Office of Student Research

APPALACHIAN STATE UNIVERSITY

25th Annual Celebration of Student Research and Creative Endeavors

Full Program

April 21, 2022

Welcome

Welcome to the 25th 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.

We are excited to host our annual event in-person once again. As has been with the past 2 years, this year continued to bring its challenges. However, we view this event and the 146 student presentations to be yet another indication of Appalachian's resiliency. Faculty have continued to engage students in the research and creative process and the Office of Student Research is pleased to be a small part of it all.

Each year I continue to be amazed by the continued dedication of the faculty on our 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. And to the students, thank you for sharing your hard work with the campus. The work you have done on these projects have the ability to make a significant impact.

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, and University College. Finally, a special thank you to Dr. Mark Ginn - Vice Provost for Undergraduate Education, Dr. Ece Karatan - Vice Provost for Research and to the staff in the Office of Student Research which include Kathy Weaver Stevens our Graduate Assistant Nick Davison.

Rebecca A. Battista, Ph.D., Professor - Department of Health and Exercise Science
Director, Office of Student Research

2022 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 ePortolio 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/scholars/gallery-scholars. Additionally, please check out the portfolio's of the following winners (links provided below).

2022 Provost's Choice - Sabrina Hess
https://appstate.digication.com/sabrina-hess-2022-aportfolio-scholar/about-me

2022 Exemplar's Award - Kate Bucci

2022 Exemplar's Award - Brianne Morris
https://appstate.digication.com/brianne-morris-aportfolio-scholar/menu-1

Schedule of Events

All events occur on the 4th floor of Plemmons Student Union
Registration Opens 8:30am

Poster Competition
Undergraduate and Graduate Student Poster Competition - 9:00-10:30am - Parkway Ballroom

Oral/Platform Talks
Morning Session
Oral Session 1: 9:00am-10:00am, Room 415
Oral Session 2: 9:00am-11:00am, Room 417
Oral Session 3: 11:00am-12:00pm, Room 415
Afternoon Session
Oral Session 4: 1:00pm-2:20pm, Room 415
Oral Session 5: 1:00-2:00pm, Room 417
Oral Session 6: 3:00pm-4:00pm, Room 415
Oral Session 7: 3:00pm-4:00pm, Room 417

Poster Presentations
Poster Morning Session 1: 9:00am-10:30am, Parkway Ballroom
Poster Morning Session 2: 10:40am-12:00pm, Parkway Ballroom
Afternoon Session
Poster Afternoon Session 1: 1:00pm-2:30pm, Parkway Ballroom
Poster Afternoon Session 2: 2:40pm-4:00pm, Parkway Ballroom

Athletic Training

Madelynn Alyea, Athletic Training Graduate Student
Faculty Mentor: Jennifer Howard, Health and Exercise Science
Co-Author(s): Grant Yarbrough
Title: TAKING CARE OF KNEE'DS: A LEVEL 3 CASE STUDY ON WHOLE PATIENT CARE

Meniscal tears are commonly reported injuries & can be the end to an athlete's season. The most common treatment in acute meniscal tears is surgery for a repair or a meniscectomy. The menisci play a huge role in the knees' ability to absorb shock, joint stability, joint motion, & joint proprioception. Early treatment is recommended to increase feasibility of repair and prevent extra damage. However, not all patients have the same resources to obtain appropriate surgical care. Access to care can be challenging to those who are underinsured and/or reside in medically underserved areas. An uninsured high school student-athlete residing in a federally classified medically underserved area presented with a meniscus tear. The patient was referred for physician evaluation which revealed a tear in his meniscus and surgical treatment was recommended. The cost of the procedure for the patient was estimated at $30,000. The patient's financial & uninsured status resulted in the surgery being postponed indefinitely. To optimize care, the athletic trainer (AT) explored alternative sources of care & medical coverage. The AT began to look into Shriners Hospitals for Children to find the patient access to the care he needed at a cost he could afford. The AT was able to facilitate an evaluation followed by a surgical consultation. The patient was approved for surgery at no cost to him. The AT's willingness to advocate for his patient & identify resources resulted in successful whole patient care.

Biology

Seamus Aparicio, Biology Undergraduate Student
Faculty Mentor: Clare Scott Chialvo, Biology
Co-Author(s): Pablo Chialvo
Title: EXAMINING THE EFFECTS OF CHEMICAL IRRITANTS ON THE SPOTTED-WING FRUIT FLY

The introduction of foreign species into ecosystems in which they are not native can have profound and potentially long-term ecological and environmental impacts. These invasive species can cause extinctions of native species, lead to destruction of habitats, and also impact local agriculture. One such species is the spotted wing fruit fly, Drosophila suzukii, which was introduced to the southeastern United States from southeast Asia. A major distinction between D. suzukii, and other fruit fly species is their preferred oviposition site. While most species prefer to lay eggs on rotting food matter, this species uses small, unbroken, fleshy fruits such as blueberries or cranberries as developmental hosts.This has led to a significant crop loss for local farmers. Much work has been done to understand this species' physiology in order to develop potential

control methods. In this study, we characterized the impact of two chemical irritants, capsaicin and allyl isothiocyanates, on oviposition and fly development in 10 isofemale genetic lines of D. suzukii. Our results provide context for how this species responds to these types of noxious compounds.

Noah Arnold, Biology Undergraduate Student
Faculty Mentor: Shea Tuberty, Biology
Co-Author(s): Meredith Artiaco, Dominik Betini, Bryn Merritt, and Andy Hill.
Title: THE IMPACTS OF WASTEWATER POLLUTION ON AN APPALACHIAN HEADWATER STREAM FROM A MEDIUM DENSITY APARTMENT COMPLEX
Headwater streams and their tributaries are delicate habitats sustaining a wide variety of both terrestrial and aquatic life. Unfortunately, the biodiversity in these streams is often threatened by pollution. Currently, in Boone, North Carolina, a housing complex has reportedly mismanaged over 100,000 gallons of raw sewage since its development in 2013. Thus, Laurel Creek–a first order headwater stream– has received the majority of this waste and the impact on assemblages of fish and macroinvertebrates is currently unknown. The health of waterways within this urbanized area is threatened by population growth and land development. To assess the effects of repeated sewage contamination, water chemistry was recorded with a YSI multimeter, anions and toxic metals were quantified from water and sediment samples by ion chromatography and inductively coupled plasma - optical emission spectrophotometry. The diversity and abundance of fish and benthic macroinvertebrates were measured at multiple sites in the watershed following the NC Department of Environmental Quality standard operating procedures for collecting and calculating the fish index of biological integrity and the Qual 4 methods, respectively. The mission of this project is to complete a longitudinal and temporal study (2022 vs. 2012 & 2005 data) of stream viability, evaluate the extent of contaminants, and promote awareness of the impacts of human activity and poor wastewater management on ecosystems and their services.

