASTE THE RAINBOW

Many fluorescent compounds can be found in nature and in the kitchen. Turmeric, a widely used cooking spice, and riboflavin (vitamin B2), which exists in food such as eggs and spinach, exhibit fluorescent properties. This project aims to quantify fluorescence efficiency by calculating their quantum yield (QY). A spectrophotometer was used to determine the absorbance and maximum wavelength, λ_{max} , and a fluorometer was used to measure the fluorescence excitation and emission spectra to calculate the quantum yields. Coumarin 153 was used for the reference standard, which has a known quantum yield value of 0.546 in ethanol, a relatively high QY. At this wavelength, the QY for B2 was 0.292 (s= 0.008, n=3), which was in agreement of the literature value (0.300). Turmeric was found to have a QY of 0.079 (0.003, n=3), but does not agree within standard deviation of the literature value of 0.063, however due to difference in experimental technique, the value was deemed reasonable. These results suggest that B2 fluoresces more efficiently than turmeric. Future goals of this project aim to measure the QY of common products/consumables with relatively unknown fluorescent properties, such as beets or olive oil, in hopes of developing a database for easily obtainable fluorescent dyes. The procedure and database will be used to develop a physical chemistry lab experiment that explores the theory of fluorescence through a hands-on and engaging project.

Caroline Donaghy, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Megan Culpepper, Arts and Sciences

Co-Author(s): Lucian Murray, Brooke Hester

Title: The Use of Fluorescence Spectroscopy to Study a Two Component Monooxygenase Enzyme

This proposed research plan studies a two-component monooxygenase enzyme that plays a role in combating global warming. Two-component monooxygenases are a family of enzymes comprised of a flavin reductase B subunit and a flavin dependent monooxygenase A subunit.

The enzyme of interest is dimethyl sulfide (DMS) monooxygenase and is comprised of subunits, DmoB and DmoA. Fluorescence spectroscopy was used to study both the dissociation constant (K_d) and stoichiometry of FMN binding to DmoB, and to probe possible protein: protein interactions between the DmoB and DmoA subunits. FMN is an intrinsic molecular probe that has maximum excitation and emission wavelengths at 450nm and 540nm, respectively. By exploiting the fluorescent properties of FMN, we are able to conduct our studies. The first study utilizes fluorescence emission to elucidate FMN binding to the DmoB flavin reductase, by fluorescence quenching to yield the stoichiometry and K_d . The next technique utilizes fluorescence anisotropy to investigate potential protein: protein interactions between the DmoB and DmoA subunits. Fluorescence anisotropy determines the degree of motion of the fluorescing molecule through unproportioned intensities along the different axes of polarized light. By labeling DmoB with an extrinsic molecular probe, Alexa 488, we can theorize the interaction with DmoA through the demobilization of the labeled DmoB as seen through the perturbation in anisotropy values. In the future, Förster Resonance Energy Transfer (FRET) will also be used to investigate possible interactions. FRET can describe the distance between the two subunits when both are labeled with two different extrinsic molecular probes representing a donor and acceptor. Utilizing fluorescence techniques such as fluorescence emission, fluorescence anisotropy, and Förster Resonance Energy Transfer will further characterize the DMS monooxygenase involved in climate regulation by unraveling its chemical mechanism of action.

Jordan Reisterer, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Duygu Ercan Oruc, Arts and Sciences

Co-Author(s): Samuel Jones, Alexander Adams

Title: APPLICATION OF PHOTO-IRRADIATED PHENOLIC ACIDS AS AN ANTIBACTERIAL SYSTEM DURING WINE PRODUCTION

One of the main safety concerns in wine is the presence of biogenic amines, which can cause the formation of carcinogenic nitrosamines. Therefore, strategies to control biogenic amine producer microorganisms is needed in wine industry. Wine industry commonly uses SO_2 as an antimicrobial additive, but it has been shown that SO_2 can cause negative health effects, such as bronchospasm, bradycardia, gastrointestinal symptoms. This study aimed to apply photosensitized materials as an alternative antibacterial system during wine production. It has been found that grape juice itself with UV-A treatment did not cause any decrease in the population of biogenic amine producer *Lactobacillus hilgardii* ($p > 0.005$). Then, grape juice was supplemented with different concentrations of gallic acid (0.25 mM-25 mM) was treated with UV-A (0-60 min). It has been found that 6 log (CFU/ml) reduction in the population of *L. hilgardii* in grape juice was achieved with minimum 5 mM gallic supplementation and 30 min UV-A treatment. Furthermore, it was found that UV-A irradiated gallic acid treatment did not affect the yeast growth ($p > 0.05$). Finally, wine production trials with gallic acid supplemented and UV-A treated grape juice were performed and compared with the wine produced with SO_2 . A successful demonstration of photo-irradiated phenolic acids can offer new opportunities for the wine industry to introduce new antibacterial approach with Generally recognized as safe antimicrobial compounds.

Alexander Adams, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Duygu Ercan Oruc, Arts and Sciences

Co-Author(s): Samuel Jones, Jordan Reisterer, Gigi Kakouras

Title: ENHANCED HUMAN LYSOZYME PRODUCTION FROM ACID WHEY BY KLUYVEROMYCES LACTIS K7

Acid whey is a byproduct from the production of fermented dairy products, such as Greek yogurt and sour cream. The sharp increase in consumption of Greek-style yogurt in recent years has challenged dairy producers in terms of what to do with large volume of acid whey as the waste. Acid whey contains far less lactose than sweet whey and has therefore been mostly overlooked in terms of concentrating or utilizing its nutrients for secondary use. This study aimed to utilize acid whey for the production of value-added product, human lysozyme, which has many applications as antimicrobial compound in food and pharmaceutical industries. In the first phase of the study, the effect of sterilization process on human lysozyme production by *Kluyveromyces lactis* K7 was evaluated. No significant difference has been found in the production of human lysozyme in sterile acid whey (69.88 U/ml) and non-sterile acid whey (71.25 U/ml) ($p > 0.005$). Then, to find the optimum combination of nutrient supplementation need to maximize the human lysozyme production, three factors Box-Behnken design was used and different concentrations of lactose (0-13 % w/v), yeast nitrogen base (0-1.5 % w/v), and casamino acid supplementation (0-1.5 % w/v) were tested. Because acid whey can be economical fermentation medium, the results of this study could be used for the development of the large-scale production of human lysozyme by using acid whey from fermented dairy products.

Samuel Jones, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Duygu Ercan Oruc, Arts and Sciences

Co-Author(s): Jordan Reisterer

Title: UTILIZATION OF WASTES OF WINE INDUSTRIES FOR THE PRODUCTION OF HUMAN LYSOZYME BY FED-BATCH FERMENTATION

Lysozyme is an enzyme which degrades the bacterial cell wall of mostly Gram-positive bacteria. Because of its antimicrobial property, lysozyme has been of interest in medicine, cosmetics, and food industries. For all of these purposes, egg-white lysozyme has been commonly used, but it poses immunological problems when applied to humans. *Kluyveromyces lactis* K7 is an organism that expresses human lysozyme. *Kluyveromyces lactis* K7's biomass amount is significantly affected by glucose concentration in fermentation medium, and lactose is needed as an inducer for human lysozyme production. Grape juice waste can be utilized as a carbon source provider after mild acid heat (0.5 M H₂SO₄ and 1 h 121 °C) and enzyme treatment to increase the biomass amount for human lysozyme production. About 18–20% of the grapes remain as waste from the wine making process and is considered to have limited economic value. Therefore, utilization of grape juice wastes as an alternative fermentation medium can decrease the production cost of human lysozyme. In this study, the basic considerations for the design of large-scale bioreactors were outlined for the production of human lysozyme using *Kluyveromyces lactis* K7 from grape waste in a fed-batch mode. The amount of raw material need, the fermentation tank volume, the required sterilization time, and the power requirement for agitation of bioreactors were calculated for a plant to produce about 15 tons of human lysozyme per year which is about 1% of the total demand.

Samuel Guy, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Libby Puckett, Arts and Sciences

Co-Author(s): N/A

Title: THE DEVELOPMENT OF SENSING SYSTEMS TO MEASURE THE HYDROLYSIS OF B-LACTAM ANTIBIOTICS

β -lactam antibiotics, or penicillins, are a common and effective class of antibiotic, however, with antibiotic resistance on the rise, they are becoming less effective. This is due to the bacterial expression of β -lactamase, an enzyme that catalyzes the cleavage of the β -lactam ring, thereby instilling the bacteria's antibiotic resistance properties. The goal of this project is to create a sensing system that can monitor the hydrolysis of β -lactam antibiotics utilizing a fusion protein of β -lactamase and enhanced green fluorescent protein (EGFP). When the β -lactam ring is cleaved, a proton is released, decreasing the local pH. EGFP is a pH-sensitive fluorescent protein that will be used as the reporter protein to monitor the catalysis of the β -lactam ring. In the assay, the EGFP domain of the fusion protein responds to the drop in local pH resulting from the β -lactam hydrolysis, which leads to a decrease in monitored fluorescence over time. Currently, the two genes are being isolated and expressed individually to validate the local pH theory, and an in vivo fusion protein of β -lactamase and EGFP is being created with the end goal of creating a whole-cell based system for measuring the bioavailability of new β -lactam antibiotics.

Sarah Bober, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Megan Culpepper, Arts and Sciences

Co-Author(s): N/A

Title: EXPRESSION, PURIFICATION, AND CRYSTALLIZATION OF A SINGLE SUBUNIT OF DIMETHYLSULFIDE MONOOXYGENASE, ISOLATED FROM ARTHROBACTER GLOBIFORMIS BACTERIA

Dimethylsulfide (DMS) is a compound formed through sulfur cycling that greatly impacts our atmosphere. Biotic species like eukaryotic and prokaryotic organisms along with anthropogenic activity, contribute to the breakdown of this volatile organosulfide compound. This catabolism ultimately decreases the amount of DMS available to reduce climate change effects. Dimethylsulfide monooxygenases (DMSO's), which have been identified in various bacterial species, are two-subunit enzymes that readily oxidize DMS into methanethiol and formaldehyde. *Arthrobacter globiformis* is a putative DMSO. In order to reduce the effects of these biological enzymes, it is imperative to understand the 3-dimensional structures of the enzymatic subunits and how they interact with their FMNH₂ and NADH cofactors. The structure of the DmoA subunit of *A. globiformis* has not yet been finalized. A series of experiments were performed to transform, express, purify, and crystallize this protein of interest. Preliminary crystallization utilizing x-ray crystallography methods resulted in protein diffraction at $< 3 \text{ \AA}$ and 3.15 \AA , suggesting that protein was present in the crystals. Further crystal optimization is necessary to obtain higher resolution, and co-enzymatic crystal assays will be performed to indicate if multiple elements precipitate together into one lattice.

Gabriel Ramirez, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Jennifer Cecile, Arts and Sciences

Co-Author(s): Abigail Paul, Loly Amaya, and Nick Mencis

Title: PHYSIOLOGICALLY RELEVANT WHOLE ORGANISM MODEL FOR XENOBIOTIC TRANSPORT

Drug transporters assist with drug and xenobiotic absorption, distribution, and excretion by moving charged molecules across cell membranes. Solute carrier drug transporters (organic cation transporters (OCTs), organic anion transporters (OATs)) and ATP binding cassette transporters (ABC transporters, p-glycoprotein (p-gp), multidrug resistance protein (mrp)) are types of transporters important for this process in mammals. The non-mammalian *Caenorhabditis elegans* (*C. elegans*) nematode may serve as a model to study mammalian drug transporters as it contains drug transporters with protein sequences similar to mammalian transporters. The *C. elegans* model is advantageous over other known models as drug transporter function may be observed under conditions with physiological gradients and regulation mechanisms. In these experiments, we utilize fluorescent dyes that are known substrates of the OAT and ABC transporters in *C. elegans* and characterize accumulation of the dye in the nematode by fluorescence microscopy or by quantification of dye in the nematode or efflux buffer by fluorescence assays. Results suggest dye accumulation occurs primarily in the nematode intestine. Furthermore, the dye may be inhibited with non-fluorescent substrates or may be stimulated with the dicarboxylate fumarate. Additional characterization of the efflux steps is ongoing.

Scott Hammers, Chemistry and Fermentation Sciences, Undergraduate Student

Faculty Mentor: Megen Culpepper, Arts and Sciences

Co-Author(s): N/A

Title: CHARACTERIZATION OF AN OXIDOREDUCTASE SUBUNIT FROM *A. GLOBIFORMIS*

Climate change is a looming threat to the world in many aspects. It is a threat to biodiversity and human societies alike and needs to be quickly addressed to mitigate any potential damage. To this end, cloud seeding has been proposed as a way to reduce the effects of global warming by increasing cloud cover, which would reflect more sunlight reduce the amount of energy which reaches the Earth's surface. Methanethiol has been shown to have promise as a cloud seed and is produced by organisms that break down dimethyl sulfide (DMS) via the enzyme DMS monooxygenase. Unfortunately, the overwhelming majority of bacteria which are capable of breaking down DMS are found in the marine environment, which makes large scale cultivation of them challenging. The exception is the one known soil bacterium *Hyphomicrobium sulfonivorans*, which has been studied extensively and was discovered to be able to break down DMS via the DMS monooxygenase enzyme. A relative of *H. sulfonivorans* which has been less studied is *Arthrobacter globiformis*, and genetic sequence alignments show it could be capable of breaking down DMS as well. To begin the process of characterizing this potential DMS monooxygenase, the preferred substrate of the oxidoreductase subunit found on the same genetic operon as the monooxygenase subunit was determined by finding the substrates with the lowest K_m (NADH at $18 \pm 4.8 \mu\text{M}$ and FMN at $3.5 \pm 1.0 \mu\text{M}$), the highest V_{max} (NADH at 207 ± 18 units/mg, FMN at 180 ± 24 units/mg), and the highest catalytic efficiency (NADH at $211/\text{min} \cdot \mu\text{M}$, FMN at $942/\text{min} \cdot \mu\text{M}$).

COMPUTER SCIENCE

Alisha Sprinkle, Computer Science, Graduate Student

Faculty Mentor: Jay Fenwick, Arts and Sciences

Co-Author(s): N/A

Title: CLASS VIBE: HELPING TEACHERS TRACK STUDENT EMOTIONS

Project Class Vibe is an Angular Web Application implementing a recently viral posterboard strategy employed by teachers nationwide to assess the emotional well being of school children. Project Class Vibe enables students to convey their emotional state with their teacher via a local device such as a tablet. The application invites students to quickly and easily select an image that best describes how they are feeling. Teachers are provided with a dashboard that allows them to discover which students are experiencing negative feelings and can then subtly check in with those students. In addition, the dashboard will provide an average class vibe and a class vibe over time. Using this information teachers can create lessons tailored to the feeling of the classroom and help students understand the feelings they are experiencing. Project Class Vibe hopes to encourage social emotional learning, increase emotional safety, and simply let students know we care.

Tyler Tripp, Computer Science, Undergraduate Student

Faculty Mentor: Abdelbaset Hamza, Arts and Sciences

Co-Author(s): Rahman Tashakkori, Benjamin Underwood

Title: LOW-COST UFSOOK-BASED OPTICAL CAMERA COMMUNICATIONS LINK FOR IOT APPLICATIONS

Internet-of-Things (IoT) solutions require a large number of low-power devices being connected to the internet. Most existing wireless IoT solutions rely on radio frequency (RF) technologies for communication. The RF spectrum is becoming more congested and limited by interference. This motivated researchers to explore new technologies operating at different bands of the spectrum, one of which is the Optical Wireless Communication (OWC) technology. In OWC, a light beam from a laser diode (LD) or a Light Emitting Diode (LED) is modulated and transmitted in the free-space. One of the subfields of OWC technologies is Optical Camera Communication (OCC), in which a camera is used as a receiver to detect the modulated light. The bitrate of an OCC link depends on the frame rate of the receiving camera, and thus any low-cost OCC link will be limited in bitrate. A low bitrate OCC link can be useful for applications in which sensors periodically post lightweight data. In this paper, we develop a low-cost OCC link for energy-constrained IoT devices. We utilize the Undersampled Frequency Shift On-Off Keying (UFSOOK) modulation scheme to modulate a 40 mA LED transmitter used to transmit continuously sensed temperature and humidity data using MQTT to be posted on a dashboard. The performance of the OCC link was comparable to its WiFi counterpart over five days of deployment at the entrance of a lab with research students frequently interrupting the LOS link.

ENGLISH

Georgia Privott, English, Undergraduate Student

Faculty Mentor: Bethany Mannon, Arts and Sciences

Co-Author(s): n/a

Title: MIND AND SPIRIT

Mind and Spirit asks how religious backgrounds, specifically participation in Christian communities, inform student experiences in college writing. We explored this connection by interviewing fifty App State students from varying Christian backgrounds. Interviewees reflected on their experiences with reading, writing, and debate in religious contexts and considered how those practices informed their communication and critical thinking in first-year writing. These interviews demonstrated that students' faith backgrounds have direct and indirect effects on their academic writing. Skills used in writing classes--such as debate, research, rhetorical awareness, and self-reflection--correlate with faith practices. In particular, students gained experience with effective communication through sermons, bible studies, community support, and group leadership. This research contributes to the field of writing pedagogy and religious rhetoric by analyzing how students integrate their religious experiences into their academic work. Previous scholars have argued that conservative Christian students resist or struggle with secular academic discourse, but we find that students gain rhetorical skills in faith communities. By understanding this, professors are able to see the transfer of knowledge by students from religious backgrounds. Beyond the academic realm, this research gives important insight into growing trends among young Christians and changes in North American religious culture.

GEOGRAPHY AND PLANNING

Stella Harden, Geography and Planning, Graduate Student

Faculty Mentor: Maggie Sugg, Arts and Sciences

Co-Author(s): Dr. Jennifer Runkle, North Carolina State University

Title: A SPATIOTEMPORAL ANALYSIS OF SEVERE MATERNAL MORBIDITY IN SOUTH CAROLINA

Severe Maternal Morbidity (SMM) is defined as serious negative outcomes a woman might experience during child delivery and can vary from severe anesthesia complications to cardiac arrest. To date, there is little research that evaluates geographic patterns of SMM and how underlying social determinants alter a woman's likelihood of SMM. The objective of this study is to examine the spatiotemporal distribution of SMM across South Carolina and the potential associations between sociodemographic factors and SMM occurrence. Hospitalized delivery records from 1999 to 2017 were provided by the South Carolina Department of Health and Environmental Control and coded as SMM based on diagnostic codes. Mapping and Kulldorff's SpatialScan statistic were used to identify geographic variability and locations with abnormally high rates of SMM. The strength of the relationship between SMM and underlying variables was statistically assessed and determined across the study area. Preliminary results support the argument that sociodemographic characteristics impact an individual's risk of SMM. Results from this project can inform future targeted public health interventions to prevent SMM among at-risk locations and sub-populations.

Tatiana Magee, Geography and Planning, Graduate Student

Faculty Mentor: Derek Martin, Arts and Sciences

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Title: SPATIAL VARIABILITY OF SOIL ORGANIC CARBON IN VALLEY BOTTOM LANDFORMS OF THE NINGAR RIVER, ECUADORIAN ANDES

Andean páramos are high elevation grassland ecosystems found largely within the tropical Andes and provide critical biodiversity, water supply, and carbon storage environmental services. Páramo soils exhibit high water retention and slow decomposition rates that promote high levels of soil organic carbon (SOC) storage. SOC in high elevation areas (>1700 m) have been found to be more sensitive to climate and prone to shifts as the climate changes. While SOC storage in upland páramos has been widely investigated, the objective of this study is to investigate SOC storage in valley bottom landforms of the páramo because a previous case study estimated that bank erosion was potentially responsible for exporting nearly 487 tons of sediment annually, potentially serving as a significant carbon flux component in páramo ecosystems. Fieldwork for this study occurred along the upper Ningar River (> 3,300 m) in the Ecuadorian Andes during the month of January 2020 and involved the collection of 151 soil cores taken from floodplains, terraces, and alluvial fans. Although currently on-going, sample analysis will provide SOC content that will be compiled and compared between landforms to provide an estimate of 1) total SOC storage in páramo valley bottoms, 2) landform-specific storage, and 3) the amount of SOC available for export through erosion. Ultimately, this data will help us continue to piece together the carbon cycle in this unique, and critically important, carbon-rich ecosystem.

Ben Capell, Geography and Planning, Graduate Student

Faculty Mentor: Maggie Sugg, Arts and Sciences

Co-Author(s): Dennis Gilfillan

Title: CLIMATE VULNERABILITY OF RURAL POPULATIONS IN WESTERN NORTH CAROLINA

Climate change impacts will amplify the underlying social vulnerability of rural populations. Rural communities have unique socioeconomic traits due to their dependence on natural resources. The induced stress of natural hazards resulting from climate change such as extreme weather and flood inundation is concerning for rural economies. Natural resource dependence is evident in rural economies reliant on agriculture, resource extraction, and recreation tourism. Socioeconomic disparities unique to rural populations include: a lack of diverse industries; physical and social isolation; low educational attainment; limited internet access; and high poverty rates. This study will assess the vulnerability of rural populations in the southern Appalachian Mountains of western North Carolina (WNC). A multivariate analysis of physical hazards and socioeconomic factors will address exposure, sensitivity, and adaptive capacity, and quantify this vulnerability at the sub-county level. An index value for each community will identify specific areas of high vulnerability and limited resilience to climatic extremes. Results from climate data modeling show that the WNC Mountains will experience greater surface water accumulation than the Coast or Piedmont. Moreover, results highlight significant heterogeneity in underlying vulnerability among rural residents in WNC and the need for targeted interventions to mitigate the adverse effects of extreme weather events.

Alex O'Neill, Geography and Planning, Graduate Student

Faculty Mentor: Baker Perry, Arts and Sciences

Co-Author(s): N/A

Title: SYNOPTIC CLASSIFICATION OF HEAVY PRECIPITATION EVENTS IN THE KHUMBU HIMAL, NEPAL

The Himalayan Mountains are on the frontlines of climate change as one of the most environmentally sensitive regions of the planet. As the climate becomes less stable, increasing mountain hazards such as landslides, avalanches, and glacial outburst floods threaten the existence of entire mountain communities and their populations. The early warning of these events stands the chance to save many lives. The objectives of this poster are twofold: 1) the creation of a synoptic classification of weather patterns based on recent weather station data and 2) the validation of ERA5 climate reanalysis data against weather station. The EarthPulse weather station network used for this analysis, established during the summer 2019 National Geographic field campaign to the Everest region, provided a high-resolution dataset of weather variables. The lack of long-term record made the classification of weather events inaccurate, and ERA5 data was used in the place of station data. The ERA5 data were validated against station records using Bland-Altman tests for bias correction. Insight into the synoptic classifications of precipitation patterns was made, however these results were not deemed significant due to the lack of data. The ERA5 data are successfully corrected and future research will use this to extend the climate record of this data-sparse region.

Heather Dulaney, Geography and Planning, Graduate Student

Faculty Mentor: Baker Perry, Arts and Sciences

Co-Author(s): N/A

Title: CHARACTERISTICS OF THE 2015-16 STRONG EL NIÑO EVENT ON THE QUELCCAYA ICE CAP, PERU

The Quelccaya Ice Cap in the tropical high Andes of Peru is the world's largest tropical glacier and has lost substantial area in recent decades. With increasing global temperatures due to climate change, this glacier is expected to disappear by the end of the 21st century. An increase in the frequency and/or intensity of El Niño could further accelerate glacier ablation. This poster compares the 2015-2016 strong El Niño with a five-year climatology from a meteorological station located near the summit. Annual seasonal and monthly patterns of temperature, relative humidity, and precipitation were analyzed using the Mann-Whitney Test and a sample T-test. The above tests showed statistically significant differences in temperature and relative humidity, but no change in precipitation for the 2015-16 summer season and November 2015 month. The 2015-16 austral winter (JJA) showed statistically significant differences in temperature and precipitation, but no change in relative humidity. This poster verifies that temperatures overall do change in this region during the 2015-2016 El Niño event, with seasonal variation in precipitation and relative humidity.

Sarah Woolard, Geography and Planning, Undergraduate Student

Faculty Mentor: Maggie Sugg, Arts and Sciences

Co-Author(s): Jennifer Runkle

Title: A MULTI-SCALE ANALYSIS OF SPATIAL AND TEMPORAL SUICIDE PATTERNS IN NORTH CAROLINA, 2000 TO 2017

Suicide is a leading cause of death among Americans with rates increasing in nearly every state from 1999 to 2017. Yet, very little is known about the spatial pattern of suicide and the relationship between social, environmental, and/or economic factors, especially in rural areas. This study identifies geographic locations and temporal trends of suicide in North Carolina at the census block group level, a small spatial scale rarely considered in suicide mapping studies. We found statistically significant clustering throughout the state of North Carolina with the largest suicide clusters found in the western region, a rural location in the Appalachian mountains with high rates of poverty, low educational attainment, and high gun ownership. Demographically, we found that suicide was more likely to occur in clusters among adolescents (under age 25) than other age groups. Identifying communities of high suicide rates and clustering could assist public health officials to target areas for the development of appropriate prevention and reduction strategies.

Jessica Mitchell, Geography and Planning, Undergraduate Student

Faculty Mentor: Maggie Sugg, Arts and Sciences

Co-Author(s): Lauren Andersen, Dr. Elizabeth Shay

Title: A SPATIAL ANALYSIS OF SOCIAL DETERMINANTS OF HEALTH IN NORTH CAROLINA

Social Determinants of Health (SDOH) are multi-faceted factors in the social environment, such as economic stability, educational attainment, and access to services, that contribute to or detract from the health of individuals and communities. Analyses of SDOH can help focus efforts to improve community health, as well as enhance understanding of the differential vulnerability to environmental hazards. The objective of the study is to map and analyze the spatial distribution of SDOH across North Carolina at a sub-county level. To assess SDOH, approximately 100 variables were collected from multiple sources, including the American Community Survey (ACS), North Carolina Center for Geographic Information and Analysis, and Homeland Infrastructure Foundation-Level Data (HIFLD). A principal components analysis (PCA) was used to address multicollinearity among variables and aggregate data into components. Geographic Information System (GIS) based methods were used to examine heterogeneity and identify locations that require targeted public health interventions to address underlying health disparities. The expected results of the study indicate that SDOH varied significantly across the state, with less resilient populations clustered in the western and eastern portions of the state and more resilient populations located in the Piedmont.

Topics: Medical Geography, GIS, Spatial Analysis

Keywords: Social Determinants of Health, GIS, Spatial Analysis, Differential Vulnerability, PCA

Taylor Lundquist, Geography and Planning, Undergraduate Student

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Co-Author(s): Lauren Andersen

Title: Forced Migration into Sweden and the Netherlands: Climate Change, Border Policy, and Politics

According to the European Union, a forced migrant is a person subject to a migratory movement in which an element of coercion exists, including threats to life and livelihood, whether arising from natural or man-made causes. The acceptance of refugees, internally displaced persons, and victims of natural or environmental disasters has sparked heated debate across the world, particularly over the past decade. As a result, many individuals identify as asylum-seekers, or those who have not been granted refugee status. In Sweden and the Netherlands, the highest number of asylum-seekers originate from countries such as Syria, Iraq, Iran, Georgia, Eritrea, and Afghanistan. In 2018, over half of these asylum applicants were rejected from Sweden (65%) and the Netherlands (66.1%). According to data from the Asylum Information Database (AIDA), the rejection rates in these countries have significantly increased since 2016 and are projected to continue increasing in the future. This is expected as a growing number of people are forced to migrate due to persecution, war, violence, and climate change. Through literature review and mapping, this study provides an analysis of the high asylum rejection rates in Sweden and the Netherlands with the objective of better understanding the complex drivers behind them.

GEOLOGICAL AND ENVIRONMENTAL SCIENCES

Allison Dombrowski, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Sarah Carmichael, Arts and Sciences

Co-Author(s): Peter Königshof, Sersmaa Gonchigdori, Johnny A. Waters, Will Waters, Ariuna Yarinpil, Olivia C. Paschall

Title: EXPRESSIONS OF LATE DEVONIAN BIOEVENTS IN THE CAO B - NEW DATA FROM THE SAMNUURUUL FORMATION, SOUTHWESTERN MONGOLIA

The Late Devonian (359-383 Ma) Samnuuruul Formation in southwestern Mongolia (Gobi-Altai region) is a part of the Central Asian Orogenic Belt (CAOB). At the Hushoot Shiveetiin Gol site, a 167-meter-thick stratigraphic section spans the Famennian through early Carboniferous and is expected to preserve the Hangenberg ocean anoxia event and the associated extinction at the Devonian-Carboniferous boundary. Nearly all of what is known of the Late Devonian mass extinction and ocean anoxia events comes from restricted marine basins and shallow continental seas in Europe and North America; there is almost nothing known about the expression of these anoxia events in open ocean, island arc environments (such as sites in the CAOB). The Hushoot Shiveetiin Gol site represents a neritic paleoenvironment subject to frequent volcanic activity with numerous ash layers. Geochemical and mineralogical analyses of the volcanic ash samples support a volcanic island arc origin with some continental arc affinities. Ash mineralogy includes quartz, albite, biotite, and magnetite with minor weathering products including kaolinite and montmorillonite. The geochemical composition of the volcanic ashes change across the section with age, from calc-alkaline at the base of the section and approaching tholeiitic at the top. Late Devonian sections within the CAOB form an essential contribution to understanding how organisms in isolated, open ocean environments survive mass extinctions and marine oxygen loss.

Virginia Brown, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Sarah Carmichael, Arts and Sciences

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Title: EBSD AND TRACE ELEMENT ANALYSIS OF REPLACEMENT DOLOMITE IN THE LATEMAR PLATFORM

The Latemar carbonate platform in northern Italy contains bodies of replacement dolomite that have been altered via the infiltration of seawater mixed with hydrothermal fluids. These fluids travelled upwards and horizontally through the platform along fractures and bedding planes, and their flow path is documented by replacement dolomite containing significant amounts of Fe, Mn, and Zn. These zones of replacement dolomite are surrounded by unreacted limestone and the region has remained un-metamorphosed, allowing for detailed analysis of the replacement process. Although replacement dolomitization has long been studied on the regional or outcrop scale, it is still not well understood on the scale of individual crystals. Herein we investigate how trace element content in replacement dolomite is reflected in the zoning and the crystallographic orientation of the individual dolomite crystals. Scanning electron microscopy (SEM) with electron backscatter diffraction (EBSD) and energy dispersive X-ray spectrometry (EDS) was used to identify crystallographic orientation patterns and trace element distribution within replacement dolomite samples across a single outcrop. Analyses reflect a variety of intensities of fluid-rock reactions and are classified as heavy, moderate, minimal, and unreacted. Elevated Fe, Mn, and Zn in replacement dolomite resulted in a less ordered distribution of orientations in a sample, illustrated by weak pole figure patterns. This implies that the dolomite samples from areas with the heaviest fluid-rock reactions have a deformed chemical structure which has affected the replacement dolomitization process, creating an irregular spread of crystal orientations. These results will be compared with stable isotope signatures at the outcrop scale to refine existing heat flow models and time-integrated fluid flux estimates of dolomitization with the Latemar carbonate buildup.

Callia Cortese, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Jamie Levine, Arts and Sciences

Co-Author(s): Arthur Merschat, Griffin A. Moyer, Scott A. MacLennan, Michael P. Eddy, Anthony Love and Gabriele Casale

Title: FIELD, TEXTURAL, AND GEOCHEMICAL OBSERVATIONS FROM RHYOLITES ALONG THE CONTACT BETWEEN THE MOUNT ROGERS AND KONNAROCK FORMATIONS, SOUTHWEST VIRGINIA

Geologic mapping in the Blue Ridge of southwest Virginia (VA) led to recognition of several small bodies of rhyolite near the contact between the Mount Rogers and Konnarock Formations northeast of Troutdale, VA. Two rhyolite bodies mapped within the Konnarock Formation are informally named the Jerry Creek and Ripshin Creek rhyolites; their field relationships contain pivotal constraints on the age of the Konnarock Formation. This study compares textural, compositional, and geochemical data from the rhyolites to better understand the relationship with the surrounding Konnarock Formation. Porphyritic and flow banded rhyolite from the Jerry Creek and Ripshin Creek rhyolite bodies were collected to examine textures and mineral compositions with the scanning electron microscopy (SEM) equipped with energy dispersive x-ray spectroscopy (EDS). The Jerry Creek rhyolite contains lapilli and fiamme surrounded by iron-oxide minerals, phenocrysts of embayed quartz and perthitic potassium-feldspar in a matrix

of sericite, quartz, and albite, with trace amounts of magnetite, allanite, and zircon. The Ripshin Creek flow banded rhyolite contains phenocrysts of embayed quartz and perthitic potassium-feldspar in a matrix of sericite, quartz, and albite, with accessory to trace amounts of magnetite, rutile, ilmenite, zircon, chlorite, and titanite. Flow banding in the Ripshin Creek rhyolite is defined by alternating millimeter-scale, maroon and light gray flow bands that dip steeply to moderately northwest. The rhyolite overlies laminite and rhythmite beds containing dropstones in the Konnarock Formation and flow banding in the rhyolite is locally subparallel to bedding. . The Ripshin rhyolite bodies have a TIMS zircon U-Pb age determined to be ~751 Ma. This age, and the field relationship between the rhyolite and the Konnarock Formation, suggest that the base of the Konnarock Formation and onset of glaciation is ~751 Ma.