James Auwn, Biology Undergraduate Student
Faculty Mentor: Andrew Bellemer, Biology
Co-Author(s): Andrew Bellemer
Title: THE CONFIRMATION OF EI3G1 IN D. MELANOGASTER
Nociceptors are a class of somatosensory neurons with specialized nerve endings with the purpose of detecting noxious stimuli (be it thermal, mechanical, or chemical stimuli). The detection of this noxious stimuli is known as nociception. In D. melanogaster, the activation of Class VI multidendritic neurons (nociceptor) via noxious stimuli provokes a behavioral response called nocifensive escape locomotion. Defects in the onset of this behavioral response can serve as an indicator for nociceptor sensitivity. The Bellemer lab seeks to investigate the cellular and molecular factors that influence nociceptor sensitivity. Using the GAL4/UAS system, a powerful Drosophila genetic

manipulation paradigm, specific genes can be knocked down via interference RNA (RNAi). Genes involved with the development of nociceptors can thus be identified by knockdown via RNAi and then observing defects in the nocifensive escape locomotion. The knockdown of eukaryotic translation initiation factors have commonly produced defects in the aforementioned nocifensive response. Eukaryotic translation initiation factor 3 subunit g1, or eIF3g1 is especially interesting. Literature suggests that knockdown of this gene results in high order branch loss and a decrease in total dendrite length, along with significant latency in larval nociceptive response time. I will confirm the eIF3g1 gene via mechanical and thermal assays and investigate its mechanistic role in nociception and sensory neuron morphogenesis.

Crawford Benjamin, Biology Undergraduate Student
Faculty Mentor: Annkatrin Rose, Biology
Co-Author(s): N/A
Title: IDENTIFICATION OF ENDOPHYTES IN HUPERZIA LUCIDULA CAPABLE OF PRODUCING HUPERZINE A
The objective of this research project is to isolate, analyze and identify endophytic fungi found in the Shining Clubmoss (Huperzia lucidula). Endophytes are bacteria or fungi that live symbiotically near or within the healthy plant tissue. More than 270 endophytes were isolated, so we narrowed it down to ~20 that were of interest using a metabolite analysis. Endophytes can produce secondary metabolites of special interest to medicinal research. The metabolite Huperzine A inhibits Acetylcholinesterase (AChE), which has been found to be effective in treating Alzheimer's disease. Several endophyte strains were tested through an enzyme inhibitor assay and HPLC analysis, which proved the presence of this metabolite at varying amounts. The highest producing endophytes then were processed for identification through DNA sequencing. This process started with a DNA extraction of the tough cells and a polymerase chain reaction (PCR) to amplify the target DNA with specific primers. The DNA was then cloned into plasmids and submitted for DNA sequencing. After sequencing, the results showed that we have isolated endophytes in both the Ascomycota and Zygomycota phyla. The results from this project can be used in future research to indicate target endophytes that can be cultured for the production of Huperzine A.

Ben Brewer, Biology Graduate Student
Faculty Mentor: Matt Estep, Biology
Co-Author(s): N/A
Title: ASSESSING THE HEALTH OF GRAY'S LILY (LILIUM GRAYI) 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 faces multiple challenges, including many small and isolated populations,

continued habitat loss, and disease caused by a fungal phytopathogen. First monitored in 1998, Lily Leaf Spot (LLS) disease results in early senescence of aboveground tissues and often prevents L. grayi from reproducing. Demographic monitoring of L. grayi across the range of the species is necessary to understand how the disease affects populations and reproductive output. During the growing seasons of 2020 and 2021, flowering L. grayi individuals at 22 sites were monitored for reproductive success. Each site was visited twice: first while plants flowered in June and early July, then when plants produced capsules in September and early October. Data was collected on plant size, number of flowers, severity of disease infection, shading strata, and reproductive success. In 2020 207 plants were monitored at 17 sites, with 67 (32.37%) successfully producing capsules and 97 (46.86%) prematurely senescing to LLS. In 2021 347 plants were monitored at 22 sites, with 45 (13.00%) producing capsules and 280 (80.69%) prematurely senescing. LLS was present at all sites visited. These data will be instrumental to Federal and State governments in determining the conservation status for this species and informing future management decisions.

Anna Brichetto, Biology Graduate Student
Faculty Mentor: Jon Davenport, Biology
Co-Author(s): N/A
Title: GEOGRAPHIC VARIATION IN THE EFFECTS OF HYDROPERIODS ON WOOD FROG (RANA SYLVATICA) TADPOLES
Environmental change is increasing climate variability (e.g. precipitation and temperature) globally. This can be detrimental to taxa, such as amphibians, that are susceptible to environmental factors. Changes in the breeding habitat (e.g., hydroperiod of temporary ponds) can lead to local declines of populations with mass mortality of embryos and tadpoles. Even if metamorphosis was possible, the potential of negative carry-over effects manifested in size at metamorphosis can have long-lasting effects on population persistence. To determine how different populations of wood frogs (Rana sylvatica) would respond to shortened hydroperiods, I examined the effects of pond drying on the growth and survival of Rana sylvatica tadpoles in a common garden experiment. I predicted that tadpoles from northern populations are more adapted to environmental variability than southern populations. As such, I predicted that northern populations could metamorphose earlier in response to pond drying than southern populations but would have a trade-off with smaller sizes at metamorphosis in shortened hydroperiods. Pond drying did significantly affect both mean size at metamorphosis and survival of tadpoles. Tadpoles from the longest hydroperiods had a larger mean size and higher survival than tadpoles from the shortest hydroperiods. Population had no significant effect on mean size at metamorphosis but did affect survival. The northern population had the highest survival, and the southern population had the lowest survival. My results suggest that populations of a widespread amphibian may vary in their ability to respond to environmental stressors. My study is also one of

the first to examine and make predictions of how changes in environmental change (via hydroperiod) will affect wood frog persistence across a latitudinal gradient.

Monica Burciu, Biology Undergraduate Student
Faculty Mentor: Nicholas Shaw, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: COMMERCIALIZING TECHNOLOGY AT ASU: COMBATING HIV
In 2020, 1.5 million people tested positive for Human Immunodeficiency Virus (HIV), bringing the global total of infected individuals to approximately 37.7 million. To date, there have been 36.3 million deaths associated with the virus. Biologically, HIV is a retrovirus that hijacks the host cell's replication machinery to produce copies of the retrovirus using a process called reverse transcription. These host-generated copies continue to infect the remaining host cells, eventually overwhelming the host's immune system. However, this process can be arrested using antiviral molecules called non-nucleoside reverse transcriptase inhibitors (NNRTIs). NNRTIs inhibit reverse transcription and prevent HIV from replicating. Unfortunately, the synthesis of NNRTIs requires lengthy reaction times (8+ hrs) and is low yielding (~50%). We will present efforts made using patented technology developed at ASU to change how NNRTIs are synthesized. Using swellable organically modified silica (SOMS), we restrict synthetic reactions to nano-sized reactors which are capable of significantly reducing reaction times and driving reactions to completion (99+% yield). Applied to the synthesis of NNRTIs, we believe our efforts in this area will facilitate the faster development of more effective NNRTIs far more quickly while also dramatically decreasing their production cost.

Ayanna Carte, Biology Undergraduate Student
Faculty Mentor: Christopher Seitz, Health and Exercise Science
Co-Author(s): N/A
Title: DIFFERENCES IN FACIAL AGING AMONG IDENTICAL TWINS WHO DO OR NOT SMOKE: A LITERATURE REVIEW
Introduction: Research indicates that there is a relationship between smoking cigarettes and premature facial aging. Some of the literature is specific to facial aging among identical twins who do and do not smoke. The purpose of this study was to review and summarize that literature. Methods: PubMed and CINAHL databases were searched using the terms "twin," "smoking," "wrinkles," "skin," and "face" in several combinations, resulting in 7 articles that met the study's inclusion factors.
Results: Participants were recruited in several ways, including the Twins Day Festival in Twinsburg, Ohio, and the Osaka Twin Research Center in Japan. The studies surveyed participants' smoking behaviors and took photos of the twins' faces. Studies measured facial aging using several parameters, including estimations in twin age differences,

facial wrinkle scales, and measurements of facial features. Overall, twins who smoked had more parameters of facial aging when compared to their twins who did not smoke. Conclusions: The findings from this literature review are noteworthy given the scientific rigor of identical twin studies. The results provide further evidence regarding the impacts of smoking and should be used in public health messaging towards smoking prevention and cessation.

Leah Carver, Biology Undergraduate Student
Faculty Mentor: Zachary Farris, Health and Exercise Science
Co-Author(s): N/A
Title: CONSERVATION PRIORITY OF PROTECTED AREAS OF MADAGASCAR: SITE SELECTION AND ANALYSIS

Madagascar is one of the most diverse regions of the world with an estimated endemism rate of 80-90 percent. However, its lemurs and native carnivores (Eupleuridae) are especially sensitive to anthropogenic changes such as deforestation, fragmentation, bushmeat hunting, and disease transmission from domestic dogs and cats. Given the increased threats to lemurs and carnivores, researchers must be able to prioritize areas for conservation research in Madagascar. In this work, 13 protected areas (PAs) of Madagascar were selected and ranked from highest to lowest conservation priority using a variety of characteristics such as PA size, deforestation rates, species richness (lemur, carnivore, mammal, and total), number of endemics, and anthropogenic threats. Further, a simple linear regression was carried out to explore which of the above characteristics correlate most with lemur and carnivore species richness. that lemur and carnivore richness strongly correlate with each other ($R2= 0.60$). Additionally, mammal species richness was found to correlate with that of lemurs ($R2=0.49$) and carnivores ($R2=0.56$). Based on their status in the aforementioned categories, the Andringitra and Makira PAs are projected to be the most critical PAs for future conservation work in Madagascar. This research proposes a methodology for a more homogeneous approach to the prioritization of conservation research both in the region and globally.

PJ Coleman, Biology Undergraduate Student
Faculty Mentor: Jennifer Geib, Biology
Co-Author(s): Paul Super, Luke Bennett, Nicole Lowder
Title: SURVEYING SYRPHID FLY DIVERSITY ALONG THE BLUE RIDGE PARKWAY

Flies of the family Syrphidae are a widespread and diverse group of dipterans consisting of over 6000 species worldwide. Although most of the buzz surrounds bees, syrphid flies are thought to be equally important pollinators of native plants. Additionally, the larval stages of many species are predatory towards common plant pests such as aphids, making them promising biological control agents in both natural and agricultural settings. Despite the dual ecosystem services offered by their holometabolous lifestyle, few studies exploring syrphid distribution and diversity have been conducted within the

United States. Prior to 2019, there were no documented records of syrphid flies along the Blue Ridge Parkway, a major unit of the National Parks System. In order to determine the diversity of species present in this region, a citizen scientist inventory collected Syrphid Flies through passive trapping (2019, 2020) as well as active netting efforts (2021) at 64 sites alongside the Blue Ridge Parkway in North Carolina and Virginia. Field sites were generally characterized by meadows with abundant floral resources ranging from high points to wetlands. Samples (N = 1000) were euthanized on site and frozen before being pinned and identified. Collections yielded over sixty syrphid species total with a range of 3 - 12 species per site. As many native pollinators begin to experience declines in abundance, a heightened focus on the conservation of syrphid flies may prove beneficial in managing natural, recreational, and agricultural assets. The data collected by this project serves as a valuable baseline for future monitoring and studies of an extremely undervalued species.

Alexandra DelTurco, Biology Undergraduate Student
Faculty Mentor: Matt Estep, Biology
Co-Author(s): Jennifer Rhode Ward, Matt C. Estep
Title: CROSS AMPLIFICATION OF GENETIC MARKERS FROM ECONOMICALLY SIGNIFICANT ALLIUM SPECIES FOR USE IN GENETIC DIVERSITY STUDIES OF THE NATIVE ONION, ALLIUM TRICOCCUM.
Allium tricoccum Ait. is a herbaceous perennial most commonly known as Ramps. Ramps are native to eastern North America and have long been harvested by indigenous American cultures. In recent years, Ramps have become a highly prized forage, with festivals celebrating the coming of spring often accompanied by Ramp eating contests. Although not a rare plant, the species' growing popularity has led to overharvesting and population declines throughout its native range. In order to better understand the current genetic diversity of Ramps and plan for sustainable harvesting into the future, a set of polymorphic genetic markers are needed. The purpose of this project is to cross-amplify 25 microsatellite markers from economically significant Allium species, such as A. fistulosum (Bunching onion), A. cepa (Common onion), and A. sativum (Garlic). This work will provide tools for population genetic studies of Allium tricoccum and can inform conservation management decisions.