Carly Maas, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: William Anderson, Arts and Sciences

Co-Author(s): Emily R. Fedders

Title: ON THE USE OF CONSTRUCTED WETLANDS TO MITIGATE ROAD-SALT CONTAMINATION IN URBAN STREAMS

Road salt contamination is a chronic and acute water-quality issue for streams in cold, urban environments. The resulting gradients temporarily create losing streams, driving road salt into the aquifer. Multiple salt/meltwater events add salt to the aquifer, but baseflow conditions and summer storms prevent the salt from leaving the aquifer. There are few methods to reduce salt contamination of streams. One method is to construct wetlands at the end of stormwater systems. The impetus for this idea was a wetland that formed in a concrete culvert adjacent to Boone Creek in Boone, North Carolina. We noted decreasing salinity levels along its length and a near-constant discharge salinity at the seepage face. Saline water undergoes natural solute transport processes that delays breakthrough of saline water while also reducing peak salinities arriving at the stream. We used this wetland as inspiration to study a hypothetical watershed in which various percentages of stormwater culverts are modified with similar wetlands. Here, we quantify the effects that these types of wetlands would have on the timing and peak concentrations resulting from road salt contamination using analytical and numerical models. We then combine these output data with a simple mixing model to assess stream salinities under various conditions. The addition of wetlands at the outlets of stormwater culverts can lag the timing of peak concentrations by up to 30 days and reduce peak salinity concentrations from 20 to 60 percent on non-mitigated watersheds. Our findings indicate that the construction of these types of wetlands in urban environments would improve water quality by reducing acute and chronic chloride contamination.

Kathleen Duckett, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Sarah Carmichael, Arts and Sciences

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Title: AGE DATING DEVONIAN ISLAND ARCS AND THEIR ROLE IN SURVIVAL ACROSS MASS EXTINCTIONS

The Late Devonian was a period 383-359 million years ago that was characterized by prolonged climate instability and contained several mass extinctions. This was a time of severe disruption in both terrestrial and marine environments caused by not just one single event, but multiple

periods of species depletion/extinction. Unlike the other Big Five mass extinction events, no single trigger for extinction is apparent, although new research suggests that massive volcanism was part of the story. Our understanding of the Late Devonian extinction events is biased as most study locations are in North America and Europe (which were paleogeographically adjacent, as Pangea was forming at this time). For this reason, we directly investigated this problem in a paleogeographically unique location: southwestern Mongolia. Since these Late Devonian rocks were formed on an island arc, they represent the isolated, open ocean conditions that were vital refuges for many marine organisms. We will use geochemistry and geochronology to assess the role of volcanism in causing these extinction events by extracting zircons from the lava flows and volcanic ash layers using heavy liquid extraction. After extracting the zircons, we will be able to radiometrically date them and obtain an absolute age of the marine sequence.

Delaney Ryan, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Steven Hageman, Arts and Sciences

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Title: A NEW APPROACH TO UNDERSTANDING BRACHIOPOD INVASIONS IN THE APPALACHIAN BASIN THROUGH MULTIDIMENSIONAL MODELING

In search for a way to track change in body form and environment through geologic time using fossils and modern specimens, the shell shape of a diverse, abundant, and well-documented group of organisms, the phylum Brachiopoda, was chronicled in a newly developed approach. Brachiopods are marine invertebrates with a unique set of shell-shape characteristics that this study aims to record with the goal of observing patterns within and between groups without the constraints of space and time. The methods are composed of a numerical coding system with 18 characters (easily distinguishable and independent external shell shape features), each with 5 character states (variation within a character). Methods were applied to brachiopod invasion data from 450 million year old rocks from the Appalachian Basin and placed into a multidimensional space of brachiopod shell shapes where the relationships of brachiopod groups before, during, and after the invasion were compared using this new methodology. Statistical analyses, including principal component analysis and canonical variance analysis, reveal controls over shell shape within and among groups based on environmental tolerance as indicated by biogeographic range. Results support this approach as useful in understanding the newly revealed nested relationship of brachiopod shell-shape in the Appalachian Basin during an invasion with implications for an expansion and shifts in geographic range based on body form and environment.

Caroline Moore, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Sarah Evans, Arts and Sciences

Co-Author(s): Connor Miller

Title: MEASURING THE IMPACT OF GROUNDWATER ON BOG TURTLE THERMAL HABITAT IN SOUTHERN APPALACHIAN FENS

Fens are wetlands sustained by groundwater that improve water quality, help reduce flooding and provide a habitat for many endangered species such as the bog turtle. Since water has a higher specific heat than air, we hypothesize that the presence of soil water in fens allows the

turtles to stay cool in the summer and warm during the winter. As climate change may alter the thermal regime of fens it is necessary to quantify baseline soil temperatures so that we may anticipate future impacts on fen thermal habitat. In this study, we present air and soil temperatures for two fens in North Carolina recorded from August 2018 through November 2019 at 2.5, 5.0 and 10.0 cm below ground level in eight locations in an Ashe County fen, and ten locations in a Wilkes County fen. Preliminary results from the Ashe County fen confirm our hypothesis that soil water provides an important thermal buffer. In December 2018, the average daily air temperature was $3.0^{\circ}\text{C}\pm 9.3^{\circ}\text{C}$. At 2.5 cm below ground level, the average daily temperature was $2.5^{\circ}\text{C}\pm 1.6^{\circ}\text{C}$, suggesting that the soil was insulated from freezing temperatures. In June 2019, the average daily air temperature was $17.5\pm 8.5^{\circ}\text{C}$. At 2.5 cm below ground level, the average daily temperature was $18.6\pm 5.7^{\circ}\text{C}$, indicating that the soil was buffered from hotter temperatures. Forthcoming results will demonstrate how soil water temperatures vary between fens which will help enact more effective conservation strategies to protect bog turtle thermal habitats.

Ciara Sailer, Geological and Environmental Sciences, Undergraduate Student

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Title: EXPLORING THE ONTOGENY AND PALEOBIOLOGY OF THE LATE CRETACEOUS CHASMOSAURINE DINOSAUR TRICERATOPS THROUGH HISTOLOGY OF FOSSIL BONES

Osteohistology is the study of bone microstructure at the tissue level and, when preserved in fossils, can provide copious amounts of information on the ontogeny, phylogeny, mechanics and the environment occupied by extinct organisms. There are many histological studies on Mesozoic vertebrates, but few focus on ceratopsians, and almost none on Triceratops. Prior to 2018, there were only two histological studies of chasmosaurines, leaving a nearly nonexistent understanding of their growth patterns. Histological studies on long bones provide the most information about growth rates due to modification of bone as the organism grows. Using a Triceratops specimen collected by an ASU crew led by Drs. McKinney and Callihan in 1975 in Marmarth, ND, my research focuses on what histologic studies on Triceratops can tell us about its ontogeny and paleobiology. Thin sections of various bones are prepared using histological core drilling and standard thin section methods to analyze bone microstructure to observe ontogenetic changes and growth rates to infer age, physiology and phylogeny in comparison to other ceratopsian dinosaurs. My research focuses on multiple bones, including a rib and an incomplete femur, which could hold the best record of this organism's growth. Although the bones are in less than ideal condition, the microstructure of a histological section of a rib fragment preserves dense haversian tissue, demonstrating that tissue structures remain intact for further analysis.

Savannah Devine, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Scott Marshall, Arts and Sciences

Co-Author(s): N/A

Title: A NEW COMPUTATIONAL METHOD FOR MODELING FAULTING IN THE GREATER LOS ANGELES, CALIFORNIA REGION

The greater Los Angeles, CA region is home to a complex network of seismically active faults, only one of which is the San Andreas. Faults pose a significant risk to society, and seismic hazard estimates require detailed information about fault location, geometry, and rates of motion (slip rates). Existing studies constrain slip rates at 64 sites along 21 faults throughout the Los Angeles region. It is not known whether these are representative of average movement along each respective fault, and many faults remain unstudied. In order to quantify the slip rates on all faults at all locations in the region, we utilize three-dimensional computational models to simulate the long-term motions of the fault network. Previous mechanical models were driven by a constant shortening; however, GPS data indicate non-uniform shortening rates, greatly limiting the size of the region that can be accurately modeled. Here, we attempt to drive faulting using the total Pacific-North American plate motion along with motion on the San Andreas fault. If successful, this method could greatly increase the area that can be accurately modeled. To assess model performance, we compare model predictions to geologic estimates of slip rates. If this new method produces results that match well with the long-term geologic estimates, the model may provide useful estimates for the many faults that do not have geologic estimates and could be utilized to simulate the entire Pacific-North American plate boundary.

Patrick Wright, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Cole Edwards, Arts and Sciences

Co-Author(s): Benjamin C. Gill

Title: SEARCHING FOR EVIDENCE OF LATE DEVONIAN LOCALIZED ANOXIA IN THE GREAT BASIN REGION (SOUTHERN NV, USA): RETHINKING CAUSES OF THE LATE DEVONIAN MASS EXTINCTION

The Late Devonian is known for one of the big five mass extinctions, which is thought to have been caused by volcanism, global cooling, and/or anoxia. The main die-off occurs at the Frasnian-Famennian boundary (FFB) where positive carbon isotopic (^{13}C) excursions are reported around the globe and are interpreted to record anoxia. However, these data cannot show whether anoxia was localized to shallow environments. Additional geochemical data that preserves a more local signal, such as I concentrations (I/Ca; to assess water column anoxia) and Fe-speciation (determining the water column redox state), are needed to show anoxia persisted during this time. In this study we sampled a Late Devonian carbonate succession in southern Nevada, USA to test whether evidence for anoxia exists before the FFB. We measured ^{13}C trends from carbonate and organic matter to correlate with published trends, but we also sampled these carbonates for I/Ca and Fe speciation to examine local redox conditions. Preliminary I/Ca values during this anoxic interval are zero and return to non-zero values after the peak ^{13}C excursion. A total of 27 samples were measured for Fe speciation, which have low total Fe (FeT) values (<0.13 wt. %), but relatively high reactive Fe (FeHR) to total Fe (FeHR/FeT) values. In general, global and local proxy evidence for anoxia indicates that water column anoxia in this section post-dates the FFB. This suggests that anoxia did not play a major role in the extinction.

Jayson Sellars, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Scott Marshall, Arts and Sciences

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Title: THREE-DIMENSIONAL COMPUTATIONAL MODELS OF ACTIVE FAULTING, IN THE IMPERIAL VALLEY, CALIFORNIA

The Imperial Valley, located in southern California, hosts numerous active faults capable of producing damaging earthquakes. Seismic hazard assessments are the primary method for estimating earthquake potential and require detailed knowledge of fault geometry and rates of motion (slip rates). For our study, we use a three-dimensional computational model to predict fault slip rates, and we compare the model predictions to slip rates estimated by geologists. Existing slip rate estimates are measured at singular points and many faults are unconstrained. Our model simulates fault movement using the modeling code, poly3D. We drive motion on the regional faults by applying the total Pacific-North American plate motion to the edges of the model. We then compare the model predictions of surface motion to those measured by GPS and Interferometric Synthetic Aperture Radar (InSAR) data gathered in the area. GPS stations measure full three-dimensional motion at individual points but gather temporally continuous data, while InSAR data has a large area of coverage but collects data sparsely in time and only measures motions in the look direction of the satellite. Thus, comparing model predictions to both GPS and InSAR leverages the strength of each measurement tool. Preliminary comparisons to GPS data show promise as surface velocities of the model are similar; however, systematic differences exist. We are currently tweaking the model boundary conditions to improve the match with GPS data.

Mathias Eads, Geological and Environmental Sciences, Undergraduate Student

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Title: BREAKING THE MOLD: 3-D VISUALIZATION AND RECONSTRUCTION OF THE LATE TRIASSIC DINOSAUR COELOPHYSIS

Molding and casting (MC) is the primary replication method for fossils in paleontology. Although MC can produce high quality replications for details, even at the mm to micron scale, it is limited in that it can only produce exact replicas. Photogrammetry and 3D printing, while unable to produce models at the same resolution as MC, allow fossils to be manipulated in 3D space in ways impossible for MC. The model generated from photogrammetry can be transformed, mirrored, scaled, and altered to suit disparate needs, and 3D models can be shared and sent across the world in seconds using the internet, unlike a MC model. In the case of the Ghost Ranch Coelophysis block, multiple individuals have all been preserved on top of one another. An order to preserve the fossils, each is left in its original (death) position. Approximately half of one individual's skull was exposed along the medial line. This individual was MC, then I performed photogrammetry on the resulting cast. Afterwards I digitally cleaned and mirrored the 3D model, scaling it to the original fossil. This resulted in a model of the complete skull of Coelophysis without having to remove the actual fossil from the block. While the 3D printed skull is not at the same level of detail as the actual fossil or cast, it does allow us to visualize an idealized version of the complete skull. Thus, while not a complete replacement for the actual fossil or a MC model, this serves as an example of the capabilities of 3D modeling.

Connor Stephens, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Sarah Evans, Arts and Sciences

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Title: ANALYSIS OF INCREASED BASEFLOW ACROSS NORTHERN EURASIAN RIVERS UNDERLAIN BY PERMAFROST

The Arctic is currently warming at twice the rate of the global average, resulting in increased rates of Arctic river discharge and the thawing of perennially frozen ground known as permafrost. Increased rates of Arctic river discharge are postulated to occur due to either increases in precipitation or increases in the depth of the active layer, the subsurface layer above permafrost that freezes and thaws on an annual cycle. In this study, we quantify how increases in precipitation and the depth of the active layer may control Arctic river discharge by performing a baseflow recession analysis on daily streamflow records for 139 stations across northern Eurasia from 1913 to 2003. Results indicate that increases in precipitation do not correlate with increases in river discharge, but that active layer thickening correlates with increases in river discharge. These findings suggest that precipitation is likely not the sole driving factor in increasing stream discharge but that Arctic stream discharge is likely increasing due to a combined effect of changing precipitation regimes and permafrost thaw. As changes to the Arctic hydrologic cycle are likely to intensify in the future, these results will aid in predicting positive feedbacks to global warming since thawing permafrost releases stored methane and carbon dioxide into the atmosphere more readily when soils are dry, further accelerating warming.

Brianna Hibner, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Cole Edwards, Arts and Sciences

Co-Author(s): N/A

Title: DOES FOOLS GOLD TELL THE TRUTH ABOUT ANOXIA? RETHINKING THE CAUSE OF THE LATE DEVONIAN MASS EXTINCTION USING SULFUR ISOTOPES IN CARBONATES

The Devonian Period (419–359 Myr ago) experienced major environmental changes that include the demise of existing reef communities all during a mass extinction. This mass extinction is thought to be caused by oxygen-poor conditions (anoxia) on a global scale, which is based on carbon isotopic trends that co-occur with extinction pulses. Carbon isotopes ($\delta^{13}\text{C}$) are commonly used to identify anoxic intervals in the rock record, but other processes can produce similar signals (e.g., changes in weathering rates). Thus, a proxy independent of $\delta^{13}\text{C}$ is needed to confirm where anoxia occurred. One such proxy is sulfur isotopes ($\delta^{34}\text{S}$) where $\delta^{34}\text{S}$ values measured from carbonate rocks (thought to record seawater chemistry) should vary along with $\delta^{13}\text{C}$ values if anoxia was present. During anoxic conditions $\delta^{34}\text{S}$ values should increase due to enhanced pyrite burial rates. As such, this study tests whether anoxia was the main driver of the mass extinction using $\delta^{13}\text{C}$ and $\delta^{34}\text{S}$ trends from the Great Basin region, USA. Two positive $\delta^{13}\text{C}$ excursions are preserved in these successions, above and below the main extinction interval, but only one positive $\delta^{34}\text{S}$ excursion is preserved in parallel to the upper $\delta^{13}\text{C}$ excursion. We interpret the lower $\delta^{13}\text{C}$ excursion as being caused by alteration, and the upper excursion is characteristic of anoxia. Anoxia occurring after the extinction interval challenges the idea that it caused the mass extinction, possibly sea level rise was a more important factor.

Hannah Field, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: William Armstrong, Arts and Sciences

Co-Author(s): Regine Hock, Matthias Huss

Title: Climatic, Glaciologic, and Geomorphic Controls on Northwestern North America Ice-Marginal Lake Area Change Between 1984 – 2018

The presence of lakes on the margins of glaciers can impact glacier evolution and downstream biophysical systems. Ice-marginal lakes, including proglacial lakes (occurring at glacier termini) and ice-dammed lakes (dammed by the glacier), may exacerbate glacier mass loss and alter downstream sediment and chemical transport. Recent work indicates that ice-marginal lake evolution is influenced by glacial retreat, although exact controls are not well understood. We quantify ice-marginal lake area change in understudied northwestern North America from 1984 - 2018 and investigate climatic, topographic, and upstream glacier influences. We utilize the Google Earth Engine Digitisation Tool to delineate timeseries of sampled lake ($n = 107$) perimeters. Regional lake area has increased 31%, with proglacial lakes growing an average of 2.9 km^2 and ice-dammed lakes decreasing an average of 0.8 km^2 . Analysis of climatic data from Scenarios Network for Alaska + Arctic Planning suggests that change in temperature and precipitation exert minimal direct influence on individual lake area behavior. Utilizing existing datasets of modelled glacial characteristics (Randolph Glacier Inventory, Farinotti et al. (2019) ice thickness product, and Huss and Hock (2015) mass balance dataset), we find that near terminal ice thickness and glacier slope weakly influence lake behavior. This indicates that lake setting, rather than climate or glacier dynamics, more strongly controls local lake area change.

Connor Miller, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Sarah Evans, Arts and Sciences

Co-Author(s): N/A

Title: EFFECT OF WATERPROOFING IBUTTON THERMAL LOGGERS ON TEMPERATURE DATA

Thumbnail-sized temperature loggers have become valuable tools for studying thermal hydrology and ecology in a diverse array of environments. Thermochron iButtons, the most popular temperature loggers, can collect and store minute to daily temperature data for months at a time at a remote site. While iButtons are commonly used to record the temperature of air, soil, and water, they are not waterproof; an iButton without a waterproof casing in a saturated environment may be damaged and lose all recorded data. Thus, it is common to prevent iButton damage from water by enclosing iButtons in a variety of waterproof casings. However, waterproofing an iButton in a case also insulates the iButton from its thermal environment, resulting in inaccurate temperature data. In this study, we explore the effects of five different methods of waterproofing iButtons on recorded soil temperatures at 2.5, 5.0, and 10.0 cm depth below the ground surface at two sites, a shaded and unshaded grassy location. Our results suggest that the Plasti Dip waterproof casing method in and out of a plastic stake appears to insulate the iButtons, resulting in recorded soil temperatures that were higher than those recorded for iButtons without waterproofing. Alternatively, the expensive black screw-on casings appear to have no thermal effect on the iButtons. Based on these results, we conclude that the best option from waterproofing iButtons is to use the black screw-on casings as they prevent device failure with minimal influences on soil temperature readings.

Alexandra Zacher, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Sarah Carmichael, Arts and Sciences

Co-Author(s): N/A

Title: VOLCANIC ACTIVITY AS A POTENTIAL TRIGGER FOR THE DEVONIAN-CARBONIFEROUS MASS EXTINCTION VIA FRAMBOIDAL PYRITE AND MERCURY PROXIES IN BELGIUM

The Devonian-Carboniferous (D-C) boundary (358 million years ago), is defined by a mass extinction that decimated fish populations and changed their evolutionary trajectory forever. The cause of this extinction event is still unknown. Severe marine regression (sea level fall) and widespread ocean anoxia (extreme lack of oxygen) characterize this time period, known as the Hangenberg Crisis, which has been documented globally. Extensive volcanic activity may be a potential trigger for the widespread ocean anoxia and loss of biodiversity at the D-C boundary. Samples from the Namur-Dinant basin of Belgium (containing the D-C boundary) were analyzed using framboidal pyrite (microscopic, raspberry-shaped crystals) distribution and trace element geochemistry to determine the depositional environment and degree of anoxia. The samples recording the D-C boundary in black shale were dysoxic (very low oxygen) and some contained a spike in mercury (Hg). Hg deposition can be used as a proxy for widespread volcanic activity and recent research has identified Hg inputs into ecosystems in Vietnam, Uzbekistan, and Germany at the D-C boundary. Although the source is unknown, the Hg concentrations in Vietnam are consistent with deposition from catastrophic volcanism. To determine the potential sources of Hg in our samples, principal component analysis of trace elements will be used to constrain the paleoenvironment and determine whether the elevated Hg is from terrestrial or volcanic sources.

Emma P Myrick, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Ellen Cowan, Arts and Sciences

Co-Author(s): Keith C. Seramur

Title: USING LIDAR TO IDENTIFY EOLIAN LANDFORMS WITH BURIED CULTURAL DEPOSITS IN THE SANDHILLS OF NORTH CAROLINA

Eleven archaeology sites were excavated in the Sandhills, North Carolina between 2003 and 2019. Stratified Woodland and Archaic cultural horizons were found between ~15 to 35 cm and 20 to 50 cm respectively. Grain size and micromorphology sediment analyses at these sites show Holocene stratigraphy that is interpreted as evidence for burial of archaeology. Additionally, grain size statistics and quartz microtextures imaged using the scanning electron microscope indicate eolian transport as a primary burial mechanism at these sites. Landform identification on a regional scale across three counties in the Sandhills is the focus of this study. Digital elevation models (DEM's) using LiDAR data were created to show bare earth features. Eolian landforms associated with each archaeology site were identified on historical topographic maps and DEM's. Each site falls within the area previously identified as drought prone. Two sites are located on the lee-sides of parabolic dunes, and five are on sand rims downwind of blowout depressions. Remaining sites appear to be buried by sand sheets, and do not demonstrate an obvious constructional landform. This suggests that local sand sources influence the burial and preservation of archaeology sites. Multiple sites are covered by

impervious surfaces due to urbanization, placing limitations on remote sensing analysis. Locating elevated eolian landforms using LIDAR bare earth models can be useful for future archaeological site reconnaissance.

Zachary Ore, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Andrew Heckert, Arts and Sciences

Co-Author(s): Logan Howell

Title: THE DISTRIBUTION OF PALEOPATHOLOGIES IN DINOSAURS AND THEIR PALEOBIOLOGICAL SIGNIFICANCE

The preserved evidence of injuries and diseases of prehistoric organisms, dinosaurs included, are known as paleopathologies. The paleopathological record allows paleontologists to make inferences about the paleobiology of dinosaurs. By analyzing over 100 different published paleopathological papers, data was compiled from more than 150 dinosaur paleopathological occurrences. These records were cataloged by the different major clades of dinosaurs (theropod, sauropod, marginocephalian, thyreophoran, and ornithopod), the type of pathology (injury or a disease/developmental anomaly), the continent the fossil was discovered on (North America, South America, Europe, Asia, Africa, Antarctica, Australia), and the relative age of the fossil (Late Triassic; Early, Middle, and Late Jurassic; Early and Late Cretaceous). Occurrences were also segregated by body mass of the affected dinosaur (1, 10s, 100s, 1,000s, 10,000s kg). Using this data, we posed several hypotheses on paleopathologies and the fossil record of dinosaurs. The null hypothesis was that injuries and diseases would be evenly distributed amongst the dinosaur record, taxonomically and by time. Instead, we found that dinosaurs with more predatory and/or agnostic lifestyles displayed more injuries than diseases, while the slow-moving, larger dinosaurs exhibit more diseases and fewer injuries. We also found that the majority of documented paleopathologies occurred in North American specimens of Late Jurassic and Cretaceous age.

Cole Blackman, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Cynthia Liutkus-Pierce, Arts and Sciences

Co-Author(s): N/A

Title: A RIVER RUNS THROUGH IT: HOW SEDIMENTOLOGY CAN RECONSTRUCT THE DYNAMICS OF A 17-MILLION-YEAR-OLD RIVER IN KENYA

We investigated sediments from Loperot, Kenya to determine the role of climate and tectonics on the Miocene landscape in east Africa. Previous work indicated that a large perennial river meandered across a semi-arid savannah. Within a 30m exposure, the sedimentology changes above Unit 17; evaporites (e.g., gypsum) in paleosol units disappear and soil chroma values decrease, both attributed to increased humidity. Cross-beds indicate that the river's flow direction changes from eastward to northward upsection. We hypothesize that a tectonic event caused the Loperot River to capture a nearby river. We analyzed quartz-feldspar-lithic (QFL) composition and texture of sand units, speculating that changes would reflect a shift in source drainage and/or local stream capture. Low in the section (Unit 25), sandstone units are fine-grained with 65%Q, 5%F, 30%L; upsection (Unit 11) feldspar disappears (99%Q, 0%F, 1%L) and the sandstones are much coarser grained (Unit 3). Loss of feldspar could be due to the wetter climate (K-feldspar weathers away) or a difference in the captured river's source area.

Coarser grain size results from increased flow velocity due to river amalgamation. Roundness and sorting remain unchanged; only a significant change in distance from source (>100km) could affect these textural components, which is unlikely within a single rift basin. We conclude that the Miocene landscape in Kenya was certainly dynamic and responded to both climate and tectonics.

Anthony Hengst, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: William Armstrong, Arts and Sciences

Co-Author(s): N/A

Title: AUTOMATED PROGLACIAL LAKE DELINEATION BY LANDSAT MULTISPECTRAL IMAGE CLASSIFICATION IN GOOGLE EARTH ENGINE

As glaciers retreat, they can develop lakes at their termini known as proglacial lakes. These lakes may affect the mass loss rate of the upstream glacier and the downstream hydrological environment. Tracking changes in size and connectivity of proglacial lakes at large scale is impractical by manual methods because of the time-consuming and subjective nature of manual delineation. We investigate the ice-marginal lake delineation capabilities of a family of automated land cover classifiers implemented in the cloud-based Google Earth Engine. These environments challenge classifiers due to the spectral similarity of sediment-rich lake water and surrounding land cover types. We investigate the spectral environment of Alaskan proglacial lakes and examine the effect of different band and band ratio inputs in the classifier dataset on classification performance. We develop supervised minimum distance classifiers to extract water cover features from Landsat 8 and Landsat 5 multispectral imagery of the Gulf of Alaska region over 1984-2019. We assess classifier performance against manually-delineated lake truth maps using the F-1 metric, and find a maximum value of $F-1=0.65$. We then implement the best-performing classifier on a broad spatial and temporal range to automatically generate detailed time series of lake area across a large number of proglacial lakes, enabling investigation of how they are changing and altering both upstream and downstream systems.

Isabella Metts, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Andrew Heckert, Arts and Sciences

Co-Author(s): Javier Ventura

Title: Triceratops Fossils and Data Visualization—New Techniques for Old Bones

A broad range of visualization techniques aid the geosciences in research, education, and outreach. The use of 3-D modeling can facilitate the spread of scientific data to educate populations or individuals who may not have access to original data. This broadens the spectrum of people exposed to science while simultaneously protecting original data.

Photogrammetry, a form of 3-D visualization, uses images taken of an object at many angles to stitch together a digital model. In the case of paleontology this model is identical to a rock or fossil specimen, but can be scaled up or down, 3-D printed, and/or shared online.

Appalachian State University's Department of Geological and Environmental Sciences houses fossil fragments of a Late Cretaceous Triceratops found in North Dakota. The Triceratops is a useful specimen to model due to the many large skull fragments that are otherwise difficult to manipulate. With enough models it is possible to stitch them together and create a new model containing all data we have on this particular Triceratops. The Triceratops fossils that underwent

photogrammetry include: an incomplete right lower jaw, a partial horn core, a complete vertebra, and both squamosals. We conducted photogrammetry in the Visualization Lab of the College of Arts and Sciences on these Triceratops fossils. After photogrammetry we plan to create 3-D models in order to effectively display and share the specimen without harming the original fossils.

Israel Sanchez, Geological and Environmental Sciences, Undergraduate Student

Faculty Mentor: Andrew Heckert, Arts and Sciences

Co-Author(s): Nickolas A. Brand, John R. Foster, ReBecca K. Hunt-Foster

Title: A look at the terrestrial vertebrates of the Upper Cretaceous Williams Fork Formation J&M Site

The J&M Site lies within the Upper Cretaceous (~75 Ma) Williams Fork Formation (WFF) near Rangely in northwest Colorado. The WFF is relatively understudied despite being locally fossiliferous. Sediment from the J&M site was broken down using DMSO (dimethyl sulfoxide) and H₂O₂; then soaked, sieved, and sorted by grain size. Specimens were collected using an optical microscope, resulting in thousands of fragmentary bones and hundreds of teeth. These fossils are overwhelmingly aquatic, pertaining to various sharks, rays, gars, bowfins, and turtles, and are consistent with a fluvial deposit. Less than 5% of recovered specimens belong to terrestrial animals. The alligatoroid *Brachychampsa* is represented by teeth ranging from small and conical to low and robust that suggest a durophagous diet of hard-shelled animals like clams and turtles. Dinosaur fossils are rare, and include hadrosaur teeth that are heavily worn suggesting extensive use of their teeth for consuming plant matter. Teeth assigned to dromaeosaurs are even more rare, and are a first for the WFF. A few teeth display multiple cusps, many of which likely belong to multituberculate mammals, but one complex tooth represents the lizard *Peneteius*, whose teeth are mammal-like and suggest an insectivorous diet. A mm-scale jaw fragment holding three small pointed teeth likely pertains to an amphibian. These fossils help build a picture of the ecosystem in the area immediately surrounding the ancient river.

GOVERNMENT AND JUSTICE STUDIES

Kara Holyfield, Government and Justice Studies, Undergraduate Student

Faculty Mentor: Nancy Love, Arts and Sciences

Co-Author(s): N/A

Title: WEAPONIZING WORDS IN THE POLITICAL ARENA: A MODERN LOOK AT LABELING

In the political arena, candidates are often given labels. People use labels like socialist, fascist, and progressive to help explain things they don't understand. Labels are a shortcut, that ultimately hurts our democracy. Unfortunately, when we use these shortcuts, they don't even truly describe the people they are meant to describe. In this paper, I look at five candidates seeking the presidency in 2020 (Bernie Sanders, Donald Trump, Bill Weld, Joe Biden, and Elizabeth Warren), and analyze the labels commonly ascribed to them. I look at whether these labels are used correctly, or even accurately describe these candidates. Most importantly, I look at whether or not labeling is meaningful. I determined that labels are little more than a

distraction and a safety net, and do little to educate people on the current political climate. This paper ultimately calls for people to take a look at their speech patterns, and determine whether or not labeling a political figure, or anyone else, is helpful or meaningful.

Tori Buffington, Government and Justice Studies, Undergraduate Student

Faculty Mentor: Catherine Marcum, Arts and Sciences

Co-Author(s): Olivia Meade

Title: Perceptions of Inclusivity and Expression in the Classroom

The purpose of this study was to investigate the perceptions of inclusiveness and expression in the classroom by majors in the Department of Government and Justice Studies (GJS).

Specifically, undergraduates in upper-division criminal justice and political science classes were asked questions regarding their comfort level on expression of religious beliefs, political affiliation and sexuality in the department, as well as at ASU. In addition, students were asked to provide suggestions on how GJS and ASU could improve the classroom climate and inclusivity. This poster will provide an analysis of the results of the responses.

Tyler Hill, Government and Justice Studies, Undergraduate Student

Faculty Mentor: Barbara Zaitzow, Arts and Sciences

Co-Author(s): N/A

Title: PAY OR STAY: THE DISCRIMINATORY NATURE OF THE AMERICAN BAIL SYSTEM

The United States bail system has a long and troubled history. The bail system was created to provide the person charged with a crime a way to gain release from the jail setting on the condition they show up for future court dates. However, because the bail system ties freedom to the ability to pay, it is inherently flawed. Current bail practices, among many other things, encourage racial disparities since people of color are more likely to be arrested, more likely to be eligible for bail, yet less likely to be able to afford it. The bail system also promotes guilty pleas since many defendants may be so desperate to get out of jail that they are willing to accept a plea offer rather than go to trial, even if they are not guilty of the crime they have been charged with. The American system of justice can do better than force vulnerable populations to unwittingly either add to the already swollen jail populations by virtue of not being able to post bail, or by the questionable practice of coercing people to plead guilty in order to secure their freedom. The purpose of this paper is to explore the legal, economic, and social costs of the bail system on our already strained system of justice, the people who are subjected to it, and to provide recommendations to promote positive change.

HISTORY

Lilyan Wright, History, Undergraduate Student

Faculty Mentor: Thomas Kaplan, Judaic, holocaust, and peace studies

Co-Author(s): N/A

Title: CHILD BEARING AND SEXUAL ABUSE OF JEWISH WOMEN IN THE HOLOCAUST: THE PSYCHOLOGICAL EFFECTS ON THE VICTIMS

Even though there have been great strides for women in the Holocaust there is still much to be done. Especially revolving around child bearing and sexual abuse of Jewish victims. Within my writing, I will explore multiple accounts of pregnant women, the sexually abused, and those who were involved. I will certainly focus on a woman by the name Joan Rigelheim, who was a pioneer lead on starting the women in the Holocaust discussion. I have found multiple memoirs and interviews of women, midwives, and children themselves. I have chosen these accounts because they vary in different circumstances. Some have a happy ending, some deal with victims of rape, experimentations, forced sterilizations, and others include abortions and miscarriages. I will explore deeper into the memoirs of Gisella Perl in her book *I Was a Doctor in Auschwitz*. Her book includes testimonies of many women and the sexual attacks they suffered on their womanhood and motherhood. A book I plan on using in my research will be, *Pregnant Women and Children Born in Auschwitz* by Helena Kubica. Kubica study the field of child bearing during the Holocaust so deeply. The difference between mine and hers, is that I plan to explore after the Holocaust and results child bearing had on the victims psychological state. One of my favorite biographies is about a woman named Miriam Rosenthal. At the Holocaust museum in Washington, D.C. there is a collection donated by herself in 1997. The collection consists of postcards, photographs of her life pre-war and post war while living in an orphanage, and personal accounts of the time. Another source of my information will come from Sonja Hedgepeth, in her novel, *Sexual Violence Against Jewish Women During the Holocaust*.