Dominic DiProspero, Biology Undergraduate Student
Faculty Mentor: Rachel Bleich, Biology
Co-Author(s): Ally Lawing, Freedom Johnson, Dr. Janelle Arthur
Title: QUANTIFICATION OF BIOFILM GROWTH BETWEEN ADHERENT-INVASIVE E. COLI & E. FAECALIS FROM PATIENTS WITH IBD.
Biofilms are communities of bacteria that colonize and bind to surfaces while creating an extracellular matrix aiding in bacterial defense and antibiotic resistance. Adherent-Invasive Escherichia coli (AIEC) are known biofilm-forming pathobionts and

have been observed in increased populations, alongside Enterococcus faecalis, within patients suffering from inflammatory bowel diseases such as Crohn's disease and ulcerative colitis. Previous research in the lab shows that AIEC and Enterococcus interactions can lead to wrinkling biofilm phenotypes in co-culture, suggesting an increase in biofilm formation when they are grown together. This research aims to discover mechanisms behind these interactions that mediate this wrinkling phenotype through the quantification of individual and co-cultured (AIEC + E. faecalis) biofilm growth under various conditions. Conditions include different times and temperatures during incubation as well as the use of a conditioned media containing metabolites from a novel E. faecalis strain to determine if physical contact or signaling molecules contribute to the enhancement of biofilm formation in vitro.

James Erny, Biology Graduate Student
Faculty Mentor: Michael Opata, Biology
Co-Author(s): N/A
Title: MODERATE MALNUTRITION INCREASES NATURAL KILLER CELLS DURING PLASMODIUM CHABAUDI INFECTION

Plasmodium falciparum is a parasitic species that has plagued humanity for millennia but despite mass effort to combat it, malaria is one of the leading causes of disease and deaths in the modern world. Previous studies on the immune response to malaria focused on the adaptive lymphocytes such as B and T cells, but recent research suggests an expanded and vital role for natural killer (NK) cells and other innate immune cells in the protection against malaria disease. Malnutrition is prevalent in malaria-endemic regions and has been identified as the greatest cause of acquired immunodeficiency. This combination of a deadly parasite and compromised immune system due to malnutrition, leads to the high death rates observed in sub-Saharan Africa. In this study we focused on defining the impact of micronutrient-related malnutrition on the Natural killer (NK) cells in mice infected with Plasmodium chabaudi, a murine malaria species that is a model for Plasmodium falciparum infection in humans. We observed that mice fed on the micronutrient deficient diet had more NK cells compared to the well-nourished counterparts at day 9 which represents the peak of infection. We also observed increased cytotoxic potential in the well-nourished murine NK cells compared to their malnourished counterparts. Future studies will investigate an earlier timepoint when these innate lymphocytes are critically important and determine their cytotoxic and cytokine production potential during this infection.

Morgan Gaglianese-Woody, Biology Graduate Student
Faculty Mentor: Matt Estep, Biology
Co-Author(s): Matt C. Estep
Title: THE EFFECT OF A PAST AUGMENTATION ON THE FITNESS OF THE FEDERALLY ENDANGERED SOUTHERN APPALACHIAN ENDEMIC GEUM RADIATUM MICHX.
Geum radiatum Michx., or Spreading Avens, is a federally endangered perennial in Rosaceae. It inhabits high-elevation rock outcrops, spreading along a rhizome within rock cracks and crevices. The long-lived hexaploid is confined to fifteen fragmented locations above 1500 meters along the North Carolina and Tennessee border. Previous studies have concluded that it is vulnerable to various disturbances due to its small range, fragmented populations, and life history, and is threatened by extinction within the next several decades. There is therefore a dire need for integrative conservation management strategies that consider genetic factors. Using genotyping technology and a long-term demographic dataset, we will quantify the effect of a past augmentation on the fitness of admixed generations within the Roan Mountain metapopulation. The aim of this study is to determine if a genetic rescue occurred and help ascertain if genetic rescue is a viable management strategy for G. radiatum and long-lived perennials alike.

Amelia Gallina, Biology Undergraduate Student
Faculty Mentor: Lynn Siefferman, Biology
Co-Author(s): K. George
Title: PLUMAGE ORNAMENTATION OF FEMALE TREE SWALLOWS (TACHYCINETA BICOLOR) MAY SIGNAL MATERNAL DEFENSE AGGRESSION AND BOLDNESS TO HUMANS
Relationships between ornamental traits and aggressive or bold behavior have been well documented in males, but less research has focused on the signaling function of ornamental traits in females. Here, we investigate correlations between behavior and plumage ornamentation in female tree swallows (Tachycineta bicolor). Female tree swallows are aggressive territorial songbirds and are the only known species wherein females exhibit delayed plumage maturation. Females breeding in their first year lack the iridescent blue-green dorsal coloration that older females and all males exhibit. Yet, all adult birds have white ventral coloration. We captured and measured female plumage color and conducted field-based behavioral assays to gauge their flushing response to humans, and mobbing aggression towards a mock predator. We found that older females with more-ornamented ventral and dorsal color were less aggressive towards mock predator intrusions. Older females with more-ornamented ventral color were also more likely to leave the nest when a researcher approached. For younger females, we found only a weak relationship wherein those with more-ornamented ventral plumage were more likely to flush from the nest when a researcher approached. Overall, our data suggest the potential for multiple ornamental traits to signal

reproductive investment in females. Moreover, our data suggest that white breast coloration may act as a signal in both age classes.