Lillian Draughon, History, Undergraduate Student

Faculty Mentor: Thomas Pegelow Kaplan, Judaic, Holocaust, and Peace Studies

Co-Author(s): N/A

Title: The Second Generations Holocaust

While the Holocaust ended in 1945 with the destruction of the genocidal Nazi regime, the impact of the genocide has not ended. Postmemory, coined by Marianne Hirsch, is the connection that the generation after creates to the memory of the generation. In this paper, the author delves deeper into those connections of memory and second generations to the Holocaust. She looks into the connections and differences between the impacts of the memories of victims and perpetrators on the second generation if there is any at all. The author, with available accounts, further broke down the victims and perpetrators into those in or working in a concentration camp, those that were relocated or worked the relocations, and those who were alive in the area during the period that experienced the war differently. With a lack of perpetrator accounts in these varying fields, the author was able to create a baseline of comparison. Within the analysis of how the stories are shared, the author also looked at how it impacted the second generation. Postmemory is the understanding of the connection to the generations after, and those factors mentioned above alter those connections. Many factors also went into play in all the divisions created like finance, and education. They altered the ability to share stories and create an understanding that may be sought out. Overall, the author looks at the overall impact of postmemory and how it can alter the life of the second generation and those after.

Walker Dalton, History, Undergraduate Student

Faculty Mentor: Thomas Pegelow Kaplan, Judaic, Holocaust, Peace Studies

Co-Author(s): N/A

Title: DECONSTRUCTING THE PINK TRIANGLE IN THE 21ST CENTURY

I will be focusing how on the symbolic use of the Pink Triangle (a symbol associated with men identified as homosexual within the Holocaust) was reclaimed in 1974 as a representation of shared oppression by LGBT activists who incorporated the Pink Triangle into their equal rights movement. The symbolic use of the Pink Triangle followed the movement throughout touchstones in LGBT history such as the ACT UP campaign and the AIDS crisis. By 1987 with the March on Washington, the symbol had become synonymous with the LGBT community. Representations of the Pink Triangle could be seen anywhere from t-shirts to newspaper company logos where its original context in the 1940s appeared to embody a different history altogether, if not completely lost. I argue that use of the Pink Triangle has over time lost its historical context and association to not only the activists who chose it, but also its history within the Holocaust. I will be pulling from various iconographic mediums including monographs from the 1970s discussing the initial relationship between West German and American LGBT activists and newspapers from the 1980s and '90s depicting the use of the Pink Triangle. The use of the symbol within the 21st century is so far removed from when it was first reclaimed by LGBT activists in the 20th century that it cannot be appropriately linked to its history when it is seen today exchanged for a dollar value.

Rebekkah Watkins, History, Graduate Student

Faculty Mentor: Andrea Burns, Arts and Sciences

Co-Author(s): N/A

Title: THE COMPARATIVE MUSEUM EXPERIENCE OF ATYPICAL AND TYPICAL LEARNERS

Community resources do their best work when they are inclusive to all those that are in the community. This is no different for those resources on a university campus - including campus museums. By creating a museum experience for those with different learning needs than those that are typical learners is important on a university campus that includes a program such as the Scholars with Diverse Abilities Program. The SDAP program works with students who have intellectual disabilities reach personal growth and occupational success. Museums are a center for learning and growing but if the experience for atypical learners and typical learners vary significantly that proves that it is not accessible for all learners. The museum may physically be accessible but to take learning behaviors and abilities into account will create a more inclusive experience for all those who visit the museum. This presentation will introduce this problem of non-inclusive museum experiences and how experiences differ based on a learners ability and interest. By looking at qualitative data taken from surveys will give a better understanding of how the two identified populations experience a museum and what their expectations and experiences of the museum visit were. The objective is to bring attention to the differing experiences of how a museum could make the experience more intellectually inclusive.

Jeremy Doblin, History, Undergraduate Student

Faculty Mentor: Thomas Kaplan, Arts and Sciences

Co-Author(s): N/A

Title: UNDERSTANDING JEWISH FAITH: HOW JEWISH RELIGIOUS LIFE IN THE CONCENTRATION CAMPS ACTED AS A FORM OF RESISTANCE

This paper explores the connections between Jewish religious life during the Holocaust and forms of resistance against the Nazi perpetrators in the concentration camps and ghettos. While current research into specific camps and ghettos find less of a connection to resistance, an investigation into the broader topic of resistance compiled with halacha and kiddush hashem finds a stronger connection. Further, looking at the differing levels of practice by Jews during the Holocaust, shows differing levels of resistance. Secondary literature occasionally looks into broader geographical areas and the religious life around those specific spots, yet these works still do not synthesize the information into a broader context whether well orientated or not. Further, they might focus on a specific event as opposed to a larger context over the course of time. Some works, including Zuker's *The Unconquerable Spirit*, examine acts of resistance in testimonies, but does not incorporate dialogue over the specific stories. This paper argues for the extensive and strong connection between Jewish religious life and resistance, and finds that the act of partaking in religious life regardless of size can and should be seen as a form of resistance to the perpetrators of the Holocaust.

Annette Waters , History, Undergraduate Student

Faculty Mentor: Thomas Pegelow Kaplan, Arts and Sciences

Co-Author(s): N/A

Title: PRIVILEGES OF THE OSTRACIZED: A STUDY OF SOCIETAL RELATIONS AND CONSEQUENCES OF MIXED MARRIAGES IN NAZI GERMANY

When considering victims of the Shoah, Holocaust scholars often focus on Jews, along with the mentally ill, elderly, children, POW's, and Sinti and Roma. In addition to Jewish persecution, scholars have also focused on Aryans who held close connections to Jews, such as those who shared families. Non-Jewish spouses who were married to a Jew, as well as the couple's children, faced ostracization and social out casting for their relations to Jews in Germany; these families who were comprised of an Aryan and Jewish spouse came to be known as mixed or intermarried. A common argument amongst survivors is that these mixed families never experienced the true hardships and consequences that were enforced upon other Jewish families. Though many families did not experience camp internment, most went through job loss, societal ostracization, and the breaking up of families. With these experiences, is it fair to argue that mixed families never truly suffered through the Holocaust? What were specific forms of persecution that members of mixed marriages faced, and what unique role did societal pressure play in that persecution? With the case of mixed-marriages and families in Nazi Germany, a large component that led to the demise of protection for Jews was the increasing societal pressure and behavior that faced Aryans related to Jews. Today, sociologists and historians can study this occurrence in relation to what others may experience as societal pressure and out casting. Family traditions, hometown values, and social expectations are evident in everyday life today, with community members expecting certain individuals to behave in a certain way. Though risks of social isolation hold nowhere near the same weight, studies can analyze the unique role that social relationships play in a person's decision-making.

LANGUAGES, LITERATURES AND CULTURES

Valerie Daratony, Languages, Literatures and Cultures, Graduate Student

Faculty Mentor: Benjamin Souza, Arts and Sciences

Co-Author(s): N/A

Title: LOS TRABALENGUAS Y LA PRODUCCIÓN DE LA FRICATIVA /s/ EN ESPAÑOL

It is well known that most textbooks and supplements for teaching Spanish offer little pronunciation instruction and fewer opportunities to practice pronunciation compared to other areas of language. Although often neglected in language classrooms, second language phonology is a crucial element in language learning because it is often the most prominent feature in the speech of a foreigner. Tongue twisters that focus on pronunciation and repetition of a specific sound are an activity that can be meaningful to learners of Spanish. The use of tongue twisters decreases the affective filters of the learners and even helps to improve the relationships between the students. This study will analyze whether tongue twisters help learners at the intermediate level to improve their pronunciation. Specifically, their pronunciation of the graphemes <s> and <z> in intervocalic and word-final positions in Spanish. The sound [z] is an allophone of /s/ in Spanish, while /s/ and /z/ are different phonemes in English, which creates a challenge for English speakers. Although the use of tongue twisters in language classrooms is not a new idea, this study will provide concrete quantitative data on the participants' pronunciation of the fricative /s/ before and after the use of tongue twisters.

Jenna Elliott, Languages, Literatures and Cultures, Undergraduate Student

Faculty Mentor: Benito del Pliego, Arts and Sciences

Co-Author(s): N/A

Title: THE RISE OF THE HISPANIC POPULATION IN NORTH CAROLINA

North Carolina is historically an English colony, but in recent years, the population of Hispanics in North Carolina has increased, despite it not being a historically Hispanic region. This increase can be explained by both economic, political, and social motivations. This research details the reasons why Hispanics have begun moving to North Carolina.

PHYSICS AND ASTRONOMY

Crockett Vass, Physics and Astronomy, Graduate Student

Faculty Mentor: Tonya Coffey, Arts and Sciences

Co-Author(s): N/A

Title: SYNTHESIZING CARBON NANOTUBES USING LAVENDER ESSENTIAL OIL

A carbon nanotube (CNT) is an allotrope of carbon that can be thought of as a rolled up sheet of graphene, or single layer of graphite, into a cylindrical structure. CNTs have favorable strength and electronic properties that make them useful in a variety of applications. Traditionally, synthesizing carbon nanotubes through a process known as chemical vapor deposition (CVD) uses injection chemicals that produce harmful exhaust to the environment once heated until vaporization occurs. The initial and ultimate goal of our research is to find more sustainable and environmentally friendly chemicals to synthesize carbon nanotubes while using the CVD process. We intend to focus on the essential oil from lavender buds. We will then study the

effects on our synthesized nanotubes based on manipulating input variable such as reaction temperature and mass of essential oil used.

Plant extracts have been previously proven to yield CNTs when used as a catalyst on a substrate. Some prior examples include green leaves from garden grass, rose, neem, kaner, and walnut. Essential oil will be manually produced in our research through the use of grain alcohol to extract the oil from lavender buds.

Ross Robertson, Physics and Astronomy, Graduate Student

Faculty Mentor: Brooke Hester, Arts and Sciences

Co-Author(s): N/A

Title: AUTOMATION OF DUAL OPTICAL TWEEZERS

Optical tweezers use highly focused high-powered laser light to trap particles smaller than the width of a human hair. Optical tweezers have been influential in discoveries that include force measurements of DNA and proteins that interact with actin. These discoveries typically consist of a single optical trap with one end of the protein connected to a microsphere in the trap and the other end connected to the slide or a micropipette tip. This can limit the scope of studies possible. Instead, trapping two microspheres allows us to manipulate both ends of a biological object such as a protein or system of proteins simultaneously with a dual optical tweezers setup. A dual optical tweezers system is more complex than a single optical tweezers system because both laser beams require independent alignment, data must be gathered simultaneously for two position sensing detectors acquiring data at 15 kHz, and more data analysis is needed as the forces on the two beads are correlated. Automation code written for the single optical tweezers system was modified to control both beams and acquire data. I present how we modified the code to control the beams, how analysis differs with the dual optical tweezers system, and how we plan to implement analysis in our software.

Jeff Miller, Physics and Astronomy, Graduate Student

Faculty Mentor: Brooke Hester, Arts and Sciences

Co-Author(s): Claire Brown, Jaden Miller

Title: DETERMINATION OF ELASTIC MODULUS OF CELLS USING OPTICAL TWEEZERS

The elastic modulus of a cell is a parameter to describe its resistance to elastic deformation. Understanding the elastic modulus of a cell provides insight as to how the cell reacts to forces, and also may provide information about cell health. Measurements of the elastic modulus of cells are achieved in this work with optical tweezers using the indentation method. In optical tweezers, a trapped particle can be modeled as a Hookean system where the spring constant is the trap stiffness, allowing the force displacing the trapped particle to be determined by measuring the particle displacement. In order to measure the particle displacement, a laser and a position sensing detector are utilized for high-resolution position sensing. The laser scatters from the trapped particle onto the position sensing detector which produces results in units of volts. These detections are converted from volts to micrometers through a calibration process. The calibration process is expedited through automation within the program LabVIEW. The automated calibration processing program also allows for automation of most of the elastic modulus determination process. An overview of the methods, instrumentation, troubles, automation, and analyzed data produced by the LabVIEW program is presented.

Taylor Foote, Physics and Astronomy, Graduate Student

Faculty Mentor: James Sherman, Arts and Sciences

Co-Author(s): Forrest Ward

Title: HUMIDIFIED AEROSOL LIGHT SCATTERING MEASUREMENTS AT APP

Atmospheric aerosols effect sunlight directly by scattering and absorbing it and indirectly by serving as seeds for cloud droplets. The NOAA Global Monitoring Division site at Appalachian State (APP) has been measuring aerosol properties used to calculate aerosol direct radiative effect continuously since 2009. A key aerosol optical property is the dependence of light scattering on relative humidity (RH). At APP, we use a dual nephelometer system with a humidifier in between. The first nephelometer measures aerosol light scattering at low RH. The humidifier ramps the RH of aerosols measured by second nephelometer from <40% to 85% each hour to measure the RH dependence of scattering. However, large uncertainties can arise due to uncertainties in the RH inside the nephelometer. The humidifier design and method for determining RH uncertainty are presented here. The humidifier contains a permeable membrane surrounded by metal tubing which has a thin wire heater wrapped around it. The ramped RH must be monitored to ensure the RH system is successfully ramping the RH. A Vaisala RH sensor was inputted into the system before the second nephelometer to calibrate the nephelometer's internal RH sensor. The Vaisala RH sensor was then calibrated using three salts, NaCl, MgCl₂, and MgNO₃, and their known saturation RHs. The calibrated Vaisala sensor data can be compared to and used to calibrate the internal nephelometer RH sensor.

Riley Waddell, Physics and Astronomy, Graduate Student

Faculty Mentor: Dan Caton, Arts and Sciences

Co-Author(s): Lucas Sanders, Christine Massingale, Ronald G. Samec

Title: BVRCLC PHOTOMETRIC OBSERVATIONS AND SYNTHETIC LIGHT CURVE ANALYSIS OF FZ DELPHINUS

CCD, BVRI light curves of FZ Del were taken in 2017, 2018, and 2019 at Appalachian State University's Rankin Science Observatory in North Carolina with the 16-inch reflector, by D. Caton. FZ Del was first studied by Hannah and Awadalla (2004), who had sparse, low precision data. We obtained higher precision data, and R. Samec computed a Wilson-Devinney, simultaneous solution of the light curves in four passbands, binning about 5,000 CCD measurements in each color into 0.004 phase unit wide bins. Many times of minimum light were also calculated, and the results extend the work of Khaliullina (2017). A BVRclc simultaneous Wilson-Devinney Program (W-D) solution indicates that this 0.783d period, solar type pre-contact binary has a mass ratio of 0.36 and a component temperature difference of ~2200 K. A q-search was performed and the mass ratio minimized at the above value. The large temperature difference in the components verifies that the binary is not yet in contact. No spots were needed for the solution. The fill-out of our model is 78.5% for the primary component (smaller radius, but more massive), and 99.0% for the secondary component. So, it is near a classical Algol configuration. The systems distance is 265 (± 4) pc as determined from GAIA DR2.

Josiah Killam, Physics and Astronomy, Graduate Student

Faculty Mentor: Christopher Thaxton, Arts and Sciences

Co-Author(s): N/A

Title: INCLUSION OF THE ADDED MASS FORCE FOR THE INCIPIENT MOTION OF SAND GRAINS IN THE WAVE BOTTOM BOUNDARY LAYER

The threshold of motion for sand grains in the wave bottom boundary layer is typically not a strongly deterministic quantity and subject to observable variations even in controlled laboratory conditions. Traditional empirical formulae for sediment transport need not resolve time-dependent or higher-order effects to demonstrate skill (e.g., van Rijn et al., 2003); however, an effective and efficient time-dependent model for the threshold of bed motion would improve boundary and initial conditions for fluid-bed modeling and meso-scale modeling. We present a numerical model for the initiation of motion for a single proud sand grain atop a flat bed of similar grains under oscillatory forcing conditions common to the nearshore (Thaxton et al., 2020). Traditionally, motion ensues when the applied drag and pressure gradient forces combine to exceed the stabilizing force of friction (internal angle of repose for a single proud grain). However, once the grain begins to accelerate, an added mass force due to the inertia of the fluid behind the grain arises, serving to delay or prohibit motion. Our model employs a unique recursive algorithm to include the effects of the added mass term on the necessary force needed for incipient motion as well as the delay for motion within the applied wave period. We present results for a range of forcing conditions and grain sizes.

Matthew Calvelo, Physics and Astronomy, Graduate Student

Faculty Mentor: Christopher Thaxton, Arts and Sciences

Co-Author(s): N/A

Title: PERFORMANCE ASSESSMENT OF WRF PBL SCHEMES IN THE SOUTHERN APPALACHIAN MOUNTAINS

The Weather Research and Forecasting (WRF) model is a mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting. Dynamics within the planetary boundary layer (PBL) are too complex, poorly understood, and/or lack analytical solutions to permit a fully deterministic approach. WRF PBL schemes employ various parameterizations of mass, momentum, and heat flux that historically perform poorly in regions with complex terrain, such as the Southern Appalachian Mountains (SAM). We present a statistical assessment of four WRF v3.9 PBL schemes (YSU, MYNN2.5, MYJ, and ACM2) based on radiosonde data obtained during the summer months of 2013 and the winter months of 2017-18 in Boone, NC. We investigate the skill of each PBL scheme to predict vertical profiles of temperature, relative and specific humidity, wind speed and direction, as well as PBL thickness as a function of air mass type and time of day. Our analysis suggests that MYNN and YSU are leading options in PBL height prediction for the SAM. Under high shear conditions, all tested WRF PBL schemes over predicts mean wind speed in the PBL by as much as 2:1 and under predicts PBL height by the same ratio. This suggests that all tested WRF PBL schemes need to partition more wind energy into the turbulent kinetic energy regime during high shear conditions.

Lia Phillips, Physics and Astronomy, Undergraduate Student

Faculty Mentor: Jennifer Burris, Arts and Sciences

Co-Author(s): Nathaniel Scott, Scott Hancock, Brooke Hester

Title: Design and Calibration of a Laser Tweezers Raman Spectroscopy System

The Biophysics and Optical Science Facility (BiyOSeF) has designed and calibrated a laser tweezers Raman spectroscopy (LTRS) apparatus. This system has combined Raman spectroscopy and optical tweezers to optimize the data collection and resolution of Raman spectra. The optical tweezers are employed to maneuver micro-sized particles and measure the forces applied to the sample. The optical tweezers can move particles into the path of an excitation laser and Raman scattering can be collected by a spectrometer. Theory, design and calibration data of sulfur will be presented.

Forrest Ward, Physics and Astronomy, Undergraduate Student

Faculty Mentor: James Sherman, Arts and Sciences

Co-Author(s): N/A

Title: INITIAL STUDY OF ATMOSPHERIC AEROSOL HYGROSCOPICITY MEASURED OVER MULTIPLE YEARS AT THE NOAA GLOBAL MONITORING DIVISION AEROSOL NETWORK SITE AT APPALACHIAN STATE UNIVERSITY

Aerosols are solid or liquid particles suspended in the atmosphere and are observed as haze, dust, or smoke. The direct and indirect effects of atmospheric aerosols on solar radiation and clouds represent the largest uncertainties in climate models (IPCC 2013). Climate forcing and air visibility are directly affected by changes in aerosol light scattering due to water uptake under conditions of increasing/decreasing relative humidity (RH). Models require some knowledge of the RH dependence of aerosol light scattering but no long term measurements of this dependence existed in the SE U.S. until initiated at the NOAA Global Monitoring Division (NOAA GMD) aerosol network site at Appalachian State University (APP) in May 2012. Measurements of RH dependence of aerosol light scattering and hemispheric background coefficients at three visible wavelengths (450nm, 550nm, 700nm) have been made for nearly 7.5 years at APP using a dual nephelometer system. The scanning humidograph technique will be presented along with the aerosol scattering hygroscopic growth parameter at 550nm.

Claire Brown, Physics and Astronomy, Undergraduate Student

Faculty Mentor: Brooke Hester, Arts and Sciences

Co-Author(s): Jeff Miller

Title: Heat Regulated Sample Chamber to Maintain Optimal Thermal Conditions for Biological Cell Microscopy and Manipulation

Human cells must maintain a temperature of 37°C, body temperature, to remain viable. It is imperative to keep cells viable while they are studied to acquire accurate data. In order to achieve constant body temperature within a closed microscope slide, a feedback circuit is used as a thermostat system. The feedback circuit turns on a heater when the temperature is below body temperature and turns off the heater when body temperature is achieved. Heat escapes the slide into the air, so heat must be applied periodically to maintain body temperature. The circuit contains an operational amplifier that compares a constant set voltage to the voltage across a variable resistor. The circuit also consists of a transistor that activates a ceramic heating ring based on the output voltage of the operational amplifier. The heating ring rests on the glass coverslip of a slide, which will heat the slide to 37°C. A thermistor is used to monitor

the temperature of the sample chamber. As the thermistor heats up, the resistance decreases, therefore, increasing the voltage applied to the operational amplifier. As the voltage from the thermistor rises above the constant voltage set-point, the operational amplifier will output zero volts to the transistor, turning off the heater. Here, the schematic of the temperature-regulating circuit and respective data is presented as evidence that the circuit is functional.

Jordan Greene, Physics and Astronomy, Undergraduate Student

Faculty Mentor: James Sherman, Arts and Sciences

Co-Author(s): N/A

Title: INTEGRATION OF NASA MICRO-PULSED LIDAR NETWORK DATA PRODUCTS INTO THE WORLD-CLASS NASA AND NOAA AEROSOL DATASETS AT APPALACHIAN STATE UNIVERSITY

Appalachian State University (APP) is the only location in U.S. currently making near-surface aerosol measurements (as part of NOAA Global Monitoring Division; NOAA GMD), column-averaged aerosol measurements (as part of NASA Aerosol Robotic Network; AERONET), vertically-resolved aerosol and cloud measurements (as part of NASA Micro-pulsed Lidar Network; MPLNET), along with solar irradiance (as part of NASA Solar Radiation Network). The combined datasets allow for us to study the relationships between changing air quality in the southeastern U.S. and solar radiation budget (i.e. aerosol direct radiative effect; DRE). One limitation in our studies up to this point is the difficulty in placing the vertical aerosol and cloud profiles into an accessible format, which has precluded its usage. The primary research objective is to integrate vertical aerosol profiles with the column-averaged and lower atmospheric data available at the co-located NOAA Global Monitoring Division (NOAA GMD), NASA Aerosol Robotic Network (AERONET), and NASA Micro-pulsed Lidar Network (MPLNET) sites at Appalachian State University. I spent the summer extracting MPLNET data from the NETCDF format and placing the data into an easy to use tabled format. I developed scripts that both extract the MPLNET data to allow for straightforward access to the data and analyze the vertical aerosol profiles. I placed the lidar data into the format specified by the Santa Barbara DISORT radiative transfer code, so that it can be used to better quantify aerosol DRE above the APP site.

Robert Barnes, Physics and Astronomy, Undergraduate Student

Faculty Mentor: Brooke Hester, Arts and Sciences

Co-Author(s): Rose Overstreet

Title: Design and Implementation of an Optical Tweezers Apparatus

An optical tweezers (OT) apparatus utilizes focused laser light to trap micro to nano-sized objects. An OT system can be used to study multiple interdisciplinary subjects such as the elastic modulus of cells or the behavior of gold nanoshells. The objective of this project is to build a new OT apparatus. An OT system requires two laser light sources. One laser traps the object, and the other laser is used to determine the position. These are aligned through telescopes to adjust the diameter of the beams to an optimal size for focusing with an objective lens of a microscope to achieve a tight focus onto the sample. The position detection laser light is then directed to a position sensing detector where the position of the trapped object can be determined once the system is calibrated. A white light source is directed to the sample and

focused with a condenser lens. This light is then directed to a camera so the sample can be viewed on a screen by the user. To test the functionality of the OT apparatus, micrometer-sized silica spheres will be used to ensure trapping and position detection can be achieved. We present here the methods used to build an optical tweezers apparatus along with our progress on the implementation of the instrument.

Matthew Phillips, Physics and Astronomy, Undergraduate Student

Faculty Mentor: Christopher Thaxton, Arts and Sciences

Co-Author(s): N/A

Title: COMPARISON OF $k-\omega$ WITH $k-\epsilon$ TURBULENCE CLOSURE SCHEMES FOR INCIPIENT MOTION OF SEDIMENTS UNDER OSCILLATORY FORCING

The threshold of motion for sand grains in the wave bottom boundary layer is typically not a strongly deterministic quantity and subject to observable variations even in controlled laboratory conditions. Traditional empirical formulae for sediment transport need not resolve time-dependent or higher-order effects to demonstrate skill (e.g., van Rijn et al., 2003); however, an effective and efficient time-dependent model for the threshold of bed motion would improve boundary and initial conditions for fluid-bed modeling and meso-scale modeling. Our team developed a phase-resolved numerical model (Thaxton et al., 2020) for the incipient motion of sand grains based on force-balance relations that rely in part on an accurate representation of the mean fluid velocity field and the turbulent structure and dissipation near the bed. We employ two common methods for turbulence closure: the $k-\omega$ and $k-\epsilon$ models. The $k-\omega$ allows for a more accurate near-wall treatment and works best during adverse pressure gradient conditions, such as during flow reversal as a wave passes by; whereas, the $k-\epsilon$ model is more suited to fully developed turbulent flows usually found after incipient motion has already occurred for sand grains. We show preliminary results of the force balance conditions for incipient motion using both closure schemes, and compare them to predictions of threshold based on commonly used empirical parameters.

Sophia Woznichak, Physics and Astronomy, Undergraduate Student

Faculty Mentor: Anthony Calamai, Arts and Sciences

Co-Author(s): N/A

Title: ADDRESSING UNCERTAINTIES WITH THE ROOM-TEMPERATURE R-LINE DECAY RATES IN RUBY

Many existing upper-division undergraduate laboratory experiences associated with the metastable doublet-E term of chromium doped aluminum oxide, which gives rise to the ruby R-lines at 692.7 and 694.3 nm, focus on a room-temperature measurement of the radiative lifetime of the doublet-E term. In our local work developing a laboratory experience in atomic phosphorescence, we noted a lack of consistency in the literature for the lifetime of the metastable term. These projects, and ours, typically use commercially available ruby spheres; for which, the manufacturer(s) only state an ~2% Cr concentration. The uncertainty in the Cr concentration represents one source of systematic error for this laboratory experience. We present our results and corrections for systematic issues that make this project a more rewarding experience for students. Our result for the room-temperature radiative-lifetime for the

doublet-E term is 3.3 ± 0.1 ms; which, unlike some more recent published reports, compares favorably with the room-temperature result generated at Bell Labs in 1965.

Jacob Greenfield, Physics and Astronomy, Undergraduate Student

Faculty Mentor: Chris Thaxton, Arts and Sciences

Co-Author(s): N/a

Title: Meteorological Data Transmission and Acquisition System for a Drone

The TriSonica Mini (TSM) is a research-grade, integrated atmospheric sensor system that samples temperature, humidity, pressure, tilt, compass, and wind speed and direction. Being compact and lightweight, the TSM is ideal for deployment on a mobile platform such as a drone. However, the TSM does not come with data storage or transmission capability. We present an embedded design for a data logger that allows for data to be stored during flight. The design employs an Arduino Uno, an RS232 shifter, and a SD card. Since the data is streamed from the TriSonica to the SD card as individual hex bytes that represent ASCII characters, we wrote a python script to convert the hex bytes and organize the data into an excel spread sheet for processing. The python script also computes derived products such as potential temperature and specific humidity. The mounting bracket used for the drone consists of a three foot long aluminum pole mounted on the drone with a plate on top for the TSM to sit upon. The datalogger circuit is mounted at the bottom of the pole directly on the drone. This solution allows student and faculty researchers to acquire high resolution surface and boundary layer data (up to 200 meters) in support of atmospheric chemistry and physics research and modeling.

Forrest Myers, Physics and Astronomy, Undergraduate Student

Faculty Mentor: Brooke Hester, Arts and Sciences

Co-Author(s): Jeff Miller, Greg Rapp

Title: OPTICAL TRAPPING OF MULTIPLE GOLD NANOSHELLS

Light exerts a force on an object as it reflects or scatters from the object. If that object is small enough, the force effects can be influential in its motion. A particle can be quickly accelerated or held in place. This outcome is especially strong when light scatters or reflects from a metal/dielectric interface. This effect is used in optical trapping of gold nanoshells. As more nanoshells enter the optical trap, the optical forces increase nonlinearly. The strength for confining the nanoshell(s) in place can be measured based on the movement of trapped nanoshell(s). This strength is known as the trap stiffness and is dependent on particle size, number of trapped particles, material, laser color and power, ambient temperature, and viscosity and the index of refraction of surrounding fluid. Presented here is a comparison of corner frequencies, a measure of the trap stiffness, of varying numbers of trapped gold nanoshells.

PSYCHOLOGY

Emma Walker, Psychology, Graduate Student

Faculty Mentor: Jacqueline Hersh, Arts and Sciences

Co-Author(s): Dr. JP Jameson

Title: VIOLENCE VICTIMIZATION AND PERPETRATION: POTENTIAL MEDIATORS OF THE RELATIONSHIP BETWEEN SEXUAL MINORITY STATUS AND SUICIDE RISK

Suicide is an area of significant public health concern, particularly for vulnerable populations such as youth and sexual minority students. Sexual minority youth (SMY) are at an additional risk, given their higher prevalence rates of suicidality. Rates of violence victimization and perpetration are also higher among SMY than heterosexual youth. Prior research has shown links between victimization and suicide risk, as well as perpetration and suicide risk, but has not examined the mechanisms behind the specific impact of these factors on suicide risk in SMY; we aimed to address this gap in the literature. The present study examined whether violence victimization and perpetration independently mediate the relationship between being a sexual minority and suicide risk, using a large (N = 14,107), nationally representative sample of high school student responses on the Youth Risk Behavior Survey (YRBS). We ran separate binary logistic regression models to examine the mediation of victimization and perpetration on suicidal ideation and attempt among SMY. All four models were statistically significant and showed partial mediation, although given small differences, none were clinically significant (see Figures 1-4). More research on the specific mechanisms that underlie suicide risk for SMY is needed, since identifying the pathways that lead to increased risk for suicide in SMY can inform new targets for suicide prevention.

Keywords: suicide, violence, victimization, perpetration, sexual minority youth

Jessica Chambers, Psychology, Graduate Student

Faculty Mentor: Lindsay Masland, Arts and Sciences

Co-Author(s): N/A

Title: TO EXAM WRAPPER OR NOT TO EXAM WRAPPER — THAT IS STILL THE QUESTION:

A REPLICATION STUDY

Students in higher education often struggle to meet the rigorous cognitive demands of colleges and universities, and lack the metacognitive skills that would support their academic success. Research indicates that instructor feedback on student work has one of the largest effect sizes in terms of instructor effects on student learning (Hattie, 2015). Initial investigations into the efficacy of post-exam reflections, also known as exam wrappers, show promise. However, some studies have demonstrated null effects for a post-exam reflection (Masland, 2019; Soicher & Gurung, 2017; Thompson, 2012). Additional research is needed to identify the active components and boundaries of this potential educational intervention. This poster will report the results of an exam wrapper replication study of Masland (2019) that employed random assignment to reflection type while counterbalancing reflection types across the semester (N = 46 students across one section). After receiving both rubric and qualitative feedback on case study exam essays, students were asked to complete an in-class, LMS-delivered exam wrapper that required either metacognitive reflection (treatment) or career-related reflection (active control). Reflection type did not significantly impact subsequent exam and course performance. results will be contextualized in terms of hypotheses regarding why exam wrappers seem to augment academic performance in some situations, but not in others.

Sidney Murray, Psychology, Graduate Student

Faculty Mentor: Doris Bazzini, Arts and Sciences

Co-Author(s): N/A

Title: IS FAT TALK PERCEIVED AS MORE DETRIMENTAL TO ROMANTIC RELATIONSHIPS THAN OTHER FORMS OF SELF-BERATING DIALOG?

This study examined the effects of three types of self-berating talk -- Fat Talk (FT; verbal expressions of body dissatisfaction, Dumb Talk (DT; a term we entitled for berating one's own intelligence), or Neutral Talk (NT; dialog without self-criticism), spoken by the female partner in a heterosexual relationship on relationship satisfaction for the male partner. A MANOVA analyzing Talk Type on the male partner's relationship and sexual satisfaction, and perceptions of his partner's interpersonal qualities revealed an overall effect, $F(6, 244) = 2.77, p = .013, \eta^2_{\text{partial}} = .06$. Univariate analyses revealed that Talk Type significantly affected perceptions of the woman's interpersonal qualities, $F(2, 124) = 4.79, p = .01, \eta^2_{\text{partial}} = .07$, and of the man's sexual satisfaction, $F(2, 124) = 4.45, p = .014, \eta^2_{\text{partial}} = .07$. For interpersonal qualities, FT yielded the poorest ratings ($M = 5.55, SD = 1.12$) compared to DT ($M = 6.41, SD = 1.45$), $p = .005$, and NT ($M = 6.30, SD = 1.54$), $p = .014$. Interestingly, DT yielded higher sexual satisfaction ratings ($M = 4.67, SD = .86$) than both FT ($M = 4.14, SD = .80$), $p = .006$ and NT ($M = 4.24, SD = .98$), $p = .024$. Correlational analyses also revealed significant relationships between perceptions of the woman's body image, self-esteem, and relationship satisfaction variables. Results imply that FT may bear a detriment to women in the context of romantic relationships, but DT may reinforce traditional male-female relationship roles.