Courtney Garneau, Biology Undergraduate Student
Faculty Mentor: Shea Tuberty, Biology
Co-Author(s): N/A
Title: UPTAKE OF MICROPLASTICS BY CADDISFLIES [HYDROPSYCHIDAE] DOWNSTREAM OF WASTEWATER TREATMENT PLANTS IN SOUTHERN APPALACHIAN HEADWATER STREAMS
Plastic can undergo many levels of fragmentation due to its resilient nature, breaking down into microplastics found commonly in the form of fibers and other particles. When exposed to the natural environment, these microplastics are likely to incorporate themselves into sediments and be ingested by organisms, and they take decades to break down completely. The deposition of microplastic from the atmosphere is a likely cause of its copious presence in aquatic ecosystems, but there has been a lack of focus on mountain headwater streams and freshwater biotic impacts. Municipal wastewater treatment facilities are also known to filter microplastics within sewage water, and the sludge that results can make its way into freshwater areas. A study is being conducted to determine the rate of microplastic uptake within net-spinner caddisfly nets (Hydropsychidae). Samples have been collected from sites upstream and downstream of two municipal wastewater treatment facilities in the Upper South Fork New River Watershed in Watauga County, North Carolina. Whether or not there is a significant difference between particles in downstream and upstream nets will be determined by evaluating reference sites and comparing the data to the contribution by sewage effluents found in the downstream nets. This is the first step in determining the microplastic uptake by a filter feeding aquatic species, and could point to possible trophic transfer of the contaminant to the terrestrial ecosystem food web.

Safaa Ghalmi, Biology Undergraduate Student
Faculty Mentor: Shea Tuberty, Biology
Co-Author(s): N/A
Title: IMPORTANCE OF BENTHIC MACROINVERTEBRATE IDENTIFICATION AFTER DAM REMOVAL
As the removal of dams is becoming a more common approach to stream and river restoration, it is essential to understand the subsequent effects on aquatic ecosystems. The collection of physiochemical data exclusively does not provide enough information about short-term impacts on stream channels. Benthic macroinvertebrates (BMIs) can serve as a convenient indicator of both long- and short-term water changes. These organisms vary by site, have different tolerance values, and can be easily collected. However, several factors such as streambed composition, geography, and channel slope present a challenge when predicting different changes. This project is designed to

investigate the relationship between benthic macroinvertebrate identification and water quality. This was achieved by the monthly collection of BMIs from several sites before and after dam removal. The organisms will be identified to the species level to calculate abundance, water quality, and diversity. Classifying organisms to this level presents a wider range of tolerance and enables the determination of precise differences in water. The results from this study will provide an understanding of the importance the classification of benthic macroinvertebrates present in a stream and provide environmental consultants with relevant information concerning impacts dam removals have on aquatic ecosystem life.

Elizabeth Haslam, Biology Undergraduate Student
Faculty Mentor: Nicholas Shaw, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: COMMERCIALIZING TECHNOLOGY AT ASU: PHARMACEUTICAL APPLICATIONS
The work conducted in this research investigation aims to explore the application of Swellable Organically Modified Silica (SOMS) to the synthesis of pharmaceuticals. Traditional synthetic organic chemical methods used in the manufacturing of pharmaceuticals often give rise to lengthy reaction times and low reaction yields that ultimately inflate the cost of these pharmaceuticals. Utilizing technology developed in the Shaw Research Group, SOMS can be used to optimize the synthetic organic chemical conditions through the restriction of chemical reactants to nano-sized cavities. Sequestering reactants to nano-sized cavities increases the number of correct collisions between the reacting molecules and ultimately drives chemical reactivity. As a result, reaction yield is drastically increased while the time taken to conduct the reaction is drastically decreased. We are interested in investigating when and where SOMS can be deployed to improve the synthesis of important pharmaceuticals. We will report the use of SOMS in the synthesis of Aspirin and the cholinesterase inhibitor, Donepezil, as well as discuss the broader implications (lowering both the cost and time of the reactions) of synthesizing pharmaceuticals using SOMS nano-reactors.

Leigha Henson, Biology Graduate Student
Faculty Mentor: Howard Neufeld, Biology
Co-Author(s): N/A
Title: WARMING AND PRECIPITATION EFFECTS ON SEVERAL COMMON MOSS SPECIES OF THE SOUTHERN APPALACHIAN MOUNTAINS
Mosses often function as keystone species and bioindicators of forest integrity. They are sensitive to changes in atmospheric conditions and exhibit variation in their responses, so they may influence ecosystem functioning out of proportion to their biomass. Climate change is beginning in the Southern Appalachian Mountains (SAM) with unknown effects on mosses. However, there have been no studies of moss ecophysiology and moss

community changes in response to climate change in this region. I will investigate ecophysiological responses of six SAM moss species to warming and precipitation changes using mesocosms. Higher temperatures may reduce photosynthesis (A) due to evapotranspiration, while increasing A during colder periods. Elevated temperatures may increase respiration leading to lower net carbon assimilation. Precipitation changes may depress A due to longer desiccation periods, causing growth reductions. I will measure gas exchange following rainfall and during drought, and I will take moisture, light, temperature, and CO_2 response curves. Stable carbon isotope ratios will be analyzed to indicate water use efficiency changes. I will measure chlorophyll/carotenoid contents and fluorescence to assess photosystem II. Changes in moss community structure may influence ecosystem dynamics. The results of this study will provide insight into the ecophysiological responses of SAM mosses to predicted climate changes and how they may affect ecosystem functioning in the future.

Abigail Hockett, Biology Graduate Student
Faculty Mentor: Mary Kinkel, Biology
Co-Author(s): E. Rodriguez, C. Bouldin
Title: CHANGES IN CHROMOSOME NUMBER ALTER VERTEBRATE EMBRYONIC DEVELOPMENT

This research focuses on understanding how changes in chromosome number (aneuploidy) disrupt development. The zebrafish is an ideal model for such studies because fertilization is external. This allows us to observe development from the one-cell stage. Previous studies have shown that changes in chromosome number disrupt posterior body development. Our current studies are focused on neuromesodermal cells that are essential for posterior outgrowth of the body. These are stem-like cells that give rise to neural and mesodermal tissues. To investigate the effect of aneuploidy on these tissues, we have developed protocols for generating haploid and tetraploid eggs. This allows a comparison of embryonic development between normal diploid embryos versus haploid and tetraploid embryos. To confirm the ploidy of our manipulated eggs, we treated cells with colcemid to stall chromosomes in metaphase, isolated nuclei and used a fluorescent stain to visualize and count the chromosomes. Preliminary work confirms that aneuploidy is associated with shortened bodies when raised to 5 dpf. Analysis of gene expression patterns for markers of mesoderm development showed no differences between wild-type and aneuploid embryos during the first 16.5 hours of development. This suggests that the observed outgrowth defects appear later in development. Ongoing studies are intended to identify the onset of the outgrowth defect using phenotypic studies and gene expression analysis.

Abby Hrabosky, Biology Graduate Student
Faculty Mentor: Shea Tuberty, Biology
Co-Author(s): Carol Babyak, Rebecca Witter, Danielle Koontz, Sherri White-Williamson
Title: A ONE HEALTH APPROACH TO DETERMINING ADVERSE EFFECTS OF CONCENTRATED ANIMAL FEEDING OPERATION (CAFO) FARMING ON SURROUNDING WATER QUALITY IN SAMPSON COUNTY, NC

Sampson County, NC is the second leading hog producing county in the United States, with an estimated two million hogs currently in inventory. Hog waste is commonly stored in open-air basins called 'hog lagoons', comprised of, but not limited to, fecal matter, urine, contaminated water, and rain. Surrounding water sources are at risk of contamination due to both the runoff of these lagoons, and the use of their contents as 'organic' fertilizer, which is often sprayed onto surrounding crops and can leech into groundwater and runoff into surface water. Hog lagoons have the potential to produce elemental, anion, and nutrient wastes, including, but not limited to, toxic metals, nitrates, phosphates, chloride, sulfates, E. coli, and total coliform. The concentration of these chemicals will be analyzed in household well and stream water using ion chromatography (IC), inductively coupled plasma – optical emission spectrometry (ICP-OES), and 3M Petrifilm E. coli tests. Additionally, the quality of surface water sources surrounding hog lagoons will be analyzed with the use of benthic macroinvertebrate biomonitoring, where the presence (or absence) of sensitive macroinvertebrates can qualitatively (and quantitatively, using the NC biotic index) assess the water quality. The use of both chemical and macroinvertebrate analyses can indicate much about the chemical composition and overall health of a water source, respectively. We hypothesize that there is a correlation between proximity to, and density of, hog lagoons and poor water quality. This study will combine IC, ICP-OES, 3M Petrifilm E. coli testing, and macroinvertebrate biomonitoring to encompass the overall quality of nearby water sources due to continuous agricultural waste from concentrated animal feed operations (CAFOs). Comparison of this project's findings to EPA benchmarks and NC DEQ biological criteria scores will indicate any water samples that are adversely impacted by these agricultural practices.

Keegan Jenkins, Biology Undergraduate Student
Faculty Mentor: Matt Estep, Biology
Co-Author(s): Jennifer Rhode Ward
Title: CHROMOSOME NUMBER AND PLOIDY LEVELS OF VIRGINIA SPIRAEA, AND IMPLICATIONS FOR CONSERVATION OF THIS THREATENED SPECIES

Spiraea virginiana Britton (Rosaceae) is a federally-listed rare, clonal shrub that inhabits riparian zones within the Tennessee and Ohio River drainages. The species requires periodic geophysical disturbances, usually in the form of flooding, to remove the competition from woody shrubs and facilitate the dispersal of ramets. Sexual reproduction has not been observed under field conditions, and controlled matings

result in low seed production and/or viability. Determining the role of chromosome segregation is an important step towards understanding barriers to sexual reproduction, experienced by this species, possibly allowing shifts in restoration approaches. Cytogenetic investigations were carried out on a series of Virginia spiraea individuals, propagated asexually from field-grown progenitors. Inflorescences were collected a few days before anthesis and preserved in Carnoy's fixative. Chromosome squashes were prepared using acetocarmine to visualize chromosomes during meiosis. This study aimed to verify published chromosome numbers and identify any chromosome abnormalities visible during meiosis that might be a contributing factor to sexual reproductive barriers within this species.

Grace Kropelin, Biology Undergraduate Student
Faculty Mentor: Clare Scott Chialvo, Biology
Co-Author(s): N/A
Title: EXAMINATION OF FEEDING BEHAVIOR IN THE POLKA-DOTTED FRUIT FLY (DROSOPHILA GUTTIFERA).
The evolutionary arms race between insects and their plant/fungal hosts has been intensely studied. Hosts that produce highly toxic compounds typically exclude generalist feeders that are predicted to evolve the ability to detoxify closely related chemical compounds. However, some fly species in the immigrans-tripunctata radiation of Drosophila use both deadly toxic mushroom species (e.g., the death cap and destroying angel mushrooms) as well as edible species as developmental hosts. While these species are classified as generalists, we hypothesize that the one species (Drosophila guttifera) is transitioning from a generalist to a specialist feeding/ developmental strategy. To address this question, we reared larvae from two D. guttifera genotypes on diets with and without a single toxin or a mix of toxins extracted from the death-cap mushroom. We measured several fitness phenotypes (e.g., survival to adult, thorax length, adult weight) to assess whether the larvae exhibited increased performance on diets with the toxins. We also conducted oviposition preference assays in the two lines to determine if females preferred to lay their eggs on toxic mushrooms instead of edible mushrooms or fruits. Our results provide greater context for the associations between this D. guttifera and its host fungi.

Claire Martin, Biology Graduate Student
Faculty Mentor: Howard Neufeld, Biology
Co-Author(s): N/A
Title: ECOPHYSIOLOGICAL EXPLANATIONS FOR SPATIAL AND TEMPORAL VARIATIONS IN AUTUMNAL COLORATION WITHIN THE CANOPIES OF ORNAMENTAL RED MAPLE (ACER RUBRUM 'ARMSTRONG) AND FREEMAN MAPLE (ACER X FREEMANII) TREES

Leaves of some urban red maples turn red at the top of the canopy before the bottom (Freeman maples, Acer x freemanii), while others have leaves that turn red simultaneously all over (A. rubrum 'Armstrong'). Our research investigated ecophysiological mechanisms governing spatial and temporal variation in autumnal red coloration in both tree varieties. We compared leaves from upper (8-9 m) and lower (2 m) canopy locations to see if coloration differences arise from environmental or physiological differences, or both. We used a bucket truck to reach leaves and weather stations to measure microclimates at two heights. Wind speed and solar energy were the only environmental variables that differed between upper and lower leaves, and were higher at the top of the canopy. Lower leaves of Freeman maples leafed out first, reached full size ~13 days earlier, and persisted longer (~18 days) into the fall than upper leaves, resulting in longer leaf lifespans by ~14 days. Mid-summer chlorophyll content in Freeman maples was higher in lower leaves, and in fall, anthocyanins accumulated earlier and to a greater extent, in upper leaves, whereas no such differences occurred in A. rubrum. Photosynthetic rates and nitrogen content were higher in lower leaves of Freeman maples, but did not differ in A. rubrum. Higher photosynthetic rates in Freeman maples correlated with higher chlorophyll and nitrogen contents, while early and greater accumulation of anthocyanins in upper leaves correlated with lower nitrogen content, a factor known to elevate leaf anthocyanin content. Lower nitrogen in upper leaves could be the proximate driver for early anthocyanin synthesis in upper leaves of Freeman maples, but not A. rubrum maples. The results of this study also provide insight into intra-canopy variation in leaf ecophysiology of open-grown trees in an urban environment, which will help with future ecophysiological modeling studies.