Patricia Ferreira, Psychology, Graduate Student

Faculty Mentor: Twila Wingrove, Arts and Sciences

Co-Author(s): N/A

Title: MOCK JURORS' PERCEPTIONS OF CHILD SEXUAL ABUSE FRAMED AS A HATE CRIME

Child sexual abuse (CSA) crimes are infamously under-prosecuted (Block & Williams, 2019). While women convict more and blame CSA complainants less than men (Bottoms et al., 2014), 6-year-old complainants secure more convictions and are blamed less than 15-year-old complainants (Golding et al., 2015). Recently, scholars and activists have interpreted rape as a hate crime driven by gender inequality (MacKinnon, 2016). A study assessing the impact of framing rape as either a hate or interpersonal crime found that the former reduced complainant-blame ratings, but had no effect on verdict in an adult rape case (Droogendyk & Wright, 2014). Given the stated differences in conviction and blame assigned to younger versus older children, examining whether these differences can be reduced by framing CSA as a hate crime committed against children because of their age is important and has yet to be examined. We hypothesize (a) compared to the gap resulting from an interpersonal framework, a hate-crime framework will reduce the gap in conviction rates and complainant-blame ratings between 6- and 15-year-olds; and (b) women will convict more and complainant-blame less than men. Utilizing a 2 (Participant Gender) x 2 (Framework) x 2 (Complainant Age) factorial design, data collection using an online survey began in November 2019. Based on a power analysis, the goal sample size is 266 undergraduate participants. Data collection is projected to end in late March 2020.

Sierra Rufino, Psychology, Graduate Student

Faculty Mentor: Christopher Holden, Arts and Sciences

Co-Author(s): N/A

Title: Relationship-Contingent Self-Esteem as a Moderator of Borderline Personality Features and Mate Retention.

Borderline personality disorder (BPD) is characterized by unstable relationships, emotion dysregulation, and impulsive behaviors. In turn, individuals with BPD experience unsatisfying romantic relationships. However, they strongly fear abandonment, exhibit rejection sensitivity, and are highly motivated to maintain relationships.

Thus, they are inclined to engage in mate retention behaviors (MRB), which aim to prevent romantic relationships from failing. These behaviors range from positive MRB, which incentive partners to stay in the relationship, to negative MRB, which force partners to stay in the relationship and ultimately decrease relationship satisfaction.

Individuals with BPD engage in negative MRB, which may explain why their relationships are troublesome. They may be motivated to use such behaviors because they may define their self-esteem based on the nature of their romantic relationships, also known as relationship-contingent self-esteem (RCSE). RCSE may potentially explain why individuals with BPD fear abandonment and engage in negative MRB. However, no research has examined the relationship between BPF, RCSE, and MRB. Furthermore, MRB may be further precipitated by the perception of relationship threat (RT), as most MRB appear when RT is perceived.

Therefore, we examined the relationship between BPD, RCSE, RT, and MRB through a series of self-report questionnaires. We found the BPF and RCSE each predict different types of MRB, while RT had no impact on MRB.

Mary Meyer, Psychology, Graduate Student

Faculty Mentor: Yalcin Acikgoz, Arts and Sciences

Co-Author(s): N/A

Title: Examining the Relationship between Applicant Reactions and Selection Test

Performance: Is the Relationship Curvilinear?

There is evidence in the literature that negative reactions to employee selection procedures such as high anxiety and low motivation are related to poor performance by job applicants on a selection test (McCarthy, Van Iddekinge, Lievens, Kung, Sinar, Campion, 2013). However, to date the studies examining this relationship were correlational, meaning that no causal relationship could be established. This implies that while it is possible that negative reactions predict low test performance, it is also plausible that the reverse is true (i.e., poor performance at the early stages of a selection test leads to high anxiety and low motivation) or a third variable is responsible for the observed relationship. In addition, there is evidence that the relationship between stress and performance is not linear, but in the shape of an inverse U (Muse, Harris, & Field, 2003; Srivastava & Krishna, 1991), suggesting that extremely negative and extremely positive reactions lead to lower levels of performance while test performance is maximized at moderate levels of positive or negative reactions. Accordingly, the proposed study will examine the relationship between applicant anxiety and performance on a selection test. We hypothesize that there will be a curvilinear relationship between applicant anxiety and performance that is mediated by self-regulatory processing and off-task cognition. In order to establish causality, an

experimental design will be utilized such that the level of anxiety participants face during the study will be manipulated. After manipulating anxiety, participants will then complete a selection test. The results of this study will allow for a more robust test of the relationship between applicant anxiety during selection procedures and test performance, and hence provide theoretical and practical implications for staffing researchers and practitioners.

Alisa Conrady, Psychology, Graduate Student

Faculty Mentor: Jamie Yarbrough, Arts and Sciences

Co-Author(s): Alana Smith, Morgan Brooks, Alissa Barron-Moffa, Shelby Spencer, and Geena Mikesell

Title: KNOWLEDGE OF MTSS: WHAT YOU DON'T KNOW WILL HURT YOU!

Multi-tiered system of supports (MTSS) is an overarching framework that is used to address the academic and behavioral needs of students through a data-based problem-solving approach. Previous research has demonstrated that many within the education field lack knowledge of MTSS and its purpose. This lack of knowledge leads to confusion and misuse of MTSS. The purpose of this study was to determine educators' knowledge of MTSS and how it is being implemented within their particular school district. Researchers used a survey to assess educator knowledge of the structures put in place within their school districts regarding the tiers of MTSS. The following research questions were tested: Are there differences reported in MTSS knowledge and implementation between educators that work in elementary, middle, high, and multiple schools? Are there differences reported in MTSS knowledge and implementation between general education teachers, special education teachers, administrators, and student support personnel? Do differences exist in educators' knowledge of MTSS and reports of how it is being implemented within their particular school and/or district? Data were collected online using Qualtrics software. Participants were 159 educators. One-way ANOVAs found differences between school level and job position. A multiple regression determined that MTSS knowledge did not predict reported MTSS implementation practices.

Alana Smith, Psychology, Graduate Student

Faculty Mentor: Jim Deni, Arts and Sciences

Co-Author(s): Morgan Brooks

Title: Program Accreditation: The Good, the Bad, and the Ugly

Accreditation has always been an important issue for school psychology training programs. Most university training programs are accredited and governed by the National Association of School Psychologists (NASP). Although there are many advantages of NASP accreditation, there are also many external and internal barriers and challenges. The current study surveyed NASP accredited and non-accredited school psychology university program coordinators to explore their perceptions about the NASP accreditation process. Most program coordinators thought the NASP accreditation process was fair and had a number of advantages such as recruiting students and helping structure the program. However, program coordinators identified many disadvantages such as the amount of time and documentation required, the inconsistency of program reviews, and the gap between training and practice. Implication for training and limitations are also discussed.

Allison Sams, Psychology, Graduate Student

Faculty Mentor: Jim Deni, Arts and Sciences

Co-Author(s): Kaitlin Meier, Elizabeth M. Power

Title: THE UTILITY OF GRADUATE ASSISTANTS IN SCHOOL PSYCHOLOGY PROGRAMS

A Graduate Assistant (GA) provides a mutually beneficial relationship to a higher education institution under which they perform their duties. Unfortunately, there is little research on the roles of GAs in graduate programs, particularly in school psychology. The purpose of this study is to determine how GAs are used in school psychology training programs. A second purpose of this study is to determine important variables relating to provisions for GAs, such as tuition waivers and financial stipends. Further research in this area will allow for faculty and administrators to determine how other school psychology programs utilize GAs, funding sources, and other logistics of the GA role.

Harvan Kerrin, Psychology, Graduate Student

Faculty Mentor: Jim Deni, Arts and Sciences

Co-Author(s): John Marion

Title: PREPARING GRADUATES TO MEET THE MENTAL HEALTH NEEDS OF STUDENTS

There is a growing concern for the lack of mental health support for children in our schools. According to Brenner (2019), one in five school-aged children currently has at least one diagnosable mental health disorder. Along with this the Centers for Disease Control and Prevention survey (2018), listed suicide as the third leading cause of death for adolescents in the United States with high numbers of adolescents either considering or planning suicide. The growing numbers in school-aged children with mental health disorders and high risk for suicide call for schools to be more proactive in prevention and intervention. Schools are a place where students spend the majority of their time, making it an ideal place to deliver mental health services (Skalski & Smith, 2006). Both the National Association for School Psychology (NASP) and laws such as Every Student Succeeds Act (ESSA) recognize school psychologists being capable of providing services in schools. The current study was performed to gather data on the amount of pre-service training in mental health that school psychology graduate students receive in their course of study. A Qualtrics survey was sent out to program directors and faculty to determine how many courses in which mental health training do school psychology graduate students take. Key findings on training program preparation for school psychology graduate students were analyzed and presented at the National Association for School Psychology Annual Conference 2020 in Baltimore, Maryland.

Jade Schilling, Psychology, Graduate Student

Faculty Mentor: Andrew Smith, Arts and Sciences

Co-Author(s): Paul Windschitl

Title: CAN THINKING LIKE THE OPPONENT REDUCE THE DESIRABILITY BIAS?

People's perceptions are often influenced by their desires. For example, a football fan might be overly optimistic about their team's chances of winning in an upcoming game. In this instance, the football fan would be exhibiting the desirability bias. The desirability bias can leave a person unprepared for the undesired outcome. Therefore, a football fan may be more disappointed if their preferred team loses, and may engage in more risk-taking behaviors, such as suboptimal

betting. Although the desirability bias is well documented, identifying factors that mitigate the biasing influence of people's preferences has remained elusive. In the current study, we tested whether interventions aimed at getting people to take another person's perspective might reduce the desirability bias. Specifically, football fans recruited online made predictions about the outcome of the Super Bowl. Before making their final prediction, some participants were asked to estimate what an opposing fan might predict. Overall, participants exhibited the desirability bias as they were overly optimistic about their preferred team's chance of winning. Participants were significantly less optimistic after taking the perspective of an opposing team's fan, but the decrease in optimism was much smaller than expected. This study suggests that reducing the desirability bias might be possible, but people's optimism is relatively unwavering.

Sarah Daniel, Psychology, Graduate Student

Faculty Mentor: Jim Deni, Arts and Sciences

Co-Author(s): Jodi Williams & Dr Stephanie Corcoran

Title: SO, WHAT'S THE BIG DEAL ABOUT SELF-CARE?

The practice of school psychology can be stressful as evidenced by the current burn-out rate of school psychologists. To combat this burn-out problem, it is becoming increasingly necessary for school psychologists to incorporate self-care into their daily routines, not only for personal satisfaction but also to prevent job burnout and maintain good mental health. However, training programs fail to adequately address self-care, resulting in early career practitioners that are ill-equipped to deal with the pressures of their new career. The purposes of this study are to identify the specific self-care needs of graduate students, evaluate the self-care culture of their graduate training programs, and provide best practice recommendations. Key findings from this study will be presented with the goal of providing best practice recommendations to incorporate into training programs that will lead to culture change in self-care with graduate training programs.

Michael Spencer, Psychology, Graduate Student

Faculty Mentor: Mary Ballard, Arts and Sciences

Co-Author(s): Megan Kornhauser, Evan Sakrison, T'arah Kindle

Title: HORROR VIDEOGAME SOUND EFFECTS AND SHOOTER BIAS

Videogames have become increasingly popular for entertainment and educational purposes (Lofgren, 2017). This has spurred substantial, sometimes controversial, research about the potential negative and positive effects of gameplay, particularly violent gameplay. Visual and auditory stimuli are crucial elements of horror video games; graphics and sound effects in horror games aim to elicit fear in the player. Most of the extant research has compared violent with non-violent gameplay; many other aspects of gameplay, such as competition, music, graphics, and sound effects, are not well studied. This used a violent horror survival game to examine the impact of sound effects on cardiovascular, affective, and cognitive/behavioral (i.e., shooter bias – towards people of color – in a shooter game) reactions. Hypothesis 1, that shooter bias would be higher among participants exposed to the sound effects, was not supported. Hypothesis 2, that physiological and affective responding (i.e., heart rate, blood pressure, and state hostility) would be higher among participants exposed to the sound effects, was partially supported. Both systolic and diastolic blood pressure were significantly higher after gameplay among

participants exposed to the sound effects, but this was not true of heart rate or state hostility. Exploratory analyses showed that participants exposed to the sound effects rated the horror game as significantly scarier.

Andrew Taylor, Psychology, Graduate Student

Faculty Mentor: Twila Wingrove, Arts and Sciences

Co-Author(s): Patricia Ferreira

Title: RAPE AS A HATE CRIME: COMPARING THE EFFECTS OF DIFFERENT FRAMINGS OF RAPE ON MOCK JURORS

Less than 5% of reported cases of rape get prosecuted, while even less secure actual convictions. Thus, understanding how jurors reach their decisions is paramount. Recently, some scholars have proposed treating sexual assault as a hate crime (MacKinnon, 2016). This study aims to replicate and extend previous findings concerning the impact of this proposed designation on mock jurors' decision making. Participants read a stranger rape case vignette containing either a hate crime or a traditional rape definition. Results revealed that defining rape as a hate crime impacted complainant blame ratings, but not verdict decisions.

James Wyngaarden, Psychology, Graduate Student

Faculty Mentor: Andrew Monroe, Arts and Sciences

Co-Author(s): E. Ashby Plant, Ph.D. (Florida State University)

Title: Emphasizing Fairness vs. Authority Values Guides Impressions of Social Justice Protests
In 2017, Colin Kaepernick drew global attention by kneeling during the national anthem before a football game. The protest divided the country into two groups: those who supported Kaepernick's stand against inequality, and those who believed it was disrespectful. The current study investigates whether differences in moral values (i.e., fairness vs. respect for authority) predict an individual's opinion of the protestors, and whether priming one of those values influences opinions on social justice protests more broadly. Our data support the moral tradeoff hypothesis by demonstrating that when values are in conflict, the degree to which individuals value fairness versus authority predicts their opinions of the protestors. These differences in fairness vs. authority also extended to judgments of other kinds of social justice protests. These findings support the Moral Foundations Theory as a useful tool for investigating the influence of moral values on perceptions of social issues and subsequent behavior.

Charlotte Godfrey, Psychology, Undergraduate Student

Faculty Mentor: Mark Zrull, Arts and Sciences

Co-Author(s): Kate Geisinger

Title: Neural activity in proximal and dorsal subiculum of adolescent rats is affected by periodic enrichment and a single enriching experience

This project explores the differential effects of environmental enrichment (EE), which provides stimulation with spatial, object and social cues, on neural activity in rats' proximal (PS) and distal subiculum (DS). The PS and DS receive input, coming via the hippocampus, from regions of both lateral and medial entorhinal cortex (LEC and MEC), respectively. In a previous study, we found evidence that LEC neurons responded to local cues (i.e., objects) and MEC neurons to global scenes (i.e., space of the environment). The effects of EE on neurons of PS and DS

were studied using immunohistochemistry and microscopy to visualize and quantify the neural activity marker, c-FOS. Adolescent, Long - Evans rats (n=16) were placed in one of four conditions: periodic enrichment throughout life and no enrichment before death (EE+No), periodic enrichment with enrichment before death (EE+EE), no periodic enrichment with enrichment before death (No+EE), and no enrichment (No+No). While objects and their locations varied across EE sessions, the enrichment environment stayed the same. The hypothesis that there would be greater neural activity in PS for rats who experienced a final EE session (regardless of history) due to its relationship to LEC and variation in local cues (objects) was supported with increases neural activation in PS of No+EE (+2,400%) and EE+EE brains (+1,050%) compared to controls (p<.001). The hypothesis that there would be greater neural activity only in the DS of No+EE brains due to its relationship to MEC and the enrichment space not being novel for EE+EE rats was not supported with increased activation observed in the DS of both No+EE (+567%) and EE+EE (+317%) conditions compared to controls (p=.004). While PS processes information related to object location in an environment where those cues can change, the results contradict the notion that DS processes only information about new spatial settings.

Katie Feeny, Psychology, Undergraduate Student

Faculty Mentor: Twila Wingrove, Arts and Sciences

Co-Author(s): N/A

Title: YOUTH WITH DISABILITIES IN FOSTER CARE: PREVALENCE, BARRIERS AND LONG-TERM EFFECTS

This literature review investigates the prevalence of youth in the foster care system with a developmental delay or disability, physical disability, or mental disorder, the barriers to a happy, healthy, and safe life these youth disproportionately face in comparison to youth within the foster care system that do not have a disability, and the long-term negative effects this has on their transition to adulthood. Specifically, this research addresses the problems the foster care system has with identifying and assessing children with disabilities, the lack of transition services that are tailored specifically to children with disabilities, barriers in regards to their education and the inadequacy of training for foster parents and child welfare professionals. It then investigates the skewed stress response, increased suicide risk, increased chance of serious physical health problems, and lack of job outcomes that these children often encounter in adulthood as a result of these barriers. I suggest and detail creating a better identification and assessment process for foster children immediately as they enter foster care and a more comprehensive training program for all foster parents and child welfare professionals. The intention of this paper is to raise awareness and educate people on the disparities that children with disabilities in the foster care system face on a daily basis while providing ideas for tangible change

Maddie Rozics, Psychology, Undergraduate Student

Faculty Mentor: Doris Bazzini, Arts and Sciences

Co-Author(s): N/A

Title: DUMB TALK: IS IT NORMATIVE AND CAN IT BE PREDICTED BY DOMAINS OF SELF-ESTEEM?

Fat talk is a well-researched phenomenon in which there is a tendency for women to degrade their bodies in an informal manner, especially within group settings. The current study aims to expand this research and investigate whether there are other forms of self-degradation that women frequently engage in and view as normative, particularly intelligence. Women might feel pressure to degrade their intelligence in groups to avoid boastfulness and conform to modesty norms surrounding the disclosure of one's achievements. Female college students will be instructed to read a vignette in which three women are engaging in dumb talk (DT), or self-degrading behavior surrounding one's intelligence. When it is the fourth woman's opportunity to respond, participants will then answer a series of questions pertaining to the normativity and social attraction of each type of response. Participants will additionally complete a measure for how frequently they engage in DT, as well as a measure of self-complexity (the degree to which self-esteem is derived from different categorical domains). We hypothesize that participants who engage in more self-degrading dialogues, and whose self-esteem is more dependent on approval from others, will perceive DT as more normative behavior. However, those individuals whose self-esteem is more dependent on academic competence are expected to perceive DT as less normative than those whose self-esteem is less dependent on academic competence.

Georgia Mitchell, Psychology, Undergraduate Student

Faculty Mentor: Twila Wingrove, Arts and Sciences

Co-Author(s): N/A

Title: Effectiveness of Supportive Housing Based on the Opinions of Clients and Staff
Organizations that intend to help people without stable and consistent homes, by providing housing and services that help them reintegrate into society successfully, fall under the category of 'supportive housing' assistance. A significant portion of the homeless population, and of the people who use the services provided by supportive housing, contains people who have been recently released from prison and who go through a process of re-entering society labeled as 're-entry.' The purpose of my research is to interview clients, current and former, of a specific supportive housing organization, as well as employees, about their opinions of how effective various services offered are for 'successfully' re-entering society, financially and mentally. The results will be presented in my honors thesis and will hopefully be able to inform scholars and the public alike on just one of the challenges facing ex-prisoners that are prevalent all over the country.

Kailey Plowman, Psychology, Undergraduate Student

Faculty Mentor: Andrew Smith, Arts and Sciences

Co-Author(s): Andrew Monroe

Title: DO PEOPLE REALLY THINK THEY ARE ALONE IN A CROWD OF SHEEP?

People often like to think they are less biased, more rational, and less likely to conform than their peers. For example, research by Pronin, Berger, and Molouki (2007) found that Princeton students evaluated themselves as much less likely to conform compared to the average Princeton student. Although the results were convincing, this study was conducted using only 40 participants from a prestigious university. We replicated this study in order to generalize the findings to a broader range of participants and use a larger sample size. We also extended the previous research to assess if participants would evaluate a close friend the same as the self in

regard to perceptions of conformity. Consistent with the original study, we found that ASU students thought they conformed less than their peers. However, they reported that their close friend conformed as much as their peers. The results of our replication generalize the original findings to a new sample of participants and also show that this effect is specific to perceptions of the self vs. others and not when comparing a close friend to others.

Allison Curry, Psychology, Undergraduate Student

Faculty Mentor: Twila Wingrove, Arts and Sciences

Co-Author(s): Claire LeBlanc, Esther Killius, Katie Feeny, Georgia Mitchell, Madison Guinn

Title: MOCK JURORS' INDIVIDUAL JUDGEMENTS ON CONSENT IN SEXUAL ASSAULT TRIALS

Convictions in sexual assault cases rely on conflicting testimonies from the complainant and defendant, leaving little evidence to argue a probable cause (Lundrigan, Dhimi, & Agudelo, 2019; Schiewe, 2019). This study with college students explores judgments made in sexual assault trials that involve arguments about consent. Participants (N = 170) listened to one of three audio recordings of a sexual assault case, each representing a common argument found in these cases regarding consent; conditions were verbal consent (the complainant explicitly said no to sexual activity), misinterpretation of moaning (pleasure vs. pain) and tonic immobility (TI), which is predominantly ignored by the legal system. Next participants completed individual surveys, asking about conviction, demographic questions, and where blame should be placed for the incident. Across conditions, 68.8% of participants voted guilty. Conviction rates were not significantly impacted between consent conditions. Conviction rates were significantly correlated with survey responses related to responsibility, suggesting that participants placed higher blame on the complainant when the defendant was not convicted.

Willa Papanikolas, Psychology, Undergraduate Student

Faculty Mentor: Doris Bazzini, Arts and Sciences

Co-Author(s): N/A

Title: FEMININE GENDER ROLES AND SELF-DEGRADING DIALOGUE ABOUT INTELLIGENCE: DO WOMEN FEEL PRESSURE TO DUMB TALK?

The term Fat Talk (FT) is defined as self-degrading commentary about one's body image and commonly occurs in Caucasian females. FT is believed to assist in maintaining relationships with other women through mutual beratement of body image. FT may also occur due to perceived pressure to conform to group norms. The female gender role is one that encourages modesty and avoidance of boastfulness. FT researchers have demonstrated its normativeness among women but have failed to demonstrate if it is unique in its content, given that other forms of self-criticism (e.g., pressure to appear less intelligent – Dumb Talk), might also influence perceptions of women. Previous research has yet to determine (1) if participation of DT is believed to be normative among women, and (2) whether levels of a woman's femininity influences perceptions of DT dialogues. In this study, female participants were exposed to a dialogue involving four female targets, three of whom engage in beratement of intelligence. Participants were asked to put themselves in the position of the fourth female by responding with either no response, self-degrading response, or self-accepting response. Participants then assess the normativity of DT with regards to typicality and social attractiveness of each

response choice; they also completed the Traditional Femininity Scale (higher scores indicating higher femininity). It is hypothesized that women who endorse feminine gender roles will perceive DT as more normative.

Hannah Jordan, Psychology, Undergraduate Student

Faculty Mentor: Andrew Smith, Arts and Sciences

Co-Author(s): N/A

Title: THE INFLUENCE OF PERSONAL NARRATIVE INFORMATION ON ATTITUDES TOWARDS SYRINGE EXCHANGE PROGRAMS

Giving statistical information (e.g., 20% reduction) is common when describing the effectiveness of a program. However, narrative information (e.g., a description of an individual's experiences) is another type of information that could be communicated. Personal narratives have been shown to be effective at influencing people's attitudes and behavior in a wide variety of situations. One type of program that many people are unaware of—and might have negative attitudes about—are syringe exchange programs (SEPs). SEPs allow people to anonymously dispose of used syringes and acquire new, sterile syringes. Most people who use syringe exchange programs are intravenous drug users who exchange used or dirty syringes for clean syringes. SEPs have been shown to reduce the incidence of HIV and other diseases. In the current study, we examined whether narrative information could positively influence people's attitudes towards SEPs. All participants received basic information about SEPs and then received either statistical information, narrative information, or both types of information, and then we assessed their attitudes towards using government money to fund a local SEP. Overall, this study helped to test whether providing narrative information can influence people's attitudes towards SEPs.

Kurt Klessner, Psychology, Undergraduate Student

Faculty Mentor: Andrew Smith, Arts and Sciences

Co-Author(s): Morgan Coyle, Caitlin Smith, Hannah Stegner, Alaina Swick

Title: THE INACTION EFFECT, REGRET, AND RESPONSIBILITY: A REPLICATION OF ZEELENBERG ET AL. (2002)

People might regret their actions (e.g., partying before a big exam) and inactions (e.g., not studying before an exam). An influential study investigating whether people regret actions or inactions more found that it depends on the previous outcomes (Zeelenberg et al., 2002). For example, if a team has been winning their previous games, a soccer coach might regret making a change to a lineup that resulted in a loss. On the other hand, if a team has been losing their previous games, a soccer coach might regret not making a change to their lineup. In other words, when the past outcomes are positive, people regret action more than inaction, but when the prior outcomes are negative, people regret inaction more than action. We replicated Zeelenberg et al.'s (2002) study using two different samples (502 participants recruited online and 316 students). Consistent with the original findings, we also found that perceived regret was highest about action after positive outcomes, but highest after inaction after negative outcomes. Furthermore, we found that this effect appears to be driven by feelings of responsibility for the outcomes. Overall, our replication increases confidence that regret is influenced by previous outcomes.

Erin Lee, Psychology, Undergraduate Student

Faculty Mentor: Lisa Emery, Arts and Sciences

Co-Author(s): N/A

Title: NEUROTICISM: HOW IT RELATES TO EMOTIONAL INSTABILITY AND NEGATIVE AFFECT

Neuroticism is a frequently measured personality trait used in a variety of fields in psychology. This widespread use has led to variability in the way neuroticism is defined in different studies. One of the main points of inconsistency is whether emotional instability is included as a characteristic of neuroticism or as a separate, but related, construct. In the current study, we use data from a previous experiment to explore three possible hypotheses: neuroticism is mainly characterized by high negative affect, neuroticism is mainly characterized by emotional instability, or both constructs characterize neuroticism. We observed between and within-subject differences of participants scoring at different levels of neuroticism by measuring their momentary mood at distinct stages after a mood induction. Using a series of ANCOVA analyses, we found that neuroticism was typically associated with higher negative affect. The results further clarify the true characteristics of neuroticism and provide support for which definition should be typically used.

Ava Young, Psychology, Undergraduate Student

Faculty Mentor: Yalcin Acikgoz, Arts and Sciences

Co-Author(s): Cori Ferguson, Julie Brooks, Rachel Bellflowers, Nicholas Granowsky

Title: SUFFERING FROM WHIPLASH? THE EFFECTS OF PENCIL WHIPPING ON DATA VARIABILITY IN THE SAFETY INDUSTRY

Big data is being used by organizations to identify trends and predict future safety incidents. However, analytics using big data relies heavily on data quality, which can be compromised by a lack of data variability. In the safety industry, the data reports most frequently analyzed include checklists that are filled out by managers and operators, and research is being attempted to link the variables from these reports to safety outcomes. A major obstacle is the reduced variability in these reports due to a phenomenon known as pencil whipping. Pencil whipping occurs when an employee completes a safety checklist during behavior-based safety observation without actually carrying out the work required (e.g., checking safe all the way down the checklist; Ludwig 2014). In order to run analyses that will create targeted interventions, organizations need to reduce pencil-whipping in their reports. This study will attempt to identify data markers of pencil whipping and will investigate the effects of pencil whipping on data variability and analysis by using a culture survey from Elevate Textiles.

Amaka Imoh, Psychology, Undergraduate Student

Faculty Mentor: Denise Martz, Arts and Sciences

Co-Author(s): Amy Dellinger Page

Title: APP STATE FEMALE STUDENTS: RELATIONSHIP BETWEEN POLYVICTIMIZATION OF INTERPERSONAL VIOLENCE AND MENTAL HEALTH

Systematic research has established connections between interpersonal violence (IPV) and psychological disorders. The present study assessed the relationships between

polyvictimization (PV)—multiple forms of IPV—and mental health in female college students at App State using a DSM-V psychological disorder screener and a demographics survey. Female participants (N=134) were recruited for the study via SONA. Average age was 19.6 years, 83% were Caucasian, 88% were heterosexual, and 32% reported a current mental health diagnosis. Participants were asked about IPV, and 47% reported having experienced at least one form. The DSM screener included 13 psychological domains showing sleep problems (14%) as most common among participants. A continuous variable, Total IPV, quantified PV, and the DSM domains were summed, variable Total DSM. A univariate ANOVA on sexual orientation (heterosexual vs non-heterosexual) found a difference in Total IPV, with heterosexuals reporting fewer cases of PV, $F(1,134) = 11.1, p < .001$, but no differences in Total DSM. A multiple regression run using the psychological domains initially correlated as Total IPV predictor variables found that only Somatization disorders ($\beta = .40, p < .001$) and Suicidal Ideation ($\beta = .37, p < .002$) were predictors of Total IPV ($R^2 = .27$). This study suggests many App State women have experienced IPV, almost one-third report a current psychological disorder, and PV is significantly related to somatization and suicidal ideation.

SOCIOLOGY

Carter Blue, Sociology, Undergraduate Student

Faculty Mentor: Ellen Lamont, Arts and Sciences

Co-Author(s): N/A

Title: COERCION AND CONTROL: UNDERSTANDING SUBTLETIES OF INTIMATE PARTNER VIOLENCE AMONG COLLEGE STUDENTS

Although many college students experience intimate partner violence (IPV), some forms of violence may be difficult for students to recognize. Abuse can be tolerated or even justified when hostile behaviors are routinely categorized as normal by the larger culture. However, as cultural narratives pertaining to gender and IPV shift towards gender egalitarianism, we've seen an expansion of what behaviors are considered violent. As a result, college students' perception and conceptualization of IPV may shift as well. Using 200 surveys and 10 in-depth interviews, I examined how students make sense of what constitutes IPV. While physical violence remains the easiest form of violence for students to recognize, some students were also able to recognize other forms of IPV including control, coercion and surveillance. However, many students also argued that the gender of a perpetrator affected whether they categorized a behavior as violent or not. Finally, even when students themselves categorized a behavior as violent, they often noted that their opinions differed from broader cultural perceptions. Such findings demonstrate that cultural discussion of IPV and gender egalitarianism is creating broader definitions of IPV among college students, but also limits who they see as perpetrators. Using this knowledge, college campuses can create gender neutral policy to better address non-physical forms of violence and student safety.

Chloe Starr, Sociology, Undergraduate Student

Faculty Mentor: Ellen Lamont, Arts and Sciences

Co-Author(s): N/A

Title: BARRIERS TO REPRODUCTIVE JUSTICE IN APPALACHIA

Research demonstrates that gender discrimination, economic inequality, and racism in the medical field limit women's access to reproductive healthcare. Yet Appalachian residents are often overlooked in these studies. As a result, we know little about additional challenges they may face accessing these services. I conducted 10 in-depth interviews with healthcare workers in Appalachia to understand 1) how healthcare workers make sense of the barriers women in the region face, 2) how they facilitate access or not, and 3) what resources or efforts they believe are necessary to facilitate better access. Providers emphasized three main barriers. First, they discussed a lack of cultural competence among providers. Second, they found infrastructural barriers, including a lack of transportation and funding, and locale of services. Finally, they identified sociopolitical constraints, such as wait periods for abortion services and the growing number of crisis pregnancy centers in the region. Providers argued for expanded legislative support of reproductive healthcare and enhanced cultural competency in the field in order to improve accessibility. However, I found that although providers hold insight into the needs of patients, they also maintain beliefs that lead them to be gatekeepers of care themselves. I argue that Appalachian healthcare providers require a cultural competency education and that legislative progress is necessary for full accessibility of these services.

WALKER COLLEGE OF BUSINESS

BUSINESS

Megan MacDonald, Accounting, Graduate Student

Faculty Mentor: Tammy Kowalczyk, Business

Co-Author(s): Lakshmi Iyer, Gregg Marland, Dennis Gilfillan

Title: A COMPARATIVE ANALYSIS OF CARBON EMISSIONS FROM COUNTRIES OF VARYING FOSSIL FUEL DEPENDENCE

Carbon Dioxide emissions globally have been increasing to unprecedented levels in recent years due to the widespread use of fossil fuels. This research is focused on determining primary drivers of CO₂ emissions and examining patterns of emissions globally using the Kaya Identity. The Kaya Identity states that carbon emissions are a function of population, wealth (per capita gross domestic product (GDP)), energy intensity (energy used per unit of GDP), and carbon intensity (CO₂ emitted per unit of energy used). These Kaya factors guided data collection to evaluate what drives emissions for every country possible. A Log Mean Divisia Index was used to decompose changes in CO₂ emissions attributable to changes in each of values. After this processing, each country represented the factors over the years 2005 to 2015. The Kaya factors were then entered into a clustering model to group countries based on the most critical factors and similar CO₂ emissions patterns over time. The optimal number of clusters was 3 based on multiple indices used for evaluating cluster analysis. The model grouped countries into one large cluster with 146 countries, mainly driven by population changes over time; an intermediate cluster of 23 countries mainly driven by changes in GDP, and a small cluster mainly driven by decreasing energy intensity. A sensitivity analysis revealed that of all the Kaya factors, GDP

seems to most strongly impact how countries clustered. This analysis answers which factors of the Kaya Identity are driving how groups of countries emit and provides insight into the way that the rest of the world emits beyond just the heavy emitters China, India, and the United States.

COMPUTER INFORMATION SYSTEMS

Blaise Smith, Computer Information Systems, Undergraduate Student

Faculty Mentor: Jason Xiong, Business

Co-Author(s): NA

Title: THE OPPORTUNITIES AND CHALLENGES OF BLOCKCHAIN ADOPTION IN SUPPLY CHAIN MANAGEMENT

Blockchain and its related technologies start to present the business values recently. The purpose of this study is to analyze blockchain adoption within the field of supply chain management by looking at companies that have already put into place blockchain technology practices. Before looking at blockchain applications, you first need to have a basic understanding of blockchain technology. Blockchain, was first introduced to the public in 2008 after Satoshi Nakamoto, whose identity is kept secret, released the whitepaper Bitcoin: A Peer to Peer Electronic Cash System (Marr, 2018). Since then, fascination has grown exponentially with Blockchain technology, and with cryptocurrencies in general. Blockchain technology is the foundation of cryptocurrencies. It is also a shared ledger that cannot be altered and facilitates the process of transactions and tracking assets in a business network. Since blockchain technology is a fairly new topic, there is much to be looked at with thinking about its impacts, good or bad, on the field of supply chain management. Within this study I will look at challenges that companies will face or potential opportunities when putting into place blockchain adoption. This study looks at blockchain adoption within real companies. It will also look at the effects on various aspects of supply chain management, such as quality, efficiency, traceability, and more.

ECONOMICS

Henning Tovar, Economics, Graduate Student

Faculty Mentor: John Whitehead, Business

Co-Author(s): N/A

Title: THE HEALTH IMPACT OF COAL MINING: A MULTILEVEL REGRESSION ANALYSIS

Coal mining has a well-established detrimental effect on the health miners working in coal mines. However, it is less clear how mining affects the communities living around the mining area. Recent research has pointed towards increased mortality rates in coal mining areas, but the statistical analyses used to produce this association were flawed. In my research I point out the methodological problems with former research and argue for the use of hierarchical regression models instead.

My analysis investigates the relationship between county level mortality rates and coal mining across the entire United States. The multilevel regression model incorporates the effect of time over 8 years and includes county level data for all counties over the time span. Further, the

model accounts for control variables most used in the literature including economic factors and demographics, county level health indicators, and educational data. Holding all other factors constant, I find that mining does not statistically significantly affect mortality rates for the entirety of the United States. However, at the state level the effect of coal mining varies considerably, indicating different effects for some coal mining states. The mixed results point towards the disproportional effect individuals unaffiliated with the mining industry face by living in a mining area. Further, the results indicate the necessity for further state-level research.

Tristan Winkle, Economics, Graduate Student

Faculty Mentor: Guignet Dennis, Business

Co-Author(s): N/A

Title: URBAN OIL WELLS: A HEDONIC ANALYSIS OF RESIDENTIAL PROPERTY VALUES IN LOS ANGELES COUNTY

Los Angeles (LA) County, California is the most populous county in the United States. At the same time, many may not know that it is also home to the Country's largest urban oil field. Urban oil wells are small-scale wells that are used to extract crude oil from underground reserves, and that are located amidst industrial, commercial, and even residential land uses. Research on urban drilling is an emerging environmental and social issue. Several studies show that a large portion of urban oil wells in LA County are in close proximity to residential areas (O'Connor & Marquez, 2017; Prichard & Simunovic, 2015). Results of these studies indicate public health and environmental equity concerns. We use Geographic Information Systems (GIS) to combine locational data of urban oil wells, neighborhood demographics, and residential transactions from 2005-2013. We find over 24,000 active, idle, or plugged urban oil wells in LA County, and that over 550,000 residential parcels (23%) are within 500 meters of an urban oil well. We conduct a hedonic price analysis using statistical regression, quasi-experimental, and matching techniques in order to compare the value of homes near an urban oil well to those in the same neighborhoods, but that are not near an oil well. Our findings may indicate an association between proximity to oil wells and lower property values. Such a result will yield important welfare and/or environmental justice implications. The estimated price differential may suggest that oil wells lower surrounding home values, that oil wells tend to be located in lower valued areas, or a combination of both.

Key words: Urban oil wells, hedonic price analysis, environmental equity

Stephen Justice, Economics, Undergraduate Student

Faculty Mentor: Dennis Guignet, Business

Co-Author(s): N/A

Title: A SLIPPERY SLOPE: A HEDONIC PROPERTY VALUE STUDY OF LANDSLIDE RISK AND ECONOMIC COSTS IN WATAUGA COUNTY

As the threat of climate change becomes more apparent, it's important to consider the local impacts of its effects on the environment, communities, and the economy. A significant impact of climate change for Watauga County is the increase in precipitation, and subsequent increased prevalence of landslides. In order to quantify the part of the costs of climate change to Watauga County, this thesis aims to measure the reduction in the value of residential properties from landslide risks. This is achieved through the use of geographic information systems (GIS)

and statistical analyses of data provided by the North Carolina Geological Survey (NCGS), the Watauga County tax office, and the US Census Bureau's American Community Survey. Using a hedonic price methods, this thesis estimates the loss in residential property values due to increased landslide risks. The thesis is currently in the data analysis stage and is set to be finished soon. Once the data is sufficiently analyzed, the total capitalization effects of increased landslide risks on residential property values in Watauga County will be estimated.

Nicholas Bailey, Economics, Undergraduate Student

Faculty Mentor: Brock Stoddard, Business

Co-Author(s): Dr. Abhijit Ramalingam

Title: EXPERIMENTAL ANALYSIS OF THE HOUSE MONEY EFFECT IN PUBLIC GOODS GAMES

Experiments in economics usually begin with an initial endowment to subjects. Essentially, subjects are given starting capital to be used in the games conducted by the experimenter. While this practice is necessary to conduct the experiment, it could potentially affect the decisions of the subjects as there is no risk of suffering any net monetary loss. This phenomenon is known as the house-money effect. Since the original discovery, the house-money effect has been applied in different contexts and settings in studies from Clark (2002) and Cardenas et. al. (2013). The results from these experiments have varied. This study served as a robustness check on past research conducted on the house-money effect.

The experiment was run with 69 subjects in two treatment groups. Of the 69 subjects who participated in the experiment, 36 subjects participated in the house treatment and 33 subjects participated in the advance treatment. Additionally, each treatment participated in two sessions spread across three weeks. In conclusion, the study did not find statistical evidence of a house money effect within the public goods environment. We believe that while a house money effect may be prevalent within other risk environments, additional experiment evidence is required to suggest the effects prevalence within a public goods environment.

Will Robinson, Economics, Undergraduate Student

Faculty Mentor: Brock Stoddard, Business

Co-Author(s): N/A

Title: ALLOCATION OF COLLECTIVE GOODS UNDER HETEROGENEITY

Strategic and social factors affect individuals' decisions within groups. In this economic study, we examine the effect of allocation methods on contributions to a collective good under different social parameters. Participants in a laboratory experiment were divided into groups and each given token endowments that could be contributed to a shared pool. The shared pool increased the value of each token by a greater amount than the value of tokens individuals kept in private accounts. Participants made decisions in this environment for ten rounds without communication. The individual incentive for members is not to contribute, but the group benefits from contributions. An outside allocator divides shares of the common pool to the contributors at the end of each round. The allocators had incentive to allocate shares in a manner that would lead to the highest possible contributions. We examine the decisions of the allocators when heterogeneity exists among group members. We find that, relative to baseline settings without allocators where the common pool is always split equally, allocators improve efficiency in

homogeneous groups. However, allocators struggle to improve efficiency in groups with heterogeneities. As heterogeneity exists in many groups and communities, our results suggest that leaders or managers with allocative power may not always be able to improve efficiency through allocating shares of voluntarily-provided common pools.

Carlie Smith , Economics, Undergraduate Student

Faculty Mentor: Brock Stoddard, Business

Co-Author(s): N/A

Title: FRAMING & INEQUALITY IN PUBLIC GOODS GAMES

We study framing effects in repeated social dilemmas by comparing payoff equivalent Give and Take framed public goods games under varying endowment and productivity inequality. In the Give frame, group members contribute endowed tokens to a public good. In the Take frame, group members can take from an existing public good up to a predetermined limit. Within games that reflect endowment inequality, four group members will be divided, half each receiving 15 convertible tokens (or a maximum take of 15 tokens) and the other half each receiving 5 convertible tokens (or a maximum take of 5 tokens). Within games that reflect productivity inequality, group members will have different capabilities for producing a public good. Token contributions to (or tokens left in) the public good by half of the group members will have a higher production value for the group than the production value of tokens from the other half of the group members. We will be analyzing decision making across 10 decision rounds, to assess whether framing and inequality affect subjects' decisions. We will utilize statistical hypothesis tests and regression analysis to perform our behavioral analysis.

Steven Striplin, Economics, Undergraduate Student

Faculty Mentor: Brock Stoddard, Business

Co-Author(s): N/A

Title: THE EFFECT OF SHORT-TERM USERS IN A COMMON POOL RESOURCE ENVIRONMENT

This experiment examines the effects of over-extraction on a common pool resource (CPR). In the examples from the field we are interested in, short-term users can over-extract from CPRs, destroying cooperative norms that exist with only long-term users. We examine three treatments that vary group size and duration of group membership. Each user participated in a known finite number of decision rounds. In two of the treatments, there were only long-term users, one treatment with groups of three users and the other with groups of four. The third treatment had groups of three long-term users and one short-term user. Existing CPR research uses a non-linear payoff function to approximate a real-world environment with less extreme self-interested Nash equilibria and social optimum. We modify this payoff function to incorporate damages across time when the CPR is over-extracted. We introduce a variable R into the CPR payoff function as an inter-temporal multiplier that approximates over-extraction. The R variable is used to lower CPR payoffs for all group members in the subsequent round when extraction of the CPR is beyond a predetermined threshold. In the two treatments with only long-term users, a subgame perfect Nash equilibria exist where no damages occur. In the treatment with long-term users and one short-term user, damages occur when the Nash equilibrium is pursued. The experiment tested these predictions in a controlled laboratory environment. The primary finding

is that groups of four long-run players were in the damaged state more frequently than groups of three long-run players and one short-run player, contrary to predictions. The short-run players also displayed less aggressive behavior than predicted, frequently investing far below their Nash equilibria.

Decker Logan, Economics, Undergraduate Student

Faculty Mentor: Dennis Guignet, Business

Co-Author(s): N/A

Title: ROAD SALT, LAKE WATER QUALITY, AND THE IMPACTS ON HOME VALUE

Sodium Chloride (NaCl) is commonly used as road salt by local, state and federal governments to melt snow and ice on roadways, and reduce risks when traveling in hazardous conditions. Road salt has been commonly applied since the 1940s, and its use had doubled from 10 million tons in 1975 to 20 million in 2007 (Kelly et al, 2019). This trend directly correlates with increased levels of chloride in streams and lakes (Kaushal et. al. 2005). High levels of chloride in streams and lakes adversely impact water quality, as well as the aquatic and terrestrial ecosystems around these water bodies. This study examines how chloride pollution impacts nearby residents by analyzing the effects on home values around contaminated lakes. Although there are many studies that estimate the capitalization effects of water quality on house prices (Nicholas & Crompton, 2018), none examine the price effects of increased salinity in freshwater lakes. This study examines residential transactions in Dutchess, Orange, Putnam, and Ulster Counties in New York State. Residential property transactions from 2003 to 2015 were obtained from the individual county assessment offices, and are linked to data on chloride levels from the US Water Quality Portal. Preliminary analysis of 222 residential transactions within 1500 meters of a lake in Dutchess County suggests that 186 had levels of chloride higher than 250mg/L which, as a point of reference, is the EPA's secondary standard for chloride in drinking water. The next steps are to use multivariate regression techniques to investigate the effect of chloride levels in lakes on residential housing prices. Doing so allows us to isolate the potential price effects on homes, and to examine how those effects evolve with distance from the lake. The results of this study will inform decisions regarding the optimal use of salt de-icers on public roadways.

MARKETING AND SUPPLY CHAIN MANAGEMENT

Abigail Edwards, Marketing and Supply Chain Management, Undergraduate Student

Faculty Mentor: Pia Albinsson, Business

Co-Author(s): N/A

Title: THE ADVERTISING EFFECTIVENESS OF ANTHROPOMORPHIC BRAND MASCOTS VERSUS SPOKESPEOPLE IN A COLLABORATIVE ECONOMY

This research examines the advertising effectiveness of anthropomorphic spokes-characters versus spokespeople in a collaborative consumption context. There is a plethora of extant research focusing on how anthropomorphism works in marketing schemes and contexts . For example, prior literature has examined the effectiveness among different kinds of spokespeople (e.g., Male/Female, Customer/Celebrity, CEO/Founder, Consumer/Spokes-

character/celebrity/Employee) in different consumer-product settings. Out of human spokespeople, celebrities often take the lead in popularity and effectiveness due to the credibility and attractiveness they bring to the brand. However, the use of people, celebrities in particular, do not come without risk as their personal (mis)behavior may transfer to negative attitudes towards a brand. The use of animated and animal characters bypasses this risk. As limited extant research compares the effectiveness of brands using a spokesperson versus an anthropomorphized brand character, our aim is to close this research gap. The pilot study utilized ANOVA to test for interaction and main effects of type of endorser and product category on advertising effectiveness. The pilot test shows no difference between treatment effects. Our findings show that for our data the use of a spokesperson or a spokes-character did not differ in terms of advertising effectiveness (Aad, Ab, attitude towards the endorser, or behavioral intentions). This could be an interesting finding and a starting point for marketing managers to consider the use of anthropomorphic characters instead of using celebrities that comes with a risk as personal (mis)behavior can negatively affect a brand's reputation. This research is not without limitations. The stimuli were created by the research team and not professionals. We are currently conducting a follow-up study that will feature just one product category (home sharing) and two types of endorser (spokesperson vs. brand character).

Rachael Beller, Marketing and Supply Chain Management, Undergraduate Student

Faculty Mentor: Pia Albinsson, Business

Co-Author(s): n/a

Title: RECRUITING STUDENTS IN HIGHER EDUCATION IN THE AGE OF SOCIAL MEDIA

This study aims to develop a deeper understanding of recent integrated marketing communication (IMC) practices by higher education institutions in the recruitment of students. Using qualitative research methods, I present the findings from in-depth interviews and survey results with current students in order to better understand which promotional and recruitment efforts were successful in attracting students to their current university. Findings from the eight in-depth interviews concluded that price, location, and quality of professors were the top deciding factors for students in deciding which university to attend. From these interview findings, a survey was designed to find further information about the factors that affect students university decision. The findings from running data analytics in SPSS presented results from a survey of 281 responses showing that factors such as price, location, and the reputation of a Southeastern University were the top non-academic factors and quality of education, value of education, and degree program of choice were the top academic factors in helping a student decide what university to attend. Along with these factors, we find that in-person marketing efforts are more successful than social media targeted ads in capturing a student's attention. All survey and interview procedures were approved by the Institutional Review Board.

Shannon Yates, Graduate Student

Faculty Mentor: Erich Schlenker, Business

Co-Author(s): N/A

Title: Fear Stepping to Reduce Cognitive and Social Avoidance in Low-Income, First-Year College Students

The purpose of the following research is to measure behavioral and cognitive avoidance in first-year, low-income college students before and after Fear Stepping. Fear Stepping is the act of confronting one's fear in a safe and encouraging environment by creating positive experiences that outweigh previously acquired negative experiences. In 2002, Ottenbreit and Dobson developed the Cognitive Behavioral Avoidance Scale (CBAS) and concluded that higher avoidance scores correlate to increased depression and anxiety. Avoidance behaviors reinforce the fear behind the avoidance. Fear Stepping was implemented with eight first-year, low-income college students, four in a group setting and four in a one-on-one setting, over the course of seven weeks. There were six females and two males between the ages of 17 and 20. The students took a pre-assessment and post-assessment using the Cognitive Behavioral Avoidance Scale (Ottenbreit & Dobson, 2002) at the beginning and end of the seven week period. This assessment measures four types of avoidance including behavioral social, behavioral non-social, cognitive social, and cognitive non-social. Every student showed lower avoidance scores in at least two out of the four avoidance categories. Five out of the eight students showed lower avoidance in three or more of the four avoidance areas. Seven out of the eight students showed lower cumulative avoidance scores, ranging from five to thirteen points. For students that showed increased avoidance in any of the four avoidance areas, the median cumulative increase in avoidance was one point. The median cumulative decrease in avoidance was 8.5 points. This research concludes that Fear Stepping can decrease cognitive and behavioral avoidance in low-income, first-generation college students.

REICH COLLEGE OF EDUCATION

HUMAN DEVELOPMENT AND PSYCHOLOGICAL COUNSELING

Kirsten Cole, Human Development and Psychological Counseling, Graduate Student

Faculty Mentor: Dr. Geri Miller, Education

Co-Author(s): Tuesday Feral

Title: The Integration of SUD EPB Counseling Applied to the Transgender Population

Increasingly counselors have used Evidence-Based Practices (EBPs) that have been shown to be effective with the substance use disorder (SUD) population. This panel presentation integrated SUD EBPs within the transgender population. While research is limited on the rates of SUD in the transgender population, there is evidence that they: have a heightened risk for substance abuse, are more likely to seek SUD treatment than the non-transgender population, have greater frequency of mental health problems (i.e. depression, suicidality, self-harm, eating disorders), and have unique factors such as homophobia/transphobia, family problems, violence, and social isolation (Day et al., 2017; NSDUH, 2015). The three main points of the presentation were: 1) transgender population research is limited, 2) the therapeutic relationship is a cornerstone (e.g. use of the EBP of Person-Centered Therapy, and 3) therapy needs to target maladaptive thoughts/behaviors (e.g. use of Cognitive Behavioral Therapy). The integration of these 3 counseling areas (SUD, EBP, Transgender) is both pioneering and timely for counselors working with the transgender population.

Brandy Nickels, Human Development and Psychological Counseling, Graduate Student

Faculty Mentor: Laura Gambrel, Education

Co-Author(s): Jordan Gale

Title: White Fragility and Mindfulness: Student Perspectives on the Benefits of this Intersection

This presentation will focus on ways to utilize mindfulness techniques for self-care and self-compassion to combat disconnection and shame that can interfere with acknowledgement of white privilege. The concept of white fragility will be outlined as well as the possible implications of it for social justice work among white graduate students. Additionally, specific ways graduate students can apply mindfulness techniques for the self will be presented with the purpose of engaging in social justice work more sustainably.

COLLEGE OF FINE AND APPLIED ARTS

APPLIED DESIGN

Cat McDiarmid, Applied Design, Undergraduate Student

Faculty Mentor: Chelsea Helms, Fine and Applied Arts

Co-Author(s): N/A

Title: DESIGNING FOR CRISIS: A NEW APPROACH TO APPROPRIATE INTERIOR DESIGN SOLUTIONS FOR CLIMATE MIGRANTS

Populations and entire cultures are being displaced due to changing climate, disappearing land, and extreme temperature and weather. There is an urgent necessity to determine architectural and design solutions that specifically and appropriately address essential needs accompanying this growing concern. Current solutions are often temporary answers to a long-term problem and fail to provide for other needs that accompany displacement including lack of healthcare, education, jobs, and cultural services. Design solutions must provide for the other needs accompanying this unplanned and often unwanted migration, while showing empathy towards the populations impacted. As predicted numbers for displaced persons continue to rise, so too does the threat created by lack of adequate design solutions. The built environment contributes significantly to global energy usage and emissions. As the impact of climate change expands and extends, strategic design solutions are critical to support the number of displaced persons. This design research and interior design proposal addresses the challenges currently facing the Isle de Jean Charles Tribe in coastal Louisiana. The interior architectural solution provides for cultural, vocational, educational, health, and other needs identified for environmental migrants. The design gives them access to the basic needs that the climate crisis has taken away from them while creating a design precedent that can be implemented in various locations globally.

Valentina Galindo, Applied Design, Undergraduate Student

Faculty Mentor: Chelsea Helms, Fine and Applied Arts

Co-Author(s): N/A

Title: AN INTERIOR DESIGN APPROACH TO PROVIDE TRANSPARENCY IN APPAREL DESIGN, PRODUCTION, AND RETAIL

As fast fashion continues to trend, significant concerns regarding consumer waste is a growing concern. Fast fashion is an exponential concern and needs to be exposed. This research studies the opportunity to blend apparel design, fabrication, and retail space in one facility. Bringing the design process, the fabrication of the apparel, and then the retail aspect all together to provide transparency in the process. A brand that will not shy away from teaching people the whole process from making the design all the way to selling the product, this interior design solution will take a similar approach. The design philosophy is to accomplish transparency, the quality of being easily seen through, in fashion. Companies that show who they truly are and what they believe in are not easily found. By providing a design solution that allows for design and production, the fast fashion norm can be challenged. A place where the design process, fabrication and/ production, and retail interact in the same location will begin to reshape the future of apparel design and merchandising.

Laney Branch, Applied Design, Undergraduate Student

Faculty Mentor: Chelsea Helms, Fine and Applied Arts

Co-Author(s): n/a

Title: Designing a “Safe Space” for Servicewomen of the U.S. Military : Physical, Mental, and Vocational Preparation for Civilian Life

Female servicewomen and female veterans often face many challenges during and after serving for the U.S. military. These challenges can make transitioning into civilian life difficult and can hinder overall wellbeing if not addressed appropriately. By addressing and better understanding mental health and vocational difficulties faced by these women, we can make life better for female servicewomen both during and after their time of service. Some of these difficulties include finding community, healing from PTSD symptoms involving combat or sexual trauma, as well as finding proper employment once military service has ended. By creating a Mental Health and Vocational Rehabilitation clinic solely for women of the military, for both current and former servicewomen, this population can receive dignity in treatment and transitioning into civilian life. Understanding how a variety of interior design elements play a role in life improvement and healing is crucial. These elements include: lighting, acoustics, spatial configuration and materiality. Understanding how these design elements play a role in a physical space meant for self-betterment can improve mental health and vocational rehabilitation efforts. Through this, the long-term effectiveness of these treatments can be improved, providing the dignity in healing needed for this demographic. A review of the literature regarding current treatments in the mental health and vocational rehabilitation industries for female soldiers and veterans is necessary to understand how to accomplish an effective design for this type of treatment center. This paper intends to address how design can improve these factors in developing a safe space for women of the military. Ultimately, it will be used as a guideline for designing a physical space that addresses all of these specific needs to improve the lives of women of the military.

Clark Black, Applied Design, Undergraduate Student

Faculty Mentor: Charles Debelius, Fine and Applied Arts

Co-Author(s): N/A

Title: BoardWalk

The setting of this project is the swampy marsh of the Florida Everglades. The project is not a desolate location, for it was the location of an existing boardwalk. A boardwalk which takes in the beautifully expansive views focused toward the southwest, with maybe a patch of pine trees here or there. The Boardwalk tells a history of itself, a history of repair and adaptation. Through the 1950's, 60's, and so on the boardwalk has been added individual strips of boardwalk lapping over one another at their terminal points but without touching. The lanes of the boardwalk must be independent since they were built at different times, because the new structures cannot depend on 10 year old structures. One new lane after the next the boardwalk seemed to develop a more natural promenade that took better advantage of the Everglade scenery. The task that was presented for this site was to create a form of shelter for travelers experiencing the untouched environment to rest, hidden from the intense heat, and potentially enjoy an informative lesson on the surrounding ecosystems. The response is a passively ventilated organic structure that straddles the boardwalk, leaving it untouched just as the surrounding environment must remain. The structure situates itself at an intersection of two major lanes on the boardwalk. Here the travelers find themselves at a cooler comfort as soon as they are under the space. They travel up a bended stair that leads to a magnificent view from a birds eye view 20 feet off the ground. Then they are led by the organization of the benches to a seat or to another perspective. The Structure has a horizontal hierarchy but an irregularly oriented Unit to Whole. This can be seen as the smaller cubical form pokes through the top of the wider rectangular form as if to poke its head out to in the view for itself.

ART

Joel Crothers, Art, Undergraduate Student

Faculty Mentor: John Stephenson, Fine and Applied Arts

Co-Author(s): N/A

Title: ANTIQUE AESTHETICS: HOW MUSEUMS DISPLAY ANCIENT OBJECTS

Museums at their best serve as both collections and visual galleries. Although the bulk of the academic work takes place behind the exhibit halls and with objects and specimens not usually seen by the public, the draw of these institutions is their displays. Regardless of a museum being designated to the arts, natural sciences, or history, the exhibits are what draw visitors to their spaces, and what fuel a multi-billion dollar global industry. The reality of museum collections is that many of these artifacts, works of art, and specimens are incredibly ancient, fragile, and often already broken. To combat this issue, museums have created a plethora of methods and techniques to preserve and present their treasured collections. These range from full scale restorations of broken objects in which the missing parts are essentially recreated, to raw non-intrusive displays in which the piece is presented in its shattered form. The method of the display is usually indicative of the budget and or exhibition mindset of a museum, as well as the time period of the display's creation. Additionally the type of artifact dictates much of the institutions approach to their exhibit. Though museums act as scientific and artistic archives for researchers and in their respective fields, they also must serve their publics, schools, and local

cities. It is up to the institution to decide what is the best way to present their ancient objects and inspire and educate their visitors.

SUSTAINABLE TECHNOLOGY AND THE BUILT ENVIRONMENT

Christopher Lauer, Sustainable Technology and the Built Environment, Graduate Student

Faculty Mentor: Brian Raichle, Fine and Applied Arts

Co-Author(s): N/A

Title: MINIMIZING GRID INTERACTION WITH A RESIDENTIAL SELF_CONSUMPTION SYSTEM THAT INCLUDES PV AND BATTERY STORAGE

As development of the solar PV industry continues to expand concerns about the affects intermittency will have on grid stability will continue to grow. In order to reduce concerns about grid stability and otherwise preserve the value of PV electricity for residential PV homeowners one solution may be the installation of self-consumption PV systems with battery storage. A self-consumption system can be defined as one that prioritizes electricity consumption by the electricity producer, therefore minimizing grid interaction. Self-consumption has been shown to be regularly enhanced by the existence of battery storage within the system, though the extent of this varies by system component capacity and installed region. This study examines the effect a PV and battery storage self-consumption system has on a model residential home in Boone, NC and its interaction with the utility grid. The performance of the self-consumption system is compared to an equivalent PV only no battery storage model system, and a no PV or battery storage model system. It is seen that the implementation of the self-consumption with PV and battery storage reduces grid imports and exports relative to the aforementioned modeled systems.

Adam Mancini, Sustainable Technology and the Built Environment, Graduate Student

Faculty Mentor: Marie Hoepfl, Fine and Applied Arts

Co-Author(s): N/A

Title: A PRELIMINARY COST-BENEFIT ANALYSIS OF PERMEABLE PAVEMENT: BEAR POPLAR COMMUNITY CASE STUDY

A net present value (NPV) calculation is conducted to evaluate the costs of using pervious concrete in place of conventional concrete in a proposed eco-community in North Carolina. Factors considered include cost of installation of the pavement, costs of stormwater infrastructure and associated offset of using pervious concrete, maintenance costs, and the environmental benefits of runoff reduction. Environmental benefits are monetized by using a direct benefit transfer function to determine resident willingness-to-pay (WTP) for improved water quality. Results show that in the majority of cases, pervious concrete has a higher NPV than typical concrete over a 35-year life cycle despite the need for replacement after 25 years. Of particular note is the impact of stormwater infrastructure installation and maintenance costs on the long-term value of the pervious and impervious systems.

Aaron Bradshaw, Sustainable Technology and the Built Environment, Graduate Student

Faculty Mentor: Jeremy Ferrell, Fine and Applied Arts

Co-Author(s): N/A

Title: ANALYSIS OF CONVERTING BIOMASS FROM CBD PROCESSING TO BIOCHAR

Since the Agricultural Improvement Act of 2018, the cultivation and production of industrial hemp in the United States has grown exponentially. The problem with this newly emerging industry, is the amount of waste generated from mass production. The current trend is that most of the industry's waste ends up in landfills, which perpetuates greenhouse gas emissions (Black, 2017). This biomass waste stream could be utilized through the production of biochar. Biochar is a soil amendment designed to reintroduce nutrients and microorganisms into soils to increase fertility; biochar has also been acknowledged to increase water holding capacity, remove toxins, and sequester carbon (Yu, Harper, Hoepfl and Domermuth, 2017). Currently, there is no research that characterizes industrial hemp waste from cannabinoid extraction as a biochar feedstock. The purpose of this study is to determine the potential hemp waste, from CBD processing, has as a biochar feedstock and soil amendment. In an effort to do so, this research is aimed at developing characterizations of industrial hemp waste as a biochar feedstock through these three metrics: CHN (carbon, hydrogen, and nitrogen) ratios, CEC (cation exchange capacity) and surface area. Samples were made using the benchtop kiln located in room 41 of Katherine Harper at Appalachian and using the pilot scale kilns located at the Nexus research facility. Characterizations were determined by tests performed in on-campus labs and external lab testing.

Michelle Stanziola, Sustainable Technology and the Built Environment, Undergraduate Student

Faculty Mentor: Charles Debelius, Fine and Applied Arts

Co-Author(s): N/A

Title: CASE STUDY ON FORM AND SPACE

Architectural form and space study to analyze the effects of moving forcing when creating space. Using inspiration from well-known pieces, forces are applied to create a new sense of space.

BEAVER COLLEGE OF HEALTH SCIENCES

COMMUNICATION SCIENCES AND DISORDERS

Shelby Baker, Communication Sciences and Disorders, Graduate Student

Faculty Mentor: Joesph Klein, Health Sciences

Co-Author(s): Faith Kreoger, Bailey Schneider, Kinley Brown, Madeline Morgan

Title: Research Emphasis of The Journal of Fluency Disorders

The International Classification of Functioning, Disability, and Health (World Health Organization, 2001) classifies health and health-related conditions of individuals. It is divided into Functioning and Disability and Contextual Factors. Functioning and Disability is divided into Body Functions/Structures (BF&S) and Activity/Participation (A/P). Environmental factors (EF)

and Personal Factors (PF) are considered Contextual Factors. These four categories interact with one another and with the individual's health conditions. Factors can facilitate or hinder quality of life. The Journal of Fluency Disorders (JFD) is the only publication devoted specifically to fluency. It provides information about the clinical, experimental, and theoretical aspects of stuttering. The purpose of this research is to identify ways in which stuttering research has changed over time and to identify any factors that require further inquiry.

Methods: Articles published in JFD from 1974 to 1979 were compared with articles published between 2015 and 2019. Results: Of 79 articles published between 1974 and 1979, researched coded 61% as BF&S, 8% as A/P, 24% as environmental, and 8% as personal factors. From 2015 to 2019, 119 articles were published. Researchers coded 56% as BF&S, 2% as A/P, 19% as environmental, and 23% as personal factors. Contemporary research continues to fail to address the impact of stuttering on the participation of individuals who stutter in daily activities.

Leanna Pollack, Communication Sciences and Disorders, Undergraduate Student

Faculty Mentor: Jordan Hazelwood, Health Sciences

Co-Author(s): Clark, Makenna

Title: ONLINE RESOURCES FREQUENTLY UTILIZED BY SPEECH-LANGUAGE PATHOLOGISTS FOR DYSPHAGIA MANAGEMENT LACK RELIABILITY

Online resources provide an infinite interface for medical speech-language pathologists (SLPs) to utilize when seeking answers to clinical questions that may arise in managing patients with swallowing disorders (dysphagia). SLPs use these resources to continue their education and enhance therapeutic skills. As consumers of online information, SLPs' ability to critically review these resources for biased, unethical, or deceitful information may directly affect the health of their patients. As such, a survey of 88 SLPs from the American Speech-Language-Hearing Association's Swallowing and Swallowing Disorders Special Interest Group revealed which online resources the clinicians frequently utilized. When measured by a standardized metric for reliability and worthiness as a trusted source of information, most of the resources lacked a high level of reliability for the majority of the review criteria. The results of this study support the need for professional training in the critical review of online resources utilized for managing dysphagia.

Elizabeth Keeter, Communication Sciences and Disorders, Undergraduate Student

Faculty Mentor: Jordan Hazelwood, Health Sciences

Co-Author(s): Sartori, Kathryn

Title: SPEECH-LANGUAGE PATHOLOGY GRADUATE STUDENT CLINICIANS' SELF-PERCEIVED COMPETENCY IN DYSPHAGIA MANAGEMENT IMPROVES WITH TRAINING

Speech-language pathologists (SLPs) are the primary care providers for people with swallowing disorders (dysphagia). Despite the complexity of dysphagia, SLPs are not adequately prepared to comprehensively assess and treat this disorder. Competency in dysphagia management is imperative in order to provide the best patient care and achieve maximum quality of life. By self-assessing competency throughout their schooling, future SLPs may better direct their education as they train to become dysphagia specialists.