Emma Metcalf, Biology Graduate Student
Faculty Mentor: Rachel Bleich, Biology
Co-Author(s): Janelle Arthur, Cassandra Barlogio
Title: HUMAN INTESTINAL AIEC STRAINS ALTER THE JEJUNAL MICROBIOME IN IL10-/- MICE

Resident microbes in the gastrointestinal tract (GI) are implicated in host health and progression of diseases such as Crohn's Disease (CD). CD is a chronic inflammatory condition of the GI tract. An Eschericihia coli (E. coli) species termed Adherent-Invasive E. coli (AIEC) has been associated with increased inflammation in CD patients. Prior studies investigated the impact of AIEC on the microbiota and inflammation in colonic and ileal tissues, however, their impact on jejunal tissue is less known due to its location in vivo. The project goals were to determine the extent Crohn's-associated AIEC and non-AIEC strains colonize the jejunum and validate their impact on microbial dysbiosis and jejunal inflammation. A novel barcoding approach was used to identify clinical strains of E. coli within a complex microbiota. A collection of well-characterized AIEC and non-AIEC strains isolated from the intestinal mucosa of healthy and CD patients were used. Strains were introduced into germ-free mice (inflammation-susceptible

Il10-/- or inflammation-resistant WT) along with a fecal microbial transplant (FMT) to create relevant CD model conditions. After the 10-week mouse model, Illumina MiSeq sequencing of the barcode region and 16S amplicon allows us to assess relative abundance of E. coli strains and changes to the jejunal microbial community. Our in vivo modeling indicated inflammation promoted increased E. coli colonization of the jejunum in inflammation-susceptible mice.

Drew Milavec, Biology Undergraduate Student
Faculty Mentor: Jennifer Geib, Biology
Co-Author(s): Alex Nixon, Brooke Reutinger, Paul Super, Sam Droege, Jennifer Geib
Title: DIVERSITY, ABUNDANCE, AND FORAGING HABITAT PREFERENCES OF SOLITARY BEES ON THE BLUE RIDGE PARKWAY
Habitat loss through fragmentation and urbanization are key threats facing bee populations worldwide. In the last two decades, it has been documented that populations of many bee species have been declining. However, most data on bee declines originates from eusocial bee species, particularly bumble bees (Bombus sp.); the status of most solitary bee populations is unknown despite comprising a vast majority of bee species. Like social bees, solitary bees contribute integral pollination services to agricultural and native ecosystems, yet, key aspects of their life history and ecology remain unknown. To address these gaps in knowledge for species in the southern Appalachians, I will quantify solitary bee abundance and diversity along the entire length of the Blue Ridge Parkway, using bees samples collected by students and citizen scientists in a 2019 survey. I will then develop occupancy models in R software (unmarked package) to investigate habitat preferences of ecologically important solitary bee species and estimate their detectability. I predict that environmental covariates such as elevation, temperature, and availability of bee preferred floral resources will be usable for predicting the true presence and absence of bees at each site. In conservation and management as well as everyday life, bees are often viewed as monolithic with all species being treated the same, whereas in reality different families of solitary bees have different life histories that vary greatly especially when and compared to social families of bees. Understanding the needs of solitary bees is essential for land managers to allow them to have a better understanding of what types of patches need to be conserved.

Alexander Moore, Biology Undergraduate Student
Faculty Mentor: Zachary Farris, Health and Exercise Science
Co-Author(s): N/A
Title: ANALYSIS OF ANTHROPOGENIC AND LANDSCAPE FACTORS INFLUENCING FOSSA FOSSANA ABUNDANCE ACROSS EASTERN MADAGASCAR
Madagascar is home to a host of endemic carnivore spp., many of which are understudied and therefore the necessary information for effective conservation is unavailable. Endemic carnivores, including Fossa fossana (Spotted fanaloka), are

negatively impacted by human activity and are classified by the International Union for Conservation of Nature as a vulnerable species. To increase our understanding of this vulnerable Malagasy carnivore sp., we investigated variables (temporal activity, seasonal activity, and specific landscape factors) influencing their relative abundance. Image capture data specifically looking at: time at capture, season " " , elevation " " , and temperature " " were analyzed and the relationship between F. fossana relative abundance and other anthropogenic factors (e.g. distance to nearest village, etc.) were analyzed using linear regression. The data review, spanning 10 years (2010-2019) and 1066 F. fossana captures, showed that F. fossana exhibited clear nocturnal and crepuscular behavior between 5PM and 5AM (97.81%), were most active during the months of July-October (61.16% of all captures), and occurred most often between elevations of 750 and 999 meters above sea level (36.05%; R2=0.5489). This study increases knowledge of activity and location behaviors of F. fossana with the benefit of providing an analysis of historical camera trapping data to help shape and advance future rainforest carnivore conservation in Madagascar."

Adrianna Nelson, Biology Undergraduate Student
Faculty Mentor: Lynn Siefferman, Biology
Co-Author(s): N/A
Title: PERSONALITY INFLUENCES HABITAT PREFERENCE IN FEMALE TREE SWALLOWS (TACHYCINETA BICOLOR)
Animal personality, when an individual shows consistent behavior across time and contexts, can differentially impact where animals settle across a landscape according to the Personality-Matching Habitat Choice Hypothesis (PMHCH). Tree Swallows readily nest in artificial boxes and demonstrate variation in personality within a population and thus are ideal for testing the PMHCH. We predicted that aggressive female Tree Swallows would outcompete less aggressive females and thus acquire territories with better-quality habitat. To test this, we studied wild breeding birds and used behavioral trials to quantify female aggression. We used ArcGIS Pro to create 300m radius buffers around each nest to characterize habitat with USGS StreamStats and ESRI Land Cover 2020. We found that swallows were more likely to settle in habitat with more grass and further from forests and roads, suggesting that this is their preferred habitat. However, we found an unexpected result wherein the most aggressive birds settled in the poorer habitat (less grass, more trees). Swallows nest in open areas away from buildings and trees to avoid nest competitors like House Sparrows and House Wrens. It stands to reason that highly aggressive birds are most effective at defending their nests against heterospecific competitors, perhaps allowing them to nest in less suitable habitat and avoid competition with the conspecifics that would prefer to nest in higher quality habitats.