The Dysphagia Competency Verification Tool (DCVT) is a metric used to measure clinician competency. By modifying the DCVT for SLP graduate student clinician use, we systematically

measured the competency of knowledge and skills in the area of Clinical Swallow Assessment across two timepoints. The results of this study revealed an improvement in participants' mean scores from Timepoint 1 to Timepoint 2 in self-perceived competency for both General Skills and Direct Patient Care. We will detail these results and explore future directions by explaining how SLP graduate student clinicians' perception of competency may change throughout their program of study.

Claire Roberts, Communication Sciences and Disorders, Undergraduate Student

Faculty Mentor: Laura Chapman, Health Sciences

Co-Author(s): Elizabeth C. Nolen, Danielle Shanley

Title: DOES DEMYSTIFYING THE RESEARCH PROCESS INFLUENCE UNDERGRADUATE INTEREST IN RESEARCH?

Background. There has been a recent decline in Speech-Language Pathology (SLP) Ph.D. candidates. This may lead to a loss of clinical resources, funding sources, and research autonomy for future clinicians and researchers. Practicing SLPs reported a lack of interest in research as one of the top reasons for not pursuing a doctoral degree. The purpose of this study was to demystify the research process, and explore if exposure to and explanation of relevant research would increase undergraduate students' interest in research and/or a research-related career path. **Methods.** Summaries of influential research articles were embedded into CSD 2259 (Communication Disorders). Summaries were designed to introduce students to components of the research process, and make connections between research and clinical practice. Interest in research was gauged by pre/post surveys, generating both quantitative and qualitative data. **Results.** Results from the post-survey indicated that students had more knowledge of components of the research process, but this did not lead to a significant increase in interest in research. Increasing interest likely requires a multi-faceted approach; analysis of qualitative responses from the post-survey provide several concrete suggestions. **Impact.** This study sets the stage for future work aimed at increasing Ph.D. candidates in the field, a lack of which would impact preparation of future professionals and jeopardize the quality of research in the field.

Emily Wren McDaniel, Communication Sciences and Disorders, Undergraduate Student

Faculty Mentor: Joseph Klein, Health Sciences

Co-Author(s): Sydney Shank

Title: SCHOOL AGE STUTTERING THERAPY: A CALL FOR COMMUNITY BASED PARTICIPATORY RESEARCH

Many studies (e.g., Brisk, Healey, & Hux, 1997; Kelly et al., 1997; Mallard, Gardner, & Downey, 1988; St Louis & Durrenberger, 1993; Tellis, Bressler, & Emerick, 2008) have documented that speech-language pathologists feel less prepared and less competent when treating children who stutter than when treating other clients on their caseloads (children with language disorders, speech-sound disorders, etc.). Although we have known this since the 1980s, little has changed. The ultimate goal of this project, therefore, is to improve therapy for children who stutter by using Community Based Participatory Research (CBPR). CBPR is a partnership approach to research that includes (for example) consumers, organizational representatives, therapists, and researchers in all aspects of the research process. Importantly, all partners contribute expertise and share decision making and responsibilities. The purpose of CBPR is to

increase understanding of a phenomenon and use that knowledge to improve the quality of life of community members (Israel, et al., 2003 & 2005). Articles are beginning to appear that introduce CBPR to clinicians of other disorders that SLPs treat, such as autism (Donaldson, Krejcha, & McMillin, 2017), but as of today, no articles have been published describing the use of CBPR with people who stutter. This paper hopes to be the beginning of that movement.

HEALTH AND EXERCISE SCIENCE

Valesha Province, Health and Exercise Science, Graduate Student

Faculty Mentor: Abigail Stickford, Health Sciences

Co-Author(s): J. Carter Luck, Jonathon L. Stickford, Abigail S.L. Stickford

Title: A COMPARISON OF NEURAL CARDIOVASCULAR CONTROL IN PHYSICALLY ACTIVE AND SEDENTARY YOUNG WOMEN

Improvements in neural cardiovascular control may lead to lower risks of cardiovascular disease (CVD). The impact of exercise training on neural control, specifically in women, remains unclear. The purpose of this study was to investigate sympathetic activity and reactivity in physically active and sedentary young women. **METHODS:** Physically active (PAW, n=7) and sedentary (SED, n=7), yet healthy, young women participated in this study. Exercise history and peak aerobic capacity were measured. Likewise, muscle sympathetic nerve activity (MSNA), heart rate (HR), and systolic (SBP) and diastolic (DBP) blood pressures were measured continuously at rest, and during cold pressor (CPT) and dynamic hand-grip (DHG) tests. **RESULTS:** Baseline characteristics were similar; PAW had higher VO₂ max values than SED. Beat-by-beat SBP during spontaneous breathing (SB) was lower in PAW than SED. HR tended to be lower in PAW compared with SED during SB. MSNA burst frequency was lower in PAW than SED during CB. A significant group x time interaction was found for total MSNA, with SED exhibiting greater MSNA response to the CPT. During DHG, average SBP tended to be higher in SED than PAW. **CONCLUSION:** Preliminary results indicate physical activity may alter autonomic and cardiovascular function at rest and in response to a painful stimulus. Further testing will help determine if physical activity or fitness, alters MSNA responses to stressors, as well as if a dose-response exists.

Danna Rodriguez, Health and Exercise Science, Graduate Student

Faculty Mentor: Abigail Stickford, Health Sciences

Co-Author(s): Danielle Nunnery

Title: EXERCISE BEHAVIORS AND BELIEFS AMONG PREGNANT WOMEN IN RURAL COMMUNITIES

Purpose: To determine beliefs about exercise during pregnancy in pregnant women living in rural areas of North Carolina. By obtaining an understanding of women's beliefs, we can more effectively promote safe exercise, and educate on the prevention of preeclampsia, gestational diabetes, and bedrest through exercise. **Methods:** Electronic and paper surveys were placed in professional healthcare settings to pregnant women living in rural areas of western North Carolina. Participation was voluntary and anonymous. **Results:** 50 women (age 27.9 ± 7.4 yrs) completed the survey. Nearly all women (87%) believe it is safe to perform light intensity

exercise during pregnancy, while fewer agree moderate (64%) or vigorous (18%) intensity exercise is safe. Most women believe exercise increases the risk of falling during pregnancy (85%). Only 45% believe that women should continue their exercise regimen, and 11% believe that previously inactive women can begin exercise training while pregnant. Less than one-third of women do moderate-intensity exercise ≥ 2 days per week. Additionally, the majority (62%) of pregnant women do not engage in vigorous exercise, and most (73%) do not engage in resistance exercise. Conclusion: Based on our findings, pregnant women are participating in light intensity exercise, but are not meeting ACSM guidelines for aerobic exercise. In addition, resistance exercise is not popular in this community, and knowledge related to safe exercises during pregnancy is limited.

Nina Stute, Health and Exercise Science, Graduate Student

Faculty Mentor: Abigail Stickford, Health Sciences

Co-Author(s): Jonathon Stickford PhD, Rebecca Kappus PhD

Title: CARDIOVASCULAR RESPONSES TO PHYSIOLOGICAL STRESS IN ANXIOUS AND NON-ANXIOUS YOUNG ADULTS

BACKGROUND: Anxiety is associated with the incidence of high blood pressure and cardiovascular disease. It is unknown if healthy anxious young adults exhibit markers of cardiovascular dysfunction. The purpose of this study is to examine cardiovascular function in anxious (ANX) vs. non-anxious (NON) college-aged students. METHODS: NON (n=4) and ANX (n=8) subjects were recruited from a university setting. Anxiety classification was determined by the General Anxiety Disorder-7 questionnaire. Beat by beat systolic (SBP) and diastolic (DBP) arterial blood pressure and heart rate (HR) were measured during resting conditions with 6 min each of spontaneous and controlled (12 breaths/min) breathing, a 2 min cold pressor test (CPT), a 5 min dynamic handgrip test (DHG), and 6 min each at 30° and 60° head up tilt (HUT). RESULTS: SBP, DBP, and HR were similar between NON and ANX under both resting conditions. During the CPT, the SBP change from baseline to peak was greater in ANX ($\Delta 31 \pm 18$ mmHg) compared with NON ($\Delta 17 \pm 11$ mmHg) ($p=0.09$); HR and DBP responses were similar. SBP, DBP, and HR were also similar between groups during DHG and 30° HUT. During 60° HUT, HR tended to be higher in ANX (93 ± 11 bpm) compared with NON (80 ± 9 bpm) subjects ($p=0.07$), but blood pressures were not significantly different. CONCLUSION: The preliminary results suggest that anxiety in the college-aged population can negatively impact the cardiovascular responses to painful and orthostatic challenges.

Jasmine Cash, Health and Exercise Science, Graduate Student

Faculty Mentor: Alan Needle, Health Sciences

Co-Author(s): Herman van Werkhoven

Title: THE EFFECTS OF 72 HOURS OF DYNAMIC ANKLE IMMOBILIZATION ON NEURAL EXCITABILITY

Orthopedic injuries have been shown to modify nervous system function, with ankle injuries being the most common among the physically active. Casting models have demonstrated the effects of immobilization on neural excitability; however, walking immobilizers (WI) are more commonly used following injuries. Despite this, little is known about the effects of prolonged WI

use on corticospinal (CE) & reflexive excitability (RE). We aimed to evaluate the effects of 72-hour dynamic ankle immobilization in a WI on neural excitability in an uninjured population. A crossover design was implemented using 12 healthy individuals (age: 20.8 ± 1.4 yrs, H: 1.7 ± 0.1 m, W: 75.2 ± 9.9 kg). Participants were asked to wear a WI or a compression sock (CS) for 3 days, with at least 7 days between conditions. CE was measured using transcranial magnetic stimulation over the primary motor cortex & RE was assessed using the Hoffmann reflex, with outcomes assessed for the tibialis anterior (TA), peroneus longus (PL), and soleus (SOL). CE outcome measures included resting motor threshold (RMT) & motor evoked potential (MEP) size at 90, 110, and 130% RMT. RE was determined as the ratio of the maximum reflexive (H) response to maximum direct (M) response. Differences between times and muscles were assessed with factorial analysis of variance ($\alpha=0.05$). Significant time-by-muscle interactions were observed for only RMT ($F_{6,36}=4.351$; $p=0.002$) and H:M ratio ($F_{3,33}=4.026$; $p=0.015$). Post hoc testing revealed significantly decreased RMT & H:M ratio pre- to post-WI. Results indicate WI increased CE, and decreased RE. WI have a potential to increase mechanical stiffness of the ankle joint & deprive the joint of proprioceptive feedback during gait. We postulate that increased muscle spindle sensitivity due to mechanical stiffness changes serve to raise CE; however, sensory deprivation from lack of movement serves to inhibit RE. Future studies are needed to determine effects in injured populations.

David Schumacher, Health and Exercise Science, Graduate Student

Faculty Mentor: Herman van Werkhoven, Health Sciences

Co-Author(s): Alan Needle, Jennifer Howard

Title: THE EFFECT OF MOVEMENT COMPLEXITY ON RELATIONSHIPS BETWEEN FOOT ANTHROPOMETRY AND JUMP PERFORMANCE

The purpose of this study was to investigate relationships between foot structure and jump performance and whether movement complexity influences these relationships. It is currently not known if changing the complexity of a jump from single joint to multi-joint jump alters these relationships. Thirty participants (14 ♂, 16 ♀) performed jumps with the right leg on an inclined sled. Participants performed: ankle jumps with (ACMJ) and without (ASJ) a countermovement; and whole lower extremity jumps with (CMJ) and without (SJ) a countermovement. Each jump was repeated twice while jump height was recorded. Dual energy x-ray absorptiometry scans of the right foot were used to measure Achilles tendon moment arm (ATMA), and lengths of the hallux metatarsal (MT), proximal phalanx (PP), and distal phalanx (DP). Data were analyzed using Pearson product-moment correlations and Fisher exact tests. ATMA, MT, and PP each significantly correlated with jump heights during ACMJ, CMJ, and SJ ($p < 0.05$). However, within each sex, there were no significant correlations between anthropometric measures and jump height. Fisher's exact tests revealed no significant differences in correlation strength between the different anthropometric measures and different types of jumps ($0.13 < p < 0.99$). Although ATMA, MT, and PP appear to be positive predictors of jump height, when considering men and women separately, this was not the case. Movement complexity did not affect the strength of relationships.

Lainey Hunnicutt, Health and Exercise Science, Graduate Student

Faculty Mentor: Scott Collier, Health Sciences

Co-Author(s): N/A

Title: DIFFERENCES IN SLEEP QUALITY IN ELITE YOUTH ATHLETES DURING AND AFTER THE COMPETITIVE SEASON

PURPOSE: Our study investigated the differences in sleep architecture and health in and out of a competitive season. METHODS: Nine competitive youth athletes between the ages of 12 and 16 who compete for either the tumbling and trampoline team or the diving team were recruited for this study. Data was collected for 3 consecutive nights during the competition and for 3 consecutive nights during post season. Data was then analyzed using the Sleep Profiler™ scoring software. All data is expressed as Mean +/- SEM. RESULTS: Mean nocturnal pulse was statistically different from in season versus post season ($p = 0.049$, +/- ; 66.8 ± 9.6 bpm in season versus 61.7 ± 6.3 bpm post season). Sleep efficiency, WASO, and spindle duration were all not statistically different from in season to post season. Sleep latency, REM, and NREM sleep though not statistically different from in season to post season have a strong correlation. CONCLUSION: These data demonstrate a significant decline in mean heart rate when an athlete moves from competition season to the non-competitive season. These data show that gymnastic training in addition to competition training may lead to deleterious cardiovascular changes. Future studies should elucidate the impact and volume of training a youth athlete undertakes and the benefits and risks on physiological and psychological well-being.

Jennifer Tinsley, Health and Exercise Science, Graduate Student

Faculty Mentor: Jennifer Howard, Health Sciences

Co-Author(s): Laurie Rivera, Kimberly Fasczewski, Erin Bouldin

Title: Use of a Patient-Generated Outcomes Measure to Identify those Symptoms and Activities of Greatest Importance to Collegiate Athletes

Background: There has been a strong push to utilize patient-reported outcome measures(PROMs) in athletic training(AT). PROMs evaluate patients' perceptions of their health/injury. However, the most commonly used PROMs were not designed for athletes and may not adequate. The purpose of this study was to compare the content of existing PROMs with the primary concerns of injured athletes. Methods: Injured collegiate athletes($n=149$) participated in this mixed-methods, cross-sectional study. Each completed an open-ended measure asking them to identify 3 items of greatest importance. Responses, and content of existing PROMs, were linked by 3 raters to codes in the International Classification of Function, Disability, and Health(ICF) framework. The proportion of PROM content that was represented in the most common patient-generated responses was then evaluated overall and by body region. Results: Open-ended responses yielded 594 codes. Of the 23 codes representing 80% of all Lower extremity responses, 3 were contained in a common lower extremity PROM. Of the 12 codes represented by 80% of upper extremity codes, 5 were contained in the common upper extremity PROM. Clinical Significance: Because there is so little shared content between primary patient concerns and those addressed by common PROMs, it raises concerns that existing PROMs are poorly representative of an athletic population. Therefore, they are not appropriate for examining athlete perception of their health/injury.

Nicholas Tocci, Health and Exercise Science, Graduate Student

Faculty Mentor: Marco Meucci, Health Sciences

Co-Author(s): Dana Morris, Brandon Nightingale

Title: SEX DIFFERENCES IN MAXIMAL OXYGEN UPTAKE: WHAT ARE THE MAIN CONTRIBUTORS?

The aim of this study was to assess the main factors associated with maximal aerobic capacity (VO_{2max}) in a sample of physically-active young adults. Methods: 19 college-aged students (11 males, 8 females) attended in one visit for measures of body composition (via DEXA scan), hematocrit (HCT), and VO_{2max} . Hydration status was validated by measures of urine specific gravity. An exercise test was performed on the cycle ergometer using 25 watt/minute and 20 watt/minute incremental protocols for men and women respectively. VO_{2max} , cardiac output at max (Q_{max}) and stroke volume at max (SV_{max}) were recorded using the COSMED Quark metabolic cart. Test measure means were grouped by sex and analyzed in a one-way ANOVA. Pearson's R correlations were used to determine the association between variables of HCT, lean body mass (LBM), SV_{max} , Q_{max} , and absolute VO_{2max} . Results: Males had significantly greater measures of LBM ($61.75 \text{ kg} \pm 7.67 \text{ kg}$ vs. $43.85 \text{ kg} \pm 1.90 \text{ kg}$), HCT ($47.3\% \pm 3.3\%$ vs. $42.2\% \pm 3.0\%$), absolute VO_{2max} ($3.385 \text{ L/min} \pm 0.464 \text{ L/min}$ vs. $2.439 \text{ L/min} \pm 0.300 \text{ L/min}$), Q_{max} ($20.6 \text{ L/min} \pm 2.6 \text{ L/min}$ vs. $14.87 \text{ L/min} \pm 1.84 \text{ L/min}$) and SV_{max} ($110.2 \text{ mL} \pm 13.4 \text{ mL}$ vs. $78.24 \text{ mL} \pm 7.47 \text{ mL}$) compared to females ($p < 0.05$). Correlational analysis showed that absolute VO_{2max} was positively correlated with Q_{max} ($R = 0.992$), SV_{max} ($R = 0.964$) and LBM ($R = 0.751$). Conclusion: Sex differences in maximal aerobic capacity should be understood primarily as a consequence of the sexual dimorphism in Q_{max} , body size and LBM.

Madeline Miller, Health and Exercise Science, Graduate Student

Faculty Mentor: Caroline Smith, Health Sciences

Co-Author(s): Caroline J. Smith¹, Killian D. Wustrow¹, Martin R. Root¹, Scott R. Collier¹, Emiel A. DenHartog², Xinyi, Sui², Nelson R. Vinueza²

Title: Effect of Skin Temperature on Dermal Absorption of Anthracene

In many occupations, including firefighters, tar and asphalt workers, are exposed to a multitude of pollutants such as polycyclic aromatic hydrocarbons (PAHs). Dermal absorption of potential carcinogens is challenging to measure and has received little attention compared to respiratory route of exposure. PURPOSE: Our aims are to determine the effect of skin temperature on the dermal absorption of anthracene, a non-carcinogen PAH. METHODS: Two MD fibers were placed in the ventral forearm of 6 healthy participants (32 ± 5 yrs, 5 male, 1 female) and then perfused with lactate Ringers and 10% 2-hydroxypropyl- β -cyclodextrin at a rate of $1 \mu\text{L/min}$. 2% ANT cream was applied over each site on the arm. Dialysate samples were then collected and skin blood flow was measured using local heating at one site (HT, 43°C) and a thermoneutral site (TN, 33°C). The dialysate samples were then analyzed from ANT concentrations using targeted tandem mass spectrometry. RESULTS: Both sites contained similar dialysate ANT concentrations (2.9 ± 0.4 vs. 3.5 ± 0.4 ppm, $P = 0.26$). Absolute SkBF was significantly higher at the heated site compared to the thermoneutral site (35.7 ± 11.8 and 7.2 ± 1.0 CVC, $P = 0.001$). CONCLUSION: Although similar ANT concentrations were observed in both sites, dermal absorption and sampling can be modulated by many factors. Further research is needed to determine the influence of skin temperature compared to clearance when observing dermal absorption of ANT and other PAHs. These implications and needed to understand the dermal

absorption of potentially carcinogenic compounds in occupational workers and the general population.

Marc Augenreich, Health and Exercise Science, Graduate Student

Faculty Mentor: Jonathon Stickford, Health Sciences

Co-Author(s): Steve M. Ratchford, Kyle C. Kimball, Nina L. Stute

Title: EFFECT OF ACUTE FORMALDEHYDE EXPOSURE ON PULMONARY FUNCTION

Formaldehyde (FA) is a known pulmonary irritant that is commonly utilized in the preservation of cadavers used during dissection laboratories. The purpose of this project was to investigate the effects of FA exposure during a cadaver dissection laboratory on pulmonary function. Students from two regional universities were recruited to perform spirometry immediately prior to and following a single cadaver dissection laboratory session. Spirometry was measured by having subjects complete forced vital capacity (FVC) and maximal voluntary ventilation (MVV) maneuvers following American Thoracic Society guidelines. The NHANES III dataset was used to calculate percent predicted values. Pre- and post-FA exposure spirometry data were subsequently compared. Before entering the laboratory, subjects (N=17; two males; 24 ± 3 yr; 24 ± 4 kg·m⁻²) displayed normal pulmonary function, as indicated by the percent predicted values for FVC ($97 \pm 10\%$), forced expiratory volume in one second (FEV₁; $96 \pm 11\%$), and MVV ($102 \pm 16\%$). Subjects were exposed to 172 ± 135 ppb of FA over the course of the dissection period. Following the session, no changes were observed for any of the spirometric parameters examined (FVC, $0 \pm 3\%$ Δ; FEV₁, $0 \pm 4\%$ Δ; MVV, $0 \pm 0\%$ Δ). Further, there was no correlation between the percent change in FEV₁ and FA exposure ($R^2=0.04$). Acute exposure to FA over the course of a single dissection laboratory does not impair pulmonary function.

Sera Denlea, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Jonathan Stickford, Health Sciences

Co-Author(s): J.T. Oliver, A.S.L. Stickford, and R.M. Kappus

Title: THE EFFECTS OF ANXIETY ON THE UNPLEASANTNESS OF EXPERIMENTALLY-INDUCED DYSPNEA DURING EXERCISE

Negative affective states can impact the perception of breathlessness in patients with cardiopulmonary disease. Yet, it is unclear how anxiety may alter experimentally-induced dyspnea during exercise in otherwise healthy adults. The purpose of this study was to examine emotional responses to experimentally-induced dyspnea in students of various anxiety levels. METHODS: Subjects (N=18, 13 females, 21 ± 2 y, 169.1 ± 8.7 cm, 69.9 ± 13.7 kg) were categorized (Minimal, Mild, Moderate) based on responses to the Generalized Anxiety Disorder (GAD-7) questionnaire. Subjects completed four cycling tests at 50% of their predetermined maximal aerobic capacity and separated by 20-min of rest. During the exercise, dyspnea was induced via 1) external dead space (DS), 2) resistance loading (RS), or 3) lessened via a heliox gas inspirate (HEL) and compared with control (CON). Ratings of perceived breathlessness (RPB) and unpleasantness of breathlessness (RPU) were collected during exercise. At rest, subjects rated unpleasantness and accompanying negative feelings (depression, anxiety, frustration, anger, and fear) associated with their dyspnea during exercise using a visual analog scale (VAS). RESULTS: No group by challenge interactions were observed for perceptual measures. During CON exercise, RPB and RPU were 2 ± 1 AU and 1 ± 1 AU, respectively. Use of

DS, but not RS or HEL, significantly altered RPB ($3\pm 1\text{AU}$) and RPU ($3\pm 1\text{AU}$) compared with CON ($p < 0.05$). VAS ratings of unpleasantness and anxiety, but not depression, frustration, anger or fear, were increased during DS compared with CON ($p < 0.05$). GAD-7 scores were positively correlated with VAS ratings of unpleasantness and depression during CON ($p < 0.05$)

CONCLUSION: Individuals of various anxiety levels had similar distress ratings to experimentally-induced dyspnea. Additionally, a chemical (CO_2) stimulus during exercise was perceived to be more unpleasant and anxiety-inducing than resistance loading, which was similar to control.

Emma Frye, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Rebecca Kappus, Health Sciences

Co-Author(s): Elise Witwer, Samantha Lew, Emily Heier, Amaron Craig

Title: THE EFFECTS OF ORAL CONTRACEPTIVES ON CENTRAL AND PERIPHERAL BLOOD PRESSURES

BACKGROUND: Oral contraceptive use, even low-dose formulas, is linked with slight elevations in brachial blood pressure, thought to be related to the composition of estrogen and progesterone. Hypertension stimulated by oral contraceptives is seen in approximately 5% of women consuming high-dose formulas. It is unknown if hormonal birth control may also increase central pressure, which is more strongly related to future cardiovascular events and is affected differently by medications compared to brachial blood pressure. The purpose of this study is to determine if oral contraceptive use results in alterations in central blood pressure in young, healthy females. **METHODS:** Thirty-four young (ages 18-40) females (20 not on oral contraceptives, 14 on oral contraceptives) free of disease underwent measurements of central (aortic and carotid) and peripheral (brachial) blood pressures. Participants were 4 hours fasted and refrained from caffeine, alcohol, and exercise for 24 hours prior and were tested during the early follicular phase of their menstrual cycle. **RESULTS:** Independent t-tests were performed to determine significance between groups, with $p < 0.05$. Females on oral contraceptives had significantly higher brachial systolic (SBP) and diastolic blood pressures (DBP) and carotid and aortic SBP and DBP compared to females not taking any form of birth control. (SBP = 120 vs 110 mmHg, DBP = 72 vs 64 mmHg, carotid SBP = 113 vs 103 mmHg, carotid DBP = 72 vs 64 mmHg, aortic SBP = 103 vs 96 mmHg, aortic DBP = 72 vs 65 mmHg, respectively). **CONCLUSIONS:** Females taking hormonal birth control exhibited higher peripheral and central pressures compared to females who did not take a hormonal birth control. This indicates that oral contraceptive use has the ability to increase central blood pressure, which is a better predictor of cardiovascular disease and stroke.

Chris Murrell, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Christopher Seitz, Health Sciences

Co-Author(s): n/a

Title: THE EFFECTIVENESS OF A POINT-OF-DECISION-PROMPT PROGRAM FOR INCREASING STAIR USE: AN OBSERVATIONAL STUDY

Background: Point-of-decision prompts (PODP) are posters placed in areas at the point of making a decision to either use the elevator or the stairs (i.e., near an elevator button). The posters use evidence-based messaging to encourage people to use the stairs. Research

suggests that PODP programs are effective in improving stair use. As such, the purpose of this study was to evaluate the effectiveness of PODP program that was implemented in Leon Levine Hall of Health Sciences (LLHS). Methods: Students enrolled in a research methods course in public health observed and recorded stair use and elevator use. Data collection took place from March 27th to April 8th, 2019, with one week dedicated to pre-test data collection, and one week dedicated to post-test data collection. Data was collected from 9am to 3pm each day. Data was analyzed using chi-square test of independence. Results: We observed a total of 4,693 elevator and stair trips during pre-test, and 4,539 trips during post-test, for a total sample of 9,232 observations. There was a statistically significant increase in stair use of 4%, with a small effect, $\chi^2(1, N = 9232) = 24.7, p < 0.05, \phi = 0.1$. Discussion: Our study found that the PODP program in LLHS was effective. Although the increase of stair use was only 4%, this result reflects comparative success of similar studies on PODP programs and stair use. The program was cost-effective, as it only required a \$50 budget.

Emily Heier, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Rebecca Kappus, Health Sciences

Co-Author(s): Emma Frye, Amaron Craig, Elise Whitwer, Samantha Lew

Title: SEX DIFFERENCES IN CARDIOVASCULAR RESPONSES TO ACUTE RESISTANCE EXERCISE

Background: Hypertension is associated with arterial stiffening, a risk factor for cardiovascular disease. During resistance exercise there is a short-term, but significant, increase in pressure. In males, an acute bout of resistance exercise has been shown to increase large artery stiffness, which persists for up to 30 minutes after the training session. Because of the vasodilatory effects of estrogen, it is possible females may be better protected from this elevated pressure load and subsequent arterial stiffening. The purpose of this study was to compare blood pressure and arterial stiffness in males and females before and following an acute resistance exercise bout. Methods: Seven males and 11 females (mean age = 26 years) not currently resistance training underwent measurements of aortic and brachial blood pressures and aortic stiffness (central pulse wave velocity, cPWV; left ventricular ejection time, LVET) before, immediately after, and 30 minutes after a full body resistance exercise bout. Values across the 3 time points were compared between sexes using an ANOVA and when the interaction was significant, followed up with appropriate t-tests. Results: Aortic stiffening was seen following resistance exercise in males only, demonstrated through increases in cPWV (5.6 to 6.3 to 5.6 ms⁻¹) and decreases in LVET (325 to 303 to 300 ms). Females had no change in either measure at any time point. Males increased brachial SBP (119 to 126 to 124 mmHg) compared to females (113 to 112 to 110 mmHg) and DBP changed similarly with no sex differences. Both aortic systolic (99 to 95 to 94 mmHg) and diastolic (68 to 60 to 65 mmHg) pressure decreased immediately in females compared to males (101 to 101 to 99 mmHg; and 70 to 65 to 64 mmHg, respectively). Conclusions: Females appear to be protected from the acute aortic stiffening and increased blood pressure seen in males following resistance exercise. This may be due to the vasodilatory effects of estrogen.

Bryce Clark, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Christopher Seitz, Health Sciences

Co-Author(s): Emma Swarts, Aidan Estes

Title: A Decade of Research: Flu Vaccinations among College Students in the US

Background: Although the flu is a major public health issue among college students in the US, tracking the trend of flu vaccines and distribution of vaccine information among this population is nonexistent. As such, the purpose of this study was to analyze the trends over the past decade among students. Methods: A secondary data analysis was conducted using the American College Health Association's (ACHA) publicly available National College Health Assessment (NCHA) reports. The NCHA is conducted every semester among a nationally representative sample of students. For this study, findings from the NCHA reports were collected from 2008 to 2019. Variables from the reports included: (1) percent of students who received the annual flu vaccine, (2) percent interested in receiving flu information from their college, and (3) percent who actually received flu information from their college. Trends in variables were tracked over time. Results: The trend of students who received the flu vaccine has increased from 2008 (32%) to 2019 (53%). In contrast, the percent of college students interested in receiving flu information from their college (43% in 2008, 44% in 2019), and the percent of college students who actually received flu information from their college (44% in 2008, 46% in 2019) stayed constant. Discussion: The percent of students receiving information is consistent over the decade, in order to increase student vaccination the source and quality of information must improve.

Shawn Ellis, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Christopher Seitz, Health Sciences

Co-Author(s): Melene Mehari, Addy Keck, Elizabeth Baird, Shelby Lazenby

Title: E-CIGARETTES FOR SALE ON FACEBOOK MARKETPLACE: A DESCRIPTIVE ANALYSIS

Background: E-cigarettes have been sold on E-bay and Craigslist, but no one has studied if these products are being sold on Facebook Marketplace. As such, the purpose of this study was to explore e-cigarette sales through the website. Methods: During the fall of 2019 (prior to the Tobacco 21 law), Facebook Marketplace was searched for posts within the 500 largest cities in the US that were selling the 5 most popular e-cigarettes at the time of the study: Juul, Vuse, Myblu, Njoy, and Sourin. Data that was collected included: e-cigarette brands, types of products, price, and if the seller stated they would check identification for age. Data was analyzed using descriptive statistics. Results: There were a total of 42 posts, including the following brands: Juul (29 posts), Myblu (6 posts), Sourin (3 posts), Vuse (3 posts), and Njoy (1 post). Posts advertised sales for devices, chargers, pods, and accessories (e.g., skins, flags). 38 of the posts were priced above the companies' prices. No posts included information about checking identification for age. Discussion: Posts for Juul product were the most popular of the brands included in this study, which reflects Juul's dominance in the e-cigarette market. The products' prices might indicate that the target population may be underage and increase the demand for the products. Finally, the lack of checking for identification indicates that underage buyers could use Facebook Marketplace as a resource for obtaining e-cigarettes.

Kennedy Williams, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Jonathan Stickford, Health Sciences

Co-Author(s): D.S. Fletcher, J.T. Oliver, R.A. Shanely, A.S.L. Stickford

Title: THE EFFECTS OF BEETROOT JUICE SUPPLEMENTATION ON MODERATE INTENSITY CYCLING IN OBESE MALES

Obese adults exhibit increased whole-body oxygen consumption (VO₂) and ratings of perceived breathlessness (RPB) during moderate intensity exercise when compared with normal weight adults. Nitrate-rich beetroot juice (BRJ) has been shown to reduce VO₂ during moderate intensity exercise in normal weight adult males. Purpose: The purpose of this study was to evaluate VO₂ and RPB during moderate intensity, constant work rate cycling in obese males following BRJ supplementation. Methods: Subjects completed exercise testing procedures following ten-day supplementation periods of BRJ and placebo (tomato juice) and separated by a 10-day washout period. During the exercise testing visits, subjects cycled at a moderate exercise intensity for six minutes. Data obtained during the exercise tests were compared. Results: At study entry, subjects displayed normal spirometry function and functional residual capacity indicative of obesity. Furthermore, subjects displayed poor physical fitness but normal cardiovascular function. During the exercise tests, VO₂ was unaltered as a result of the BRJ supplementation. Tidal volume was reduced during BRJ conditions; however, ventilation was unaffected. No other physiological or perceptual measures were altered as a result of the BRJ supplementation. Conclusion: BRJ does not reduce metabolic and perceptual stress during moderate intensity cycling in obese males. BRJ supplementation may play a role in ventilatory dynamics during submaximal exercise.

Emma Swarts, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Adam Hege, Health Sciences

Co-Author(s): Gracyn Travitz

Title: COMBATING FOOD INSECURITY IN WOMEN AND CHILDREN IN THE APPALACHIAN REGION

Background: In the Appalachian region, food insecurity is an issue that plagues many of its people. The region, largely rural, often has limited funding for resources, education, and food options; therefore, many suffer at the hand of unhealthy food accessibility.

Methods: A systematic literature review of peer-reviewed articles was conducted from 2005-2020 concentrating on food insecurity in the Appalachian region, with a focus on women and children. Utilizing Google Scholar as our primary search engine and the search terms Appalachian and food insecurity, 581 articles were initially identified. We next narrowed our search to 117 articles that emphasized women and children. We are finalizing our review of the 117 articles to identify ones that provide specific intervention and policy strategies.

Results: Currently results are pending the literature review, but will be available for the Student Research and Creativity Symposium. Discussion: Maternal and child nutrition is an aspect that is overlooked. However, it's vital that this vulnerable population receives proper attention. Due to rural circumstances, women are restricted on providing necessary and healthy nutrients to their children. Without proper nutrition, growth and development for infants is impaired.

Implementing evidence-based interventions in rural Appalachia can sustainably improve the health outcomes of women and children.

Taylor Lovci, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Abigail Stickford, Health Sciences

Co-Author(s): Marc Augenreich, Jonathon Stickford

Title: LOCOMOTOR-RESPIRATORY COUPLING AND ATTENTIONAL STRATEGIES IN HEALTHY, BUT UNTRAINED, INDIVIDUALS

Locomotor-respiratory coupling (LRC) is a subconscious synchronization of locomotor and breathing patterns, with beneficial effects on energetic and perceptual responses to exercise. It is unknown if attentional focus, which impacts locomotion and ventilation, independently, alters LRC. The purpose of this study is to examine the role of attentional focus on LRC during exercise in untrained individuals. Seven subjects (23 ± 4 yr, VO_{2max} : 46.7 ± 3.8 ml \cdot kg $^{-1}$ \cdot min $^{-1}$) ran on a motorized treadmill at three predetermined submaximal speeds under associative (ASSOC) and dissociative (DISSOC) attentional focusing conditions. To measure the degree of LRC during exercise, light-weight event switches were placed on the bottom of both feet. Inspiratory flow, expiratory flow and oxygen consumption were continuously measured. Running economy was calculated as the amount of O₂ consumed per distance traveled. LRC increased during ASSOC compared with during DISSOC ($55.8 \pm 13.5\%$ and $47.0 \pm 12.7\%$, $p = 0.034$). Running economy was not different ($p = 0.284$) between conditions. Tidal volume (VT) trended towards a significant increase (2.48 ± 0.72 L and 2.28 ± 0.67 L, $p = 0.064$) during ASSOC compared with during DISSOC, respectively. There was a significant relationship ($p = 0.037$) between the change in LRC and the change in VT at the faster speed. LRC can be changed in untrained individuals by altering attentional focus. This change in LRC may be a result of a change in breathing patterns.

Lucas Saacks, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Abigail Stickford, Health Sciences

Co-Author(s): N/A

Title: Comparisons of leg, arm, and back muscle oxygenation during rowing exercise using near infrared spectroscopy

Indoor rowing is an increasingly popular mode of exercise that provides a total-body workout. In a proper rowing motion, muscles in the leg, back, and arm are utilized sequentially. These different muscle groups, which vary in terms of muscle fiber composition, all consume oxygen during rowing exercise. However, it is unknown how changes in muscle oxygenation during an acute bout of rowing may differ between these primary working muscles; further, whether or not men and women, who tend to have differences in both absolute muscle mass and muscle fiber composition, exhibit different rates and/or magnitude of muscle deoxygenation responses during rowing is not clear. In this study, near infrared spectroscopy (NIRS) devices are placed on the vastus lateralis, biceps brachii, and erector spinae muscles to measure oxygen saturation during rowing exercise. Subjects row for two minutes each at three different relative (i.e., based on percent of maximal power output) exercise intensities, in a randomized order. Muscle oxygen saturation is continuously monitored during each stage, as well as in the rest periods between each stage. Data collection is ongoing, but preliminary data indicate strikingly similar trends in muscle oxygen consumption in men and women during rowing. Additionally, oxygen saturation in the vastus lateralis appears to decrease to the greatest degree and most rapidly out of the three muscle groups, regardless of intensity, while the oxygenation of the erector muscles appears to decrease the least.

Kelsey Eaves, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Scott Collier, Health Sciences

Co-Author(s): Kasey Kleiber, Sarah Brown, Sarah Altman, Lainey Hunnicutt, Scott Collier

Title: FAMILIARIZATION LENGTH FOR ACCURATE AMBULATORY SLEEP AND BLOOD PRESSURE MONITORING

Introduction: Sleep is a life-sustaining action that has implications in aspects of physical, mental, and emotional well-being. However, little is known regarding the reliability of data and the time it takes oneself to familiarize with the equipment necessary to measure sleep. Therefore, the purpose of this study was to determine how many nights of wearing the monitoring equipment were required to restore sleep architecture and blood pressure data to baseline. Methods: Eight male and female subjects completed all 3 nights of both sleep and blood pressure familiarization. Visit 1 consisted of anthropometric and resting blood pressure measurements. The subjects were also familiarized with the equipment and instructed to wear the Sleep Profiler™ and ambulatory blood pressure cuff simultaneously for 3 consecutive nights. Subject returned equipment at visit 2. Results: The percent of time spent in N1, N2, N3, and REM were not statistically different between nights 1, 2, and 3. Time for wake after sleep onset was not statistically different between nights 1, 2, and 3. Time for sleep latency was statistically greater from night 2 to night 3 ($p = 0.042$). Percent nocturnal systolic and diastolic blood pressure dips were not statistically different between nights 1, 2, and 3. Cortical and autonomic arousals were not statistically different between nights 1, 2, and 3. Conclusion: Ambulatory sleep monitoring data is most accurate on the 3rd night of familiarization.

Edgar Villeda, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Zachary Farris, Health Sciences

Co-Author(s): Brian Gerber

Title: THE MOST THREATENED PRIMATES IN THE WORLD - POPULATION ESTIMATES FOR MADAGASCAR'S LEMURS.

Madagascar is a global conservation priority due to intense anthropogenic pressures threatening its diverse, endemic wildlife. With more than 90% of Madagascar's lemurs classified as threatened by the IUCN, they are the most imperiled group of vertebrates on the planet. Betampona Reserve, at 2,228-ha protects diverse eastern rainforest wildlife, including multiple critically endangered lemur species. To provide accurate estimates of density for both diurnal and nocturnal lemurs across both cool-wet (June-July) and hot-dry (October-December) seasons, we conducted repeat, standardized line transect sampling across the entire reserve. We estimated density in program DISTANCE, while accounting for imperfect detection, for six lemur species, including two critically endangered species: Indri (*Indri indri*, $D=0.33 \text{ ind/km}^2 \pm 0.12$) and ruffed lemurs (*Varecia varieagata*, $D=2.31 \pm 0.59$). We also provide the first density estimates, for any site in Madagascar, of endangered fork-marked lemurs (*Phaner furcifer*, $D=1.52 \pm 0.52$). These seasonal density estimates represent the first population estimates for any lemur species at Betampona Reserve. These estimates are critical for the development of targeted, effective management and conservation objectives. Madagascar's forests are expected to be completely gone in the next 80 years and these types of studies are critical to

propose solutions that will contribute to the long-term protection of these imperiled, charismatic lemurs.

Kyle Kimball, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Stephen Ratchford, Health Sciences

Co-Author(s): Marc Augenreich, Laurel Koontz, Nina Stute, Jonathon Stickford

Title: EFFECTS OF ACUTE FORMALDEHYDE EXPOSURE ON ARTERIAL STIFFNESS

Formaldehyde (FA) is a carcinogen used in human donor preservation. Acute (< 3 hours) FA exposure results in decrements to pulmonary function with many experiencing symptoms of eye, nose, and throat irritation, chest tightness, and dyspnea. While some believe the lung traps inhaled FA, resulting only in pulmonary dysfunction, animal studies have revealed FA can cross the alveolar-capillary membrane, leading to systemic inflammation and vascular dysfunction as well. Yet, few studies have investigated the potential acute effects of FA exposure on the human vasculature. Purpose: This study sought to investigate the effects of acute FA exposure on young healthy adults' arterial stiffness. Hypothesis: We hypothesized that FA exposure would exacerbate arterial stiffness in an otherwise healthy adult population. Methods: Young healthy adults (8 females) had their peripheral artery stiffness (SphygmoCor) assessed before and after a 2-hour exposure to FA. Results: Pulse wave velocity was unaltered by a 2-hour exposure to FA (Pre: 5.1 ± 0.2 m/s, Post: 5.1 ± 0.2 m/s). Discussion: These results indicate that the vascular architecture is unaffected by acute FA exposure. Ongoing investigations will examine the effects to repeated FA exposures over a 3-month period.

Cole Siemasko, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Steve Ratchford, Health Sciences

Co-Author(s): Caleb Gaydish, Laurel Koontz, Kaitlin Dillard, and Sarah Brown

Title: ESMARCH BANDAGE AND SURGICAL TOURNIQUET USE: IMPLICATIONS FOR VASCULAR FUNCTION

Tourniquet-use during orthopedic surgeries is typically accompanied by an Esmarch bandage, a wide wrap which helps exsanguinate the venous blood prior to tourniquet inflation. While intended to prevent blood loss during surgery, the combination use of the Esmarch bandage and tourniquet may lead to ischemia-reperfusion injury which could affect vascular function and impair rehabilitation efforts. Purpose: This study sought to investigate the effects of a tourniquet cuff during 30 minutes of ischemia with or without the use of an Esmarch bandage to determine the time-course effects on vascular function after the release of the tourniquet. Hypothesis: We hypothesized that the use of the Esmarch bandage would exacerbate the vascular impairments caused by the tourniquet. Methods: We applied a tourniquet cuff to the upper extremity of young adults for 30 minutes and measured their vascular function in their upper and lower extremities before and 20, 40, and 60 minutes after cuff deflation. The results of this study will have implications for orthopedic surgery and rehabilitative practices.

Kimberly Todd, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Zachary Farris, Health Sciences

Co-Author(s): Cullen Anderson, Rado Rafaliariason

Title: ARE FOSA FEW AND FAR BETWEEN WHERE TOURISTS ROAM? ESTIMATING POPULATIONS ACROSS ANDASIBE-MANTADIA, MADAGASCAR

Despite its remarkable biodiversity, Madagascar's wildlife remains understudied and inadequately protected even as anthropogenic pressures (e.g. habitat fragmentation, exotic species) mount. Of Madagascar's imperiled wildlife, the endemic carnivores (Family Eupleridae) are among the most threatened and least known/studied carnivores in the world. We provide the first assessment of carnivore populations in Madagascar's most popular rainforest tourism destination: Andasibe. In 2017, we photographically sampled (n=24 sites) across three protected forests from June-July (cool-wet season) and October-December (hot-dry season). Using program Presence, we estimated single-season occupancy while accounting for imperfect detection for fosa (*Cryptoprocta ferox*), Madagascar's largest and most widespread carnivore, and explored landscape, habitat, and co-occurring species effects. With 388 total trap nights in June, we calculated fosa trap success (1.29) and estimated naïve occupancy ($\sim\Psi=0.22$). With 1,138 total trap nights in Oct-Dec, we calculated fosa trap success (3.35) and estimated both naïve ($\sim\Psi=0.61$) and true ($\Psi=0.85$) occupancy. These important findings provide the first estimate of fosa populations across the Andasibe-Mantadia protected landscape, enabling Madagascar's national parks to make more informed decisions on the management of these threatened carnivores.

Kayla Chipman, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Kym Fasczewski, Health Sciences

Co-Author(s): N/A

Title: DEVELOPMENT OF A BEHAVIORAL TRANSITION PROGRAM FOR PREVENT T2 - A CLINICALLY SUPERVISED TYPE 2 DIABETES MELLITUS PREVENTION PROGRAM

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease typically caused by excessive weight, diet, and physical inactivity. According to the Centers for Disease Control and Prevention, approximately 27 million people in the United States have been diagnosed with T2DM. To help those who are at risk of developing T2DM, intervention programs have been created to modify nutrition and increase physical activity. Although these programs are initially effective, long-term adherence is low. The behavioral constructs of self-efficacy and self-determined motivation are essential for long-term behavior change, but are often absent from T2DM interventions. The purpose of this project was to develop a transition program to help individuals maintain high levels of self-efficacy and self-determined motivation after the conclusion of their participation in Prevent T2, a medically supervised weight loss and exercise program. Data were collected through observation of the Prevent T2 program, interviews with the program staff, and through consultation with the developer of a similar program for post-bariatric surgery patients. A team of researchers then analyzed data and developed a transition program to address the need for specific self-efficacy and self-determined motivation programming in Prevent T2. Next steps include implementation of the newly-developed transition program to help participants improve their motivation and confidence for long-term physical activity behavior change.

Sophie Vazquez, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Zachary Farris, Health Sciences

Co-Author(s): Lauren M. Andersen

Title: MAPPING CONSERVATION IN A BIODIVERSITY HOTSPOT: USING INTERACTIVE GIS TO UPDATE AND INFORM POLICY MAKERS IN MADAGASCAR

Anthropogenic pressures threaten tropical ecosystems globally. Managers and conservationists working to protect these areas are in need of updated information on research and conservation activities on the ground to inform future decisions. Significant levels of biodiversity and endemism coupled with intense human pressure distinguish Madagascar as a global biodiversity hotspot. Madagascar has lost over 90% of its original forest and the endemic wildlife are highly threatened. The purpose of this research is to provide updated, comprehensive and user friendly thematic maps to researchers, non-profits, and government agencies working across the Andasibe-Mantadia protected landscape. I collected field, vet clinic, and survey (GPS-tracking and camera-trap) data from NGOs: Mad Dog Initiative and Association Mitsinjo. I used satellite imagery and ArcGIS software to create detailed interactive maps to identify research activities, study sites, veterinary clinics, and key conservation sites. We created organization-specific maps for veterinarians, field researchers, and national park managers. The specificity achieved with interactive map format will allow customized display of data based on organization, to provide critical information to a variety of conservation research interests working across this threatened landscape. The maps will be used to inform conservation and management agencies and organizations, educate the general public, and support these NGOs in grant acquisition.

Caleb Gaydish, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Steve Ratchford, Health Sciences

Co-Author(s): Laurel Koontz, Cole Siemasko

Title: MUSCLE METABOLISM AND PERFUSION DURING RHYTHMIC HANDGRIP EXERCISE: AN INVESTIGATION OF CENTRAL AND PERIPHERAL HEMODYNAMICS

Background: Handgrip exercise is a common rehabilitative technique used in treating clinical populations such as rheumatoid arthritis and hypertension. However, little is known regarding the variations in hemodynamic responses between handgrip modalities. The possibility exists that some handgrip modalities are better suited for clinical use. Purpose: This study sought to examine the influence of finger combinations on the integrative physiologic response to handgrip exercise and is part of a larger project devoted to understanding the intricacies of various handgrip strategies on rehabilitative efforts. Hypothesis: We hypothesized that there would be a positive linear relationship between perceived exertion of finger combinations used during handgrip exercise and the magnitude of the central and peripheral hemodynamic responses associated with those combinations. Methods: To test this hypothesis, we recruited young, healthy male and female adults to perform isometric and isotonic handgrip exercises, at an equal workload, using a variety of finger combinations (3.8 kg resistance using fingers 1-4, fingers 1 and 2, fingers 2 and 3, or fingers 1 and 3). The subjects performed rhythmic handgrip exercise for 3 minutes while central hemodynamics (heart rate, stroke volume, cardiac output, and blood pressure), peripheral hemodynamics (blood flow, vasodilation, shear rate, and vascular conductance), and muscle oxygenation (near infrared spectroscopy) were measured continuously.

Dylan Green, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Zachary Farris, Health Sciences

Co-Author(s): Mamadou Kane

Title: LIONS (PANTHERA LEO), GUINEA BABOONS (PAPIO PAPIO), AND MULTI-SPECIES MODELING TECHNIQUES, OH MY: EXAMINING PRIMATE-PREDATOR INTERACTIONS IN SENEGAL, WEST AFRICA

Primate species across the globe face ecological pressures that have a direct impact on their long-term welfare. Primate-predator interactions are often left unstudied due to the difficulty in data collection, but the combination of non-invasive surveys and population modeling techniques allows for a better understanding of this crucial ecological factor on primates. Using camera trap data collected from February to July of 2013 across the Niokolo-Koba National Forest (NKNF) in Senegal, West Africa, we estimated single-species and two-species occupancy for guinea baboons (*Papio papio*) and lions (*Panthera leo*) in program PRESENCE. We found that baboons had a higher probability of occupancy ($\psi_{Ba} = 0.86$ SE 0.13) and detection ($r_{Ba} = 0.29$ SE 0.05) at sites where lions were absent (ψ_{Ba}) compared to sites where lions were present ($\psi_{Ba} = 0.79$ SE 0.13 and $r_{Ba} = 0.22$ SE 0.08, respectively). This resulted in a species interaction factor of 0.80 (SE 0.30), indicating baboons are avoiding lions across their range. Both lions and baboons are threatened, yet understudied across this region and in need of effective management solutions. These novel two-species modeling techniques allow researchers to explore understudied interactions between rare, elusive primates and their predators. These results will aid in the development of effective, targeted management and conservation plans for these threatened species and the NKNF protected landscape.

Stephanie Dotson, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Zachary Farris, Health Sciences

Co-Author(s): Dr. Susan Lappan, Mamadou Daha Kane

Title: PREDATOR-PRIMATE DISTRIBUTIONS: IMPLICATIONS FOR MANAGEMENT AND CONSERVATION

Leopard populations are widely distributed, yet decreasing across Africa. Patas monkeys are understudied, generalist primates occurring across Africa. The interactions between this predator and primate remain unstudied across their range. We provide the first investigation of this predator-primate relationship using populations across the World Heritage Site: Niokolo-Koba National Park, Senegal. In 2013, camera traps were set up at two sites Linguékountou Ling and Niokolu Nio which ran for 78 and 67 days, respectively. We estimated single season, single species occupancy for both patas monkeys and leopards in program Presence. We also estimated two-species, co-occurrence to investigate the interactions between these two species. At Ling, we estimated trap success (relative activity; 1.99) and occupancy ($\Psi=0.78$) for leopards, as well as trap success (3.18) and occupancy ($\Psi=0.65$) for patas monkeys. At Nio, we estimated trap success (0.76) and naive occupancy ($\sim\Psi=0.27$) for leopards, as well as for patas monkeys (1.17 and $\Psi=0.33$, respectively). These results on predator and primate populations across this threatened landscape provide managers and government officials with critical estimates, enabling them to effectively manage these predator-primate interactions and conserve these imperiled populations.

Leah Carver, Health and Exercise Science, Undergraduate Student

Faculty Mentor: Zachary Farris , Health Sciences

Co-Author(s): Ntsoa Ramarondrinaibe

Title: HOME RANGES OF FERAL DOGS AND CATS IN THE ANDASIBE REGION OF MADAGASCAR UTILIZING GPS TRACKERS

Andasibe National Park in Madagascar is a region with large amounts of biodiversity, characterized by multiple species of rare lemurs and carnivores. A top threat to carnivore populations, Madagascar and globally, are feral dogs and cats, who carry potentially dangerous diseases like rabies and toxoplasmosis. To gain a better understanding of their impact on Madagascar's endemic, threatened carnivore population, we used GPS trackers fastened on collars of 35 dogs and cats to estimate activity patterns and range. We tracked each dog and cat from 1 to 23 days, depending on the battery life of each collar. With as many as 550 data points and a maximum elevation of 952 m, dogs had the greatest range compared to cats with 340 data points. Dogs move on average 3.67 km in their longest trip, while cats move 2.42 km. Yet, cats have, on average, a larger area of movement of 0.42 km², while dogs span 0.25 km². We estimated the average peak and range of activity patterns and the home range (via kernel density estimation) for each dog and cat. These results represent the first estimates of feral dog and cat home range for any site in Madagascar. These estimates are being used by non-profit organizations and government agencies in Madagascar to inform and direct research, veterinary clinics, and conservation activities across the Andasibe-Mantadia region.

NURSING

Marina Ruff, Nursing, Undergraduate Student

Faculty Mentor: Dana Brackney , Health Sciences

Co-Author(s): Blaire Lewis, Bailee Holleman, Jessica Rubio, Andrea Mattox

Title: Use of a Plant-Based Diet Versus a Ketogenic Diet for Management of Type 2 Diabetes: a Systematic Review

In the United States, 30.3 million people are living with type 2 diabetes mellitus (T2DM), with 7.2 million unaware they have the disease. Research on T2DM and diet is abundant but there is little information on the application of a plant-based, or ketogenic diet for T2DM management. A ketogenic diet promotes high intake of fat and protein, with low intake of carbohydrates, while a plant-based diet is rich in fruits, vegetables, whole grains, legumes, and plant-based fats. This systematic review compares the effects of the plant-based diet and the ketogenic diet on T2DM. Methods: CINAHL and PubMed databases were systematically searched to identify articles for inclusion. Search terms included ketogenic, vegan, and type 2 diabetes. The nine articles included in this systematic review explored the dietary effects that these two diets had on people with T2DM. The Johns Hopkins Nursing Evidence-Based Practice appraisal scale was used to assess the strength and quality of each article. Findings: There were two level I studies, six level II studies, and one level III study. The studies indicate that a plant-based diet can improve glycemic control, incretin effects in the gastrointestinal tract, beta cell function, and overall insulin secretion. A ketogenic diet was also revealed to be efficacious in management of

T2DM through a reduction in body weight, HbA1c, and T2DM medication requirements. Both the plant-based and ketogenic diet showed clinical improvements for T2DM.

Kimberly Scharenbroich, Nursing, Undergraduate Student

Faculty Mentor: Dana Brackney, Health Sciences

Co-Author(s): Charlotte D'Ambra, Taylor Sabia, Claudia Scruggs

Title: THE CORRELATION BETWEEN BREASTFEEDING AND THE INCIDENCES OF POSTPARTUM DEPRESSION: A SYSTEMATIC REVIEW

Postpartum depression (PPD) is a serious mental health condition that afflicts 1 in 9 mothers soon after delivery according to the Center for Disease Control and Prevention (2019).

Breastfeeding is a potentially protective measure against PPD due to the neuroactive hormones released during breastfeeding. However, the relationship between breastfeeding and PPD is still unclear. This systematic review examined published research to evaluate the incidence of postpartum depression when women breastfeed compared to bottle feeding. Method: CINAHL, Cochrane, and PubMed databases were searched for the study terms. The search, MeSH, and boolean, terms that were used included: postpartum depression AND (breastfeeding OR bottle feeding). The search strategy yielded eight studies for inclusion in this review. The Johns Hopkins Nurse Evidenced Based Practice Appraisal Tool was used to assess the quality of evidence. Findings: All of the articles used in this review were determined to be Level III-B. Together these studies included 129,958 women ranging in age from 15 to 44 years old and living in one of seven countries. Six out of eight articles were survey-based using the Edinburgh Postnatal Depression Scale. Conclusion: The evidence is not definitive that exclusive breastfeeding can prevent PPD. However, research studies have established a positive correlation between breastfeeding and decreased incidence of PPD.

Implications: Nurses can educate women about both the severity and risk of PPD after delivery and that exclusively breastfeeding has been associated with PPD prevention.

Amber Pratt, Nursing, Undergraduate Student

Faculty Mentor: Dana Brackney, Health Sciences

Co-Author(s): Logan King, Elizabeth Baggott, Lindsay Urban

Title: SYSTEMATIC REVIEW OF MEDICATION ADHERENCE WITH PILL ORGANIZERS

Background: Nonadherence to medications is believed to cause at least 100,00 preventable deaths per year (Kleinsinger, 2018). This can have consequences for health outcomes. This systematic review seeks to evaluate how effective use of medication pill organizers is for increasing medication compliance among outpatients. Methods: CINAHL and PubMed databases were searched with the MeSH terms compliance/adherence AND outpatient AND organizer to find articles. 240 articles were identified. Duplicates (n=55) and articles which do not answer the question (n=174) were removed leaving 11 quantitative studies for inclusion. Analysis of Study: Each study's reliability, validity, evidence and quality level was analyzed using the Johns Hopkins Nursing Evidence-Based Practice Appendix E Research Evidence Appraisal Tool. All articles contained relevant data to help form an opinion on whether medication organizers are useful in outpatient settings. Limitations and statistics in the studies were reviewed to help with conclusion formation. Synthesis of Findings and Practice Recommendations: It was concluded that using methods to organize medications such as

pillboxes, applications that send reminders, and forming habits improves people's ability to be adherent and consistent with taking their medications. Due to these findings, it is suggested that people use a medication pill organizer in order to take their medications correctly.

William Osborne , Nursing, Undergraduate Student

Faculty Mentor: Dana Brackney, Health Sciences

Co-Author(s): Mike Griffin, Joseph Bost, Paige Tarleton, Kelsey McKinney

Title: Comparative Efficacy of Ketamine, Opioids, and Multimodal Approaches to Acute Pain Management

Background: Opioids are a drug of choice for acute pain management. However, due to opioids' adverse effects, the popularity of ketamine and multimodal ketamine formulations is expanding in clinical practice. Method: Studies for inclusion were identified with a systematic PubMed and CINAHL search. Ninety-two results were screened and duplicates were excluded (n=17). Remaining articles (n=75) were filtered to select only clinical trials and cohort studies. Studies with non-human subjects, lacking ketamine analgesia, without Visual Analog Scale or the Numeric Rating Scale, and those studying non-acute pain were removed (n=17). Eight articles were included in the systematic review and were assessed using the John Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal tool to affirm the relevancy, integrity, and strength of the selected studies. Findings: The studies' findings were consistent, stating that ketamine and opioid analgesics demonstrated similar efficacy for managing acute pain. Neither ketamine nor opioids produced significantly more adverse effects. The strength of evidence of this review is limited by the sample size of two of the eight articles, both of which had sample sizes of less than fifty participants. It was concluded that low-dose ketamine is as effective as opioids such as morphine in acute pain treatment. Ketamine's efficacy as an analgesic agent shows promise for pain management in patients for whom opioids might be contraindicated.

Logan McClamroch, Nursing, Undergraduate Student

Faculty Mentor: Dana Brackney, Health Sciences

Co-Author(s): Emma Drake, Katie Ost, and Sierra Varner

Title: MANAGING CHEMOTHERAPY INDUCED NAUSEA AND VOMITING IN CANCER PATIENTS: A SYSTEMATIC REVIEW OF ANTIEMETIC THERAPY AND MEDICAL MARIJUANA

Background: In the United States, cannabis has been legalized in several states for recreational and medicinal use. In these states, health care providers are prescribing cannabis because of its known anti-inflammatory, analgesic, and antiemetic properties. Particularly challenging is management of chemotherapy induced nausea and vomiting (CINV). This systematic review examines the efficacy of pharmaceutical antiemetic medications and various strains of medical cannabis, as well as the combination of the two in preventing CINV in cancer patients. Methods: Databases including PubMed, Cochrane, CINAHL Complete, and ScienceDirect were searched with specific MeSH terms (cancer, medical marijuana, and cannabis). There were 10 research articles included, ranging from Level I A, to Level 3 B, so all were good quality at minimum. Although research on this topic is limited, several studies presented in this review contain statistical data from real cancer patients who have sought out alternative treatments for their CINV, and provide results on their experiences with the efficacy of medical marijuana. Results

from a Level II B Phase II study indicates that when cannabis is combined with regularly prescribed prophylactic antiemetic treatments for CINV, reported rates of nausea and vomiting were significantly decreased. This data provides evidence that medical marijuana has positive qualities of treatment, and requires further research to explore application to medical practice.

Kara Czarnecki, Nursing, Undergraduate Student

Faculty Mentor: Dana Brackney, Health Sciences

Co-Author(s): Sarah Hefner, Madisynne Harris, Madelyn Blum

Title: IN ADULT INPATIENTS, HOW DOES THE USE OF PROTON-PUMP INHIBITORS COMPARED TO NO USE AFFECT THE OCCURRENCE OF C. DIFF INFECTION: A SYSTEMATIC REVIEW

Background: Clostridium Difficile (C. diff) affects about 500,000 people per year in the U.S. with about 29,000 of these cases being fatal within 30 days of their initial diagnosis (Pradeep & Mohammed, 2019). The use of Proton Pump Inhibitors (PPI) has increased in the hospital setting as a prophylactic treatment against gastroesophageal reflux and ulcer development. PPIs disrupt the body's natural production of gastric acid that serves as a protective barrier to invading pathogens. Risk reduction strategies are important in preventing the development of C. diff within healthcare settings since C. diff spores are easily spread and difficult to eliminate. Methods: A systematic review was conducted through PubMed, CINAHL, and Google Scholar to determine the extent of knowledge regarding the topic of PPIs use and occurrence of C. diff. Studies were reviewed based on their inclusion of keywords such as proton pump inhibitors, PPIs, gastroenteritis, Clostridium difficile, adult population, and CDI. The results were then synthesized to develop a consensus regarding the relationship between PPI use and C. diff occurrence. Conclusion: The use of PPIs has been consistently found to be a risk factor for individuals developing C. diff infection. These studies are unable to establish a causal relationship between the use of gastric acid suppressants and the development of a C. diff infection due to a lack of randomized control trials within current literature.

Payton Moore, Nursing, Undergraduate Student

Faculty Mentor: Dana Brackney, Health Sciences

Co-Author(s): Faith Baldwin, Kalli Rose, Caroline Turner

Title: INTERVENTIONS FOR SOCIAL DEVELOPMENT IN CHRONICALLY ILL CHILDREN AND ADOLESCENTS: A SYSTEMATIC REVIEW

Background: Pediatric clients with chronic illnesses undergo rapid developmental changes between birth and adulthood. The demands of chronic illness may interrupt social, emotional and psychological development. Both hands on and online interventions are available to support social development in youth with chronic illness. This systematic review aims to determine how the social development of pediatric patients with various chronic illnesses, is effected by hands-on interventions compared to online based interventions. Method: Through using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model, nine studies were identified. This model allowed for narrowing of eligible articles from a large pool of potential studies. The articles chosen were then analyzed and determined to be of high or good quality, through the use of Johns Hopkins Nursing Evidence-Based Practice Appendix E: Research Appraisal Tool. All research included were found from studies determined to be a

Level II or Level III study with high/good quality rating. Findings: The nine articles describe hands-on interventions, such as gardens in hospitals and online based outlets, such as discussion forums. Although, the majority of the studies (X=7) are qualitative in design, they provide rich descriptive narratives. Analysis of the nine studies demonstrated that hands-on interventions are superior to online based, as evidenced by the narrative accounts researched. Children have advanced social development and are more likely to develop independence if they are exposed to other pediatric patients who have chronic illness, as well as, peers who do not.

NUTRITION AND HEALTH CARE MANAGEMENT

Sydney Van Scyoc, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Danielle Nunnery, Health Sciences

Co-Author(s): N/A

Title: NUTRITION PRACTITIONER'S PERSPECTIVE OF THE NUTRITION KNOWLEDGE AND BEHAVIORS OF PREGNANT PATIENTS

BACKGROUND Women are more aware of nutrition during pregnancy but may lack access to reliable information. Physicians have limited time with clients compared to Registered Dietitians (RDs) and may not be as up to date on nutrition recommendations and needs for pregnant women. Counseling from an RD in prenatal programs is associated with improved pregnancy outcomes. The objective of this study was to address inadequate diet quality among rural pregnant women by surveying nutrition professionals regarding their delivery of nutrition education to this population. Insight on these topics from a practitioner viewpoint will help to expose gaps in nutrition care and current knowledge. **METHODS** North Carolina nutrition professionals including RDs, Diet Technicians, and Public Health Nutritionists (N=73) working with pregnant women were contacted via email and asked to complete an online survey about their provision of nutrition services to pregnant clients. **RESULTS:** Respondents named cost (91%) and lack of time to cook (83%) as the most influential barriers their clients face when attempting to make dietary changes. The topics most asked about by clients were the same topics practitioners thought clients needed more guidance on: general healthy nutrition for pregnancy, lactation, and appropriate weight gain. Practitioners cited pamphlets, websites, and telehealth counseling as potentially well accepted education methods.

CONCLUSION: RDs implementing educational interventions designed for rural pregnant women should teach general healthy nutrition and appropriate weight gain while providing guidance on time and cost-efficient approaches. When possible, delivering information through technology could be an effective and convenient way for nutrition professionals to reach and engage clients.

Lauren Jun, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Martin Root, Health Sciences

Co-Author(s): Jamie Griffin, PhD, RD; Kyle Thompson, DCN, RDN

Title: ASSOCIATION OF CAROTENOID INTAKE WITH PULMONARY FUNCTION

BACKGROUND: Chronic obstructive pulmonary disease (COPD) is an inflammatory disease causing more than three million deaths annually around the world. Previous studies show an increased incidence of COPD among smokers. Studies also show antioxidant nutrients such as carotenoids have been associated with lower rates of COPD. **OBJECTIVE:** The aim of this study is to investigate if carotenoids and carotenoid-rich foods consumption is associated with higher pulmonary function. **METHODS:** Data were taken from the Atherosclerosis Risk in Communities (ARIC) study, which included approximately 15,000 individuals aged 45-64 at baseline from four counties in the United States. Food frequency questionnaire (FFQ) data were used to assess dietary intake of carotenoids and carotenoid-rich foods. Total carotenoids intake was calculated by summing five specific carotenoids— α -carotene, β -carotene, β -cryptoxanthin, lycopene, and lutein/zeaxanthin. Pulmonary function was evaluated as the ratio of forced expiratory volume in one second and forced vital capacity. Linear regression analysis was used to assess the association between intake of carotenoids and carotenoid-rich foods and pulmonary function controlling for key covariates including smoking status. **RESULTS:** A positive association between the total carotenoid intake and pulmonary function was only marginally significant; however, α -carotene, β -carotene, and β -cryptoxanthin intakes were each significantly positively associated with forced expiratory volume in one second and forced vital capacity ratio in study participants. Lycopene and lutein/zeaxanthin were not significantly associated with lung function. Foods rich in α -carotene, β -carotene, and β -cryptoxanthin were also significantly associated with higher lung function. **CONCLUSIONS:** This study suggests a possible role for certain provitamin A carotenes, and their associated foods in lung health.

Kelsey Tillotson, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Laurel Wentz, Health Sciences

Co-Author(s): Manan Roy, Melissa Gutschall, and Cristóbal S Berry-Cabán

Title: TESTOSTERONE AND VITAMIN D CONCENTRATIONS IN MILITARY PERSONNEL FOLLOWING TRAUMATIC BRAIN INJURY

The purpose of this study was to investigate testosterone and vitamin D status in service members, with and without a history of traumatic brain injury (TBI). This retrospective medical review analyzed hormone assessments ordered for 4,285 active duty and veteran military personnel at Womack Army Medical Center, Fort Bragg, NC from 2016-2018. Overall, 343 (8%) of service members had a medically diagnosed TBI. In all men, 19% were deficient in testosterone (<270 ng/dl), and 10% had a testosterone prescription. Active duty men with history of TBI had lower testosterone compared to active duty men with no documented head injury (431 ± 162 vs 452 ± 170 ng/dl, $p=0.04$), but there was no significant difference in veteran men. 38% of all service members were deficient in vitamin D (<30 ng/ml). Service members with a history of TBI had slightly higher vitamin D concentrations compared to those with no prior head injury, but the difference was minimal (2 ng/ml) and of little clinical significance. Overall there was a weak positive correlation between testosterone and vitamin D concentrations in men but not in women. Although our 8% diagnosis rate of TBI was lower than previous studies, we found slightly lower testosterone concentrations in active duty men with documented TBI. Despite weak correlations between testosterone and vitamin D concentrations, we found a high prevalence of vitamin D insufficiency independent of TBI.

Alice Albl, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Kyle Thompson, Health Sciences

Co-Author(s): Judy Abernathy, Danielle Nunnery, Lisa McNulty

Title: PROMOTING DIGNITY IN DINING WHILE IMPROVING QUALITY OF LIFE AND PERSON-CENTERED LONG-TERM CARE

Introduction: The purpose of this quality improvement (QI) study was to examine the association between weight outcomes, QOL measures, and utilization of the neighborhood dining model in an accredited, corporately-managed long-term care facility. Materials and Methods:

Retrospective patient weight data were obtained from patients' monthly weight charts. Quality of life was assessed through a patient survey created for this research project, and rated on a scale of 1 – 3 (poor, fair, and good). Data were analyzed using SPSS 25.0 and Microsoft Excel.

Results: A marginally significant correlation was found between age groups and overall weight change ($p=0.053$). No significant results were found when looking at age group v. dining room usage or quality of life rating. Discussion and conclusions:

This quality improvement study found that in terms of weight status and QOL scores, the study facility is performing satisfactorily for residents who participate in the neighborhood dining program as well as residents who prefer in-room dining. Future QI studies on this topic should consider stratifying residents by cognitive status

Martina Wood, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Melissa Gutschall, Health Sciences

Co-Author(s): Dr. Kyle L. Thompson, Dr. Alisha R. Farris

Title: CLIENT CHOICE FOOD PANTRIES: BENEFITS AND BARRIERS

Research has shown that using a client-choice pantry method has the potential to improve clients' nutrition status and improve self-efficacy. However, using this pantry method may not be feasible for all pantries. The purpose of this study was to identify effective strategies and potential barriers when offering a choice pantry. Interviews were conducted with staff members from 7 choice pantries. Interviews were conducted by phone or email and consisted of 11 questions regarding the logistics of pantry operations. Qualitative data was measured by the frequency with which each concern/benefit was mentioned, and answers were analyzed for consensus between researchers. All 7 pantries food distributed based on household size. Over half the pantries utilized a shopping method. The primary benefits of the choice model included personalization of food boxes, eliminating food waste, and dignified client experience. The main challenges reported were maintaining consistent inventory and reliance on volunteers. Study results provided confirmation of how choice pantries work most effectively, reflecting the benefits and barriers identified through previous research. Overall, the study confirmed a widespread transition to the client choice method and away from the traditional model. Future research should continue to explore strategies to overcome barriers for choice food pantries. The limitations of the study include the small sample size and the variety in pantries surveyed.

Ashlyn Greene, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Melissa Gutschall, Health Sciences

Co-Author(s): Alison Seramur, Margaret Barth, Kate Younger

Title: MEALTIME BEHAVIORS AND GASTROINTESTINAL ISSUES IN CHILDREN WITH AUTISM SPECTRUM DISORDER IN WESTERN RURAL NORTH CAROLINA

Autism Spectrum Disorder (ASD) is one of the fastest growing developmental disabilities globally. The Centers for Disease Control estimates that approximately 1 in 69 children will be diagnosed with Autism Spectrum Disorder in the United States. Autism Spectrum Disorder is a complex developmental and neurological condition that presents in the first three years of life. ASD is characterized by difficulty with social interactions and communication skills, because the brain function is affected. The ASD population has been shown to have an increased incidence of nutritional disorders such as food allergies, gastrointestinal issues, nutrition deficiencies, and other abnormalities in the body affecting nutrition status. Gastrointestinal issues are four times more common in an ASD person than a non-ASD person. Those with ASD often have repeated behaviors and have narrow, obsessive interests and these behaviors can be seen with eating habits and food choices. These behaviors can lead to some health and nutritional concerns such as, limited food selection, strong food dislikes, not eating enough food, tantrums, and constipation. The aim of this study was to collect data regarding the prevalence of mealtime disturbances and gastrointestinal issues in children with autism in rural western North Carolina.

Lunan Rebekah, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Laura McArthur, Health Sciences

Co-Author(s): Dr. Melissa Gutschall, Dr. Alisha Farris, and Dr. Kimberly Fasczewski

Title: NUTRITION AND BUDGETING KNOWLEDGE OF FOOD SECURE AND FOOD INSECURE SOPHOMORES AT APPALACHIAN STATE UNIVERSITY

Introduction: Food insecurity means limited access to nutritious food that supports a healthy life. This problem is widespread among US college students, with rates from 14% to 59%. In 2016, the rate at Appalachian State University (App State) was 46.2%. This descriptive, cross-sectional study measured the food security status, nutrition and budgeting knowledge, and budgeting behaviors of food secure (FS) and food insecure (FI) sophomores attending App State during the spring 2019 semester, and identified associations between these variables. **Materials and Methods:** A random sample of 1,792 sophomores received electronic recruitment letters. Data were collected with an online questionnaire using Qualtrics survey software. Food security status was measured using the USDA ten-item Adult Food Security Survey Module (AFSSM), nutrition and budgeting knowledge were measured with multiple-choice tests, and budgeting behaviors were measured with a frequency table. Correlational analyses examined associations, and statistical significance was $p < 0.05$. **Results:** Among the 222 sophomores, 119 (53.6%) were FS and 103 (46.4%) were FI. No significant correlations were found between AFSSM scores and nutrition knowledge ($r = -0.071$, $p = 0.320$), budgeting knowledge ($r = -0.06$, $p = 0.404$), or budgeting behaviors ($r = -0.08$, $p = 0.297$). A significant positive correlation emerged between budgeting behaviors and budgeting knowledge ($r = 0.20$, $p = 0.010$). **Discussion and Conclusions:** Findings indicate a need for educational activities that teach these FS and FI sophomores how to recognize low-cost nutritious foods, construct a monthly budget that includes anticipated food costs, and use money-saving practices to purchase healthy foods.

Alison Collins, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Alisha Farris, Health Sciences

Co-Author(s): Zachary Farris, Adam Hege

Title: RESEARCH ABROAD IMPACT ON ONE HEALTH AND INTERCULTURAL COMPETENCE

Background: In health and ecology professions, research abroad can deepen student learning on One Health (OH) and Intercultural Competence (IC). OH approaches are essential to solving complicated health issues, and culturally appropriate health/environmental recommendations are associated with improved behavior change. The aim of this study was to evaluate a research abroad experience on the concepts of OH and IC. Methods: Students who participated in an OH research abroad experience in Madagascar were provided a survey on OH IC impacts. Descriptive statistics were used to evaluate differences. For Likert scale questions, frequency of agreement was determined by combining responses from agree and strongly agree for each factor. Results: Eleven students (78.6% response rate) completed the survey. Most identified as female (81.8%) and white (90.9%). For OH competencies, students reported improved confidence in understanding all concepts, with the largest improvement in how OH related to the research. For IC, students reported improved confidence in all concepts, with the largest improvement in identifying contrasts between social classes and the challenges of inequality. Conclusion: Evaluating OH research abroad will enhance educational opportunities offered to students, prepare students for future professions, and place them at the forefront of health/ecology professions. These results are helpful in designing impactful learning experiences for students.

Mackenzie Woltz, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Kyle Thompson, Health Sciences

Co-Author(s): M. Margaret Barth; Danielle Nunnery

Title: CHARACTERISTICS AND USE OF WRITTEN NUTRITION POLICIES IN A SAMPLE OF FOOD PANTRIES IN NORTHWEST NORTH CAROLINA: AN EXPLORATORY PILOT STUDY

Purpose: The purpose of this research is to compare and contrast food pantries with and without written pantry-specific nutrition policies in an 18-county area of NWNC.

Methods: This study was conducted in partnership with the Second Harvest Food Bank of Northwest North Carolina, among a sample of their 231 constituent food pantries. A 165-question cross-sectional survey was used to assess food pantry operations.

Results: In total, 56 pantries responded to the survey (24.2%), with 8/56 pantries answering 'yes' to having a written nutrition policy (14.3%). No statistically significant associations were found among the presence of a nutrition policy and any of the studied parameters. A non-significant trend was identified for the presence of a written nutrition policy and the use of nutrition education classes for clients. Half of participating pantries reported using written nutrition guidelines other than pantry-specific nutrition policies. Descriptive statistics indicated strong interest among food pantry directors for enhancing food pantry nutritional practices.

Conclusions: Descriptive statistics indicate that common concerns among food pantry directors could be addressed by the presence of such policies. The use of written nutrition guidelines indicates some pantries may be guided by informal, unwritten standards. Further research is needed to determine the contribution of written nutrition policies to food pantry operations and client services.

Hannah Boone, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Laura McArthur, Health Sciences

Co-Author(s): Melissa Gutschall, Alisha Farris, and Kym Fasczewski

Title: COMPARISONS OF FOOD SAFETY KNOWLEDGE AND COOKING SELF-EFFICACY OF FOOD SECURE AND FOOD INSECURE SOPHOMORES AT APPALACHIAN STATE UNIVERSITY

Introduction: Food insecurity (FI) is when access to safe and nutritious foods is limited. Research indicates that FI is a serious problem among college students, with rates from 14%-59%. The FI rate among students at Appalachian State University (App State) was 46.2% in 2016. The purpose of this research was to measure food security (FS) status, food safety knowledge, and cooking self-efficacy of food secure and food insecure sophomores at App State and identify correlations between these variables. Methods: A random sample of 1794 students received recruitment letters via email in the spring of 2019. Data were collected using an anonymous online questionnaire through Qualtrics survey software. FS was measured using the USDA 10-item Adult Food Security Survey Module (AFSSM), a four-point scale measured cooking self-efficacy, and a multiple-choice test measured food safety knowledge. Data were analyzed using SPSS. Correlational analyses identified associations. Results: Among the 226 sophomores, 46% were food insecure. A significant correlation was found between AFSSM scores and food safety knowledge ($r=0.008$, $p=0.037$). No significant correlation was found between AFSSM scores and cooking self-efficacy ($r=0.126$, $p=0.068$). No significant correlation was found between food safety knowledge and cooking self-efficacy ($r=0.067$, $p=0.343$). Conclusions: Findings suggest a need for educational activities that teach food safety and cooking techniques to help reduce the rate of FI.

SO McMahan, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Kyle Thompson, Health Sciences

Co-Author(s): Jamie Griffin and Danielle Nunnery

Title: CLIENT NUTRITION EDUCATION PRACTICES IN A SAMPLE OF NORTHWEST NORTH CAROLINA FOOD PANTRIES

According to the USDA, 26% of food insecure households used food pantries in 2017. Little is known regarding nutrition education provided by food pantries. This survey research was conducted among 231 food pantry constituents of Second Harvest Food Bank of Northwest North Carolina. Findings were analyzed with bivariate correlation and linear regression tests. There were significant positive associations between annual food budget and provision of written nutrition education materials, number of volunteer hours in full-time equivalents, and combined number of hours of volunteer and paid staff in FTEs ($p<0.05$, $p<0.01$, $p<0.01$ respectively); the RUCC score of each pantry's location and provision of nutrition classes ($p<0.05$); fresh vegetable availability and the use of written nutrition guidelines ($p<0.001$); and the presence of a nutrition professional with the number of days per week the pantry provides services ($p<0.05$). This research suggests food pantry operational indicators are associated with nutrition education offered to clients.

Drew Hilton, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Martin Root, Health Sciences

Co-Author(s): Kyle Thompson

Title: Danielle Nunnery

BACKGROUND: Dementia is expected to affect a greater proportion of the population as the population ages. Certain lifestyle factors have been shown to reduce risk of developing dementia. Diet, and specifically, magnesium and potassium are factors thought to play important roles in preventing dementia. The purpose of this study is to investigate whether a higher intake of magnesium and potassium is associated with less dementia symptoms later in life.

METHODS: Data from the ARIC study were used, including the FFQ data at visits 1 and 3, clinical lab chemistry at visits 1 and 2, and Clinical Dementia Rating – Sum of Boxes (CDR-SOB) scores (a rating scale for staging dementia at a clinical) at visit 5 from 3160 participants. Average magnesium and potassium intakes and average blood levels of magnesium and potassium were analyzed for a relationship with CDR-SOB scores using a linear regression model with controlling variables including a Healthy Eating Index score.

RESULTS: Blood levels of magnesium and potassium were negatively associated with CDR-SOB, however, once the relevant variables were controlled for, the relationships were not significant. Potassium intake was not significantly associated with CDR-SOB scores.

Magnesium intake was significantly positively correlated with CDR-SOB in a multivariate model ($B = 0.211$, $p = 0.024$), however, when diet quality as measured by HEI was included in the model, the relationship was no longer significant ($B = 0.188$, $p = 0.053$).

CONCLUSIONS: The contradicting results between the effects of blood levels and intakes points to a need for more accurate means of measurement in future studies.

Olivia Caldwell, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Alisha Farris, Health Sciences

Co-Author(s): Danielle Nunnery, Melissa Gutschall

Title: PACK-IT COOKBOOK: A PROCESS EVALUATION

Introduction: Research shows U.S. children consume energy dense, low nutrient foods. Packed lunches are an avenue for improving the quality of food children consume. Packing lunch provides an opportunity for parents to reinforce healthy eating habits and positive food preferences. **Methods:** Parents who previously evaluated an e-cookbook, PACK-IT, were asked to participate in a qualitative survey evaluating cookbook acceptability, and food preferences were ranked using a six-point Likert scale rating from never tried, dislikes a lot, to likes a lot to evaluate child preferences. **Results:** Seven parents completed the survey. Themes for packing healthy lunches were planning and having resources (money, knowledge, and packing containers); time, cost, and food preferences were barriers. Using a scale of 1-5 (1 = least helpful; 5 = most helpful), food safety and cost (both 3.7) were most helpful recipe components, nutrition messages (2.0) were least helpful. For vegetables preferences, sweet corn/potatoes were most liked (100% and 85.7%), and fruits were liked overall, with apples as most liked (100.0%). Cabbage was the most disliked vegetable (71.4%). All sweet/savory foods were liked by 85.7% of children or higher. **Conclusions:** Results suggest PACK-IT is acceptable and useful for parents. Child food preferences play an important role in packed lunches and children prefer snacks and sweets. Resources including money, time, and equipment are necessary for packing healthy lunches.

Sena Roberts , Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Laurel Wentz , Health Sciences

Co-Author(s): Martin Root, David Nieman

Title: Influence of Ginger Extract Supplementation on Red Blood Cell Iron Status in Women

Previous research has shown that ginger extract increases the formation of red blood cells (RBC) in zebrafish embryos. Thus, the purpose of the current study was to determine if ginger extract supplementation had an influence on RBC markers of iron status in women. Data were collected from 22 female participants ages 18-45 years. Participants were randomly assigned to consume 500 mg ginger extract supplement or placebo daily for 6 weeks. Participants provided 3 overnight fasted blood samples: baseline, week-3, and week-6. Each blood sample was analyzed for complete blood count, including hemoglobin and RBC count, to identify differences between treatments. Hemoglobin concentrations were not significantly different between women supplementing with ginger and placebo at baseline (12.9 ± 1.7 vs. 13.6 ± 0.8 g/dL). At six weeks, there were no significant differences between women supplementing with ginger or placebo (13.3 ± 1.5 vs. 13.8 ± 1.0 g/dL), nor was there a significant increase from baseline concentrations. RBC count was not significantly increased in women supplementing with ginger or placebo (ginger baseline vs. wk six: 4.5 ± 0.3 vs. 4.6 ± 0.3 ; placebo baseline vs. wk six: 4.6 ± 0.3 to $4.6 \pm 0.3 \times 10^6/\mu\text{L}$). There were no significant effects of six weeks of ginger supplementation on RBC iron markers, which is not consistent with findings in zebrafish embryos. Future research should investigate alternative methods of improving iron status.

Erin Jameson, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Danielle Nunnery, Health Sciences

Co-Author(s): Maura McClain and Lindsie Miles

Title: AN EXPLORATION OF NUTRITION EDUCATION NEEDS AND BARRIERS OF UNINSURED CLIENTS OF FREE CLINICS IN WESTERN NORTH CAROLINA

Background: North Carolina has an uninsured population of 10.7%, the tenth highest in the country, and many adults rely on free health clinics for prevention and treatment of chronic disease. Little is know about the nutrition education needs of uninsured adults served by free health clinics, and acceptable strategies for intervention. Objective: To conduct a needs assessment in western North Carolina to explore nutrition education needs, internet access, and feasibility of nutrition interventions for adults served by free health clinics. Study Design, Setting, Participants: A semi quantitative survey was distributed to 156 clients in waiting rooms of two free clinics in western North Carolina. Measurable Outcomes/Analysis: Descriptive analyses were conducted using IBM's SPSS v.26 to determine frequencies for demographics, current nutrition knowledge, barriers, and internet access. Results: Roughly 60% of participants were female with an average age of 45, and the majority were Caucasian (81%). Most participants were interested in interventions focused on produce (87%) and recipe ideas (73%). Barriers to cooking included: homelessness, time constraints, lack of access to food and equipment, fatigue, and disabilities. The majority reported having regular access to smartphone (70%) internet (60%), and were open to receiving nutrition education through social media (41%) and online videos (43%). Conclusions: This study adds to limited body of literature on nutrition education needs and strategies for intervention for uninsured adults who rely on free clinics.

Results suggest nutrition intervention should work alongside clinics to address equipment and food access to facilitate the preparation and selection of healthier items. Additionally, future interventions could leverage online modalities to support in person nutrition education.

Sakina Craine, Nutrition and Health Care Management, Graduate Student

Faculty Mentor: Jamie Griffin, Health Sciences

Co-Author(s): N/A

Title: PROMOTING FOOD LITERACY IN APPALACHIAN COLLEGE STUDENTS THROUGH A FOOD LITERACY-BASED CURRICULUM

Background/Aims: Food literacy includes the self-efficacy to plan, manage, select, prepare, and eat food. Increasing food safety and cooking skills self-efficacy may improve college students' cooking literacy and healthful food consumption habits, leading to improved academic performance and weight management. This study examined the effectiveness of a food literacy-based curriculum to promote food literacy skills and healthful food consumption habits.

Methods: In Spring 2019, Basic Food lab students received a food literacy-based curriculum to improve food literacy skills including self-efficacy, food safety, and cooking skills through hands-on, experiential skills application. A survey was given at pre- and post-semester. Analyses included McNemar test and Wilcoxon Signed rank. Significance level was set at $p < .05$.

Results: Students ($n=39$) were single (95%), white/Caucasian (92%), female (64%) nutrition majors (46%), with a mean age of 21.2 years. Results showed statistically significant ($p < .05$) increases in food literacy-based self-efficacy, food safety, and cooking skills.

Conclusion: A structured curriculum can improve college students' food-literacy-based self-efficacy and cooking skills. Improvements may also lead to positive dietary habits, and improved health and academic performance. Policy changes supporting undergraduate curriculums that include food literacy may improve student health behaviors leading to benefits in their academic performance.

Ilya Wang, Nutrition and Health Care Management, Undergraduate Student

Faculty Mentor: Alisha Farris, Health Sciences

Co-Author(s): Dr. Zach Farris

Title: DIETARY CUSTOMS AMONG BREASTFEEDING AND PREGNANT MOTHERS IN ANDASIBE, MADAGASCAR

Purpose: Mothers and children are the most vulnerable to food insecurity and malnutrition. This study aimed to describe the health practices and factors influencing the practices of pregnant and breastfeeding mothers. Methods: Fifty-five pregnant or breastfeeding women were surveyed via convenience sampling. Survey questions included demographics, a 24-hour diet recall, dietary customs during pregnancy/breastfeeding, and child diet. Data was analyzed using descriptive statistics to generalize beliefs and practices. Results: Most mothers rely on personal (16.7%), friends (18.3%), maternal (18.3%), or clinical (26.7%) knowledge for health instruction. The average diet diversity score was 3.2 (lowest score level), and many exclusively breastfed for the first 6 months (65.5%). Pregnant mothers perceived fruit/vegetables, beans, meat, and green leaves as healthy, providing vitamins, child strength, and positive health. Breastfeeding mothers perceived shrimp and fruit as good for milk production, and dark leafy greens as bad.

Conclusions: While fruits, vegetables, and protein are valued, the average diet is inadequate. Programs are warranted which increase food access and availability.

Amy Perkinson, Nutrition and Health Care Management, Undergraduate Student

Faculty Mentor: Laurel Wentz, Health Sciences

Co-Author(s): Sarah Radman

Title: IS DIETARY PROTEIN ADEQUATE TO SUPPORT MUSCLE MASS IN SOUTHEASTERN ROCK CLIMBERS?

Limited nutrition research has been investigated in rock climbers. Therefore, the purpose of this study was to examine protein intake in rock climbers of varying skill levels. We recruited rock climbers in the southeastern region ranging from beginner to elite skill level. To participate, individuals had to have been climbing regularly for at least 3 months and completed a minimum of 12 climbing sessions. Climbers were assessed using the International Society for Advancement of Kinanthropometry (ISAK) level 2 profile, measured by a certified anthropometrist. Three-day food records were collected via picture and food description and were then entered into ESHA food processor for analysis. Forty-four rock climbers (n=23 women, n=21 men) volunteered to participate in this study and completed all measurements. According to the International Rock Climbing Research Association scale, 3 men were higher elite, 8 men were elite, and 6 women were elite climbers. From the 3-day food records, mean protein intake was calculated. Protein intake will be compared to climber total body mass, muscle mass, and muscle-to-bone ratio between those in elite categories verse other climbers. It is hypothesized that total protein intake and protein per kilogram of muscle mass will be higher in the more elite climbers. Data are currently under analysis. These findings can help develop nutrition recommendations for the sport of rock climbing.

Sarah Radman, Nutrition and Health Care Management, Undergraduate Student

Faculty Mentor: Laurel Wentz, Health Sciences

Co-Author(s): Amy Perkinson

Title: ARE ROCK CLIMBERS CONSUMING ADEQUATE CALORIES AND MACRONUTRIENTS?

Rock climbing has been gaining notoriety by inclusion in the upcoming Olympic games, and little data have been published on the diet of rock climbers. The purpose of this study was to investigate energy and macronutrient intake in rock climbers of varying abilities. We recruited rock climbers in the southeastern region ranging from beginner to elite skill level. In order to participate, individuals had to be climbing regularly for at least three months and have completed twelve or more climbing sessions. Three-day food records were collected via pictures and descriptions and were then entered into ESHA Food Processor for analysis. Forty-four rock climbers (n=23 women, n=21 men) volunteered to participate in this study and completed all measurements. According to the International Rock Climbing Research Association scale, 3 men were higher elite, 8 men were elite, and 6 women were elite climbers. From the 3-day food records, mean total energy intake, carbohydrates, protein, and fat will be calculated. Each macronutrient will also be calculated as a percentage of total energy intake. Energy and macronutrient intake will be compared in elite categories versus other climbers. It is hypothesized that energy and carbohydrate intake in elite climbers will be lower overall, while

protein intake will be higher compared to other climbers. Data are currently under analysis. These findings can help develop nutrition recommendations for the sport of rock climbing.

Faith Dearman, Psychology, Graduate Student

Faculty Mentor: Jamie Yarbrough, Health Sciences

Co-Author(s): N/A

Title: GOAL, SET, MATCH! DIFFERENTIAL REINFORCEMENT CONTINGENCIES AND SELF-MONITORING

The amount of time required to implement an intervention is a primary criterion that teachers consider when selecting acceptable classroom interventions. Self-monitoring (SM), an intervention that involves student rating of their own behavior, is a minimally intrusive procedure commonly used to decrease problematic behaviors and increase academic engagement (Prater & Hogan, 1992). Although students are responsible for recording their behavior, SM still requires teachers to provide feedback and ensure accuracy of self-ratings. Research demonstrates that SM is effective with students on both academic and behavioral skills (Mooney, Ryan, Uhing, Reid, & Epstein, 2005). Most self-monitoring interventions include additional components, such as contingent reinforcement (CR) (Briesch & Chafouleas, 2009). Although CR is widely known as an effective component of many interventions, it is not considered to be an essential element of SM interventions (Ortero & Haut, 2016). The few studies that have investigated interventions that combine SM and CR differ on how CR is administered (Christensen, Young, & Marchant, 2004). Some researchers provided CR based upon the accuracy of SM ratings (CR-A). In this variation, both teachers and students rate behavior and CR is provided if the ratings match (Hinshaw & Melnick, 1992). In other SM studies, CR was delivered only if pre-arranged criteria were met (CR-C), regardless of the accuracy of student SM ratings (Ortero & Haut, 2016). There is no consensus on which reinforcement contingency is most effective. The purpose of this study was to determine the differential effects of how CR is provided within a SM intervention by direct comparison of both contingency conditions.

RECREATION MANAGEMENT AND PHYSICAL EDUCATION

Rachel Fleischut, Recreation Management and Physical Education, Undergraduate Student

Faculty Mentor: Eric Frauman, Health Sciences

Co-Author(s): N/A

Title: An Importance-Satisfaction Analysis of Recreation/Leisure Attributes at a Southeastern University

The primary purpose of the study was to better understand how important various recreation/leisure related attributes/features of a university were (e.g., student services, green spaces, outdoor programs) as compared to satisfaction with the same attributes/features. A modified Importance-Performance Analysis (IPA) was performed to generate a two-dimensional 4-quadrant grid to aid in interpreting the perceived importance and satisfaction across the attributes/features. A number of attributes/features were found to be much more important in

comparison to their perceived satisfaction (implying concentrate efforts here), while others were reversed (implying possible overkill). Further analysis of the 445 college students who participated in the study found a number of IPA grid differences when comparing varied respondent characteristics (e.g., gender, on/off campus resident). Findings from this study provide useful information for student affairs professionals to make more informed decisions about how resources are allocated for the students they serve. As well, the findings may also prove useful to campus site/facility managers and other recreation/leisure service providers off campus who wish to further meet the needs of university students.

Shannon Saracena, Recreation Management and Physical Education, Undergraduate Student

Faculty Mentor: Jill Naar, Health Sciences

Co-Author(s): Dr. Stephanie West and Morgyn Manzer

Title: Gender differences among older adults' physical activity behaviors and attitudes towards park and recreation services

Demographic trends show an increase in the older population in the United States. This older population is projected to exceed that of children by 2034. These changes create a higher demand for parks and recreation (P&R) professionals to understand older adults' recreation patterns. Determining which factors impact the activity behaviors and attitudes of older adults is vital. Examining older adults' activity levels, motivations, and limitations towards sport participation and physical activity (PA) can provide an understanding of how healthy aging and a higher quality of life are achieved. Gender plays a vital role in the attitudes and behaviors related to PA participation throughout the life course. This study determines if there is a difference between genders in PA behaviors, satisfaction with P&R services, and constraints of participation among older adults. To understand this trend, 1204 adults completed electronic surveys and asked 54 questions about their sociodemographics, sport and PA participation, PA motivators and constraints, and attitudes towards P&R services. A comparison indicates that females are more likely to be encouraged to participate under a variety of circumstances and would benefit from policies that promote their involvement. If male participation is greater, P&R professionals can increase their impact by involving more females. If P&R is considered an important player in health equity, it is critical that older females receive additional attention.

HAYES SCHOOL OF MUSIC

Michelle Jaluvka, Music, Undergraduate Student

Faculty Mentor: Reeves Shulstad, Music

Co-Author(s): N/A

Title: THE EXCLUSION OF WOMEN IN MUSIC: AN EXPLORATION OF THE WESTERN CANON

Women composers have been systematically excluded from the Western canon of music since its formation. This is partially due to the structure of society at the time of the canon's formation and throughout its early development. Another contributing factor to women's exclusion is the

role of academia and how course curricula as well as music textbooks and anthologies have not evolved rapidly enough to accommodate new discoveries of music by women. The visibility of women in the field of music began improving alongside the rising popularity of the feminist movement, but women still face many obstacles. Not only are women generally excluded, but women of intersectional identities who are members of other marginalized groups face a higher level of exclusion and discrimination. The exclusion of black women composers is due to racial discrimination during the time of canon formation and lack of remediation in academia and performance practices to accommodate for the increased scholarship surrounding this topic. The goal of this research is to present the issue of women's lack of presence in the canon, understand the foundations of why this occurs, and inspire change in future performers and teachers of music in order to form a more inclusive field of study and performance.

Hannah Koch, Music, Undergraduate Student

Faculty Mentor: Jennifer Snodgrass, Music

Co-Author(s): N/A

Title: Borders in Musical Form and in Politics: Formal Design of Shostakovich's Symphony No. 5

Composed in the summer of 1937 and premiered a few months later, Dimitri Shostakovich's Symphony No. 5 is often considered to be one of his most remarkable compositions.

Shostakovich was seen as a leader in nationalistic Soviet music for almost a decade until the Communist Party newspaper, Pravda, attacked one of his operas. He composed Symphony No. 5, to earn back his approval in what some scholars refer to as A Soviet Artist's Reply....

The first movement of the symphony is composed in classical sonata form; however, the elements of the formal design are quite hidden due to Shostakovich's use of more modern styles. The themes can be expanded into sub-themes and the sections are defined by instrumentation rather than phrase and cadential structure. The main sections of this movement are varied in terms of style, key, and mode; furthermore, several sections are clearly a reference to the climate in the Communist party. The remaining three movements also contain similar compositional techniques. This presentation will highlight Shostakovich's use of sonata form and how the form is altered in order for Shostakovich to express his own turmoil regarding the control from the Soviet government. Through musical analysis, research, and exploration, the question still remains if Shostakovich was a composer with an agenda to expose the tyrannical rule of Stalin and his regime, or was he a reserved individual that believed in the socialist idea of composing music for the people of his country?

Colin McKeon, Music, Undergraduate Student

Faculty Mentor: Jennifer Snodgrass, Music

Co-Author(s): N/A

Title: RHYTHMIC CONSIDERATIONS FOR THE MUSIC THEORY CURRICULUM

Generally speaking, the current teaching practices of music theory at the undergraduate level may not encompass all the ideas of music theory in the holistic sense. A vast majority of the curriculum and textbooks are focused upon tonal theory, specifically tonal theory of the western common practice era. While many texts tend to lack literature outside of the canon and information on more modern techniques, the concept of time, or in musical terms, rhythm is also

absent. This ultimately does a disservice to students by not preparing them to consider the important aspect of time in music, as the definition of music is movement of sound through time. While some research has been conducted on this very topic (Cooper and Meyer *The Rhythmic Structure of Music*, Huron *Sweet Anticipation*), there is much work to be done on how to implement these concepts into the music theory curriculum and analytical study. It is imperative that scholars and students begin to consider the musical principles of meter and grouping as an additional component in the discussion and analysis of music. By incorporating elements of rhythmic study within traditional analysis, scholars and students will be better equipped to answer questions in terms of performance practice and musical interpretation. Using literature from both the western canon and from percussive literature, this presentation will focus on a more in depth analytical approach, one that encompasses ideas of traditional harmony, texture, and form with a deliberate and intentional focus on syncopation, meter, and rhythm.

The following departments had Faculty who mentored undergraduate and graduate students in research and/or creative endeavors.

Accounting	1
Applied Design	4
Art	2
Biology	43
Chemistry and Fermentation Sciences	13
Communication Sciences and Disorders	5
Computer Information Systems	1
Computer Science	2
Economics	8
English	1
Geography and Planning	8
Geological and Environmental Sciences	23
Government and Justice Studies	3
Health and Exercise Science	31
History	6
Human Development and Psychological Counseling	2
Languages, Literatures and Cultures	2
Marketing and Supply Chain Management	2
School of Music	3
Nursing	7
Nutrition and Health Care Management	19
Physics and Astronomy	16
Psychology	28
Recreation Management and Physical Education	2
Sociology	2
Sustainable Technology and the Built Environment	4
Transportation Insight Center for Entrepreneurship	1