Michael O'Neill, Biology Undergraduate Student
Faculty Mentor: Zachary Farris, Biology
Co-Author(s): N/A
Title: CARNIVORES ON THE EDGE: EXAMINING THE IMPACTS OF HUMAN ENCROACHMENT ON MADAGASCAR'S CARNIVORES
Rainforest carnivores across the globe are threatened and understudied. Due to increased human activity, Madagascar's forests are being cleared at unprecedented rates. Understanding the impacts of deforestation on rainforest carnivore populations is key to conservation efforts. To better understand the relationship between human encroachment and rainforest carnivores, we investigated how relative abundance varied with distance to the forest edge, focusing on Madagascar's 6 native carnivore species in Masoala National Park. We analyzed data from 20 camera traps that ran from September 2019 to March 2020. We calculated the relative abundance of each carnivore, measured distance from each camera trap to the forest edge using Google Earth, and used linear regression to evaluate the relationship between abundance and forest edge. We analyzed 41,977 images and identified each species captured. We had 8,130 photo captures of native carnivores and found Madagascar's largest carnivore, Cryptoprocta ferox, had a positive relationship ($R2 = 0.47$) with the forest edge. Conversely, Galidictis fasciata showed a negative relationship ($R2 = 0.25$) preferring core forest. These results offer insight into carnivore behavior and distribution patterns as well as highlight interspecific variation that managers require for the development of targeted, effective management plans across this protected landscape. "

Tyler Olender, Biology Graduate Student
Faculty Mentor: Michael Opata, Biology
Co-Author(s): Nicole C. Warnick, Noah J. Murr, Paige J. Childers, Britney P. Nichols
Title: COMBINED EFFECTS OF MODERATE MALNUTRITION AND PLASMODIUM CHABAUDI INFECTION ON GUT INTEGRITY AND INNATE IMMUNITY
Malaria affects millions of people annually and thus remains a disease of global health importance. The persistence of malaria infection among 87 countries and territories despite global research efforts supports the need for a proper understanding of the pathogenesis and complications associated with the disease. Severe incidences of malaria are often in areas with high incidence of both macro- and micronutrient associated malnutrition. Common micronutrient deficiencies prevalent in malaria endemic regions include iron, vitamins A and B, iodine, and zinc. Nutritional status has been shown to affect factors of health, including immunity and the gut microbiome. Protein and micronutrient malnutrition (PMM) will alter the human gut microbiome in a way that is detrimental to immune development, functional capacity, and maintenance. In this study we sought to investigate how moderate malnutrition affect gut integrity and immunity during malaria infection. We used a murine model of Plasmodium chabaudi which mimics chronic Plasmodium infection in humans.

Moderate malnutrition was achieved using a diet that is deficient in protein, zinc, and iron. We observed a decrease in the proportions and number of activated dendritic cells. There was also damage to epithelial tissue in the malnourished, infected mice. This study reveals mechanisms by which Plasmodium infection exacerbates intestinal immunity in malnourished individuals thus leading to severe disease outcomes including diarrhea.

ROBERT ONJIKO, Biology Graduate Student
Faculty Mentor: Michael Opata, Biology
Co-Author(s): N/A
Title: EFFECTS OF MODERATE MALNUTRITION DURING PREGNANCY ON NEONATAL IMMUNITY TO MALARIA
Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. Malaria infection caused 627,000 deaths in 2020, with 80% of these deaths being reported in children below the age of 5 years. Despite this significant death in children, most studies are focused on the adult rodent model, limiting our understanding of immunity in the most vulnerable population. Our investigation involves the use of a rodent mouse model fed on different diets to induce malnutrition during pregnancy. The neonates are infected with malaria parasites that represent P. falciparum in humans. We look at how the offspring of the well-nourished and malnourished mice respond immunologically to the parasites several days after birth. We hypothesize that moderate malnutrition lowers the adaptive immunity, while prolonging innate immunity, which is less protective in chronic malaria infection, resulting in reduced survival of Plasmodium infected neonatal mice. Based on the preliminary results from our laboratory, we observed that moderately nourished mice succumb to malaria infection faster even though they seem to have lesser parasites than the well-fed young mice. We also observed that once infected, they are sicker by the fourth day post-infection. Future studies will utilize an adoptive transfer model to determine how the immune cells primed in a malnourished environment confer protection to immunocompromised Rag knockout mice. This study is important as it helps us understand how maternal moderate malnutrition during pregnancy influences the development of neonatal immunity to malaria.

Tyler Perryman, Biology Undergraduate Student
Faculty Mentor: Rachel Bleich, Biology
Co-Author(s): Chequita Brooks
Title: BACTERIOPHAGE PRESENCE IN MICROBIOTA OF ACID MINE DRAINAGE
Acid mine drainage (AMD) is a form of acidic pollution threatening the environment by turning local streams and rivers into orange, iron-rich solutions. AMD typically occurs in environments where water is allowed to react with exposed heavy metals, such as in abandoned mines. It is in these conditions that some microbiota have been found to

thrive, though it is worth noting there was no mention of any viral community members being found in the system nor any research into what roles they play in the environment. What is known is these conditions allow the forming and spreading of an acid to local water sources. However, there are bacteria and archaea successfully reducing the metal concentration in the water at the cost of increasing the pH. A large number of the bacterial and archaeal taxa present in AMD also remain uncharacterized, but steps are already being taken to change this as 29 metagenome-assembled genomes (MAGs) from microbiota living in AMD environments were published last year. Using this set of metagenomes we have searched for bacteriophages in the environment using VirSorter to identify taxa. The understanding of bacteriophage diversity in AMD environments can lead to a better overall understanding of how such phages modulate extreme prokaryotic-dominated environments.

Jazlyn Pointer, Biology Graduate Student
Faculty Mentor: Clare Scott Chialvo, Biology
Co-Author(s): N/A
Title: QUANTIFYING THE EFFECT OF HOST ON OVIPOSITION IN THE SPOTTED WING FRUIT FLY (DROSOPHILA SUZUKII)
The introduction of species into habitats that they did not previously occur in can have major ecological, environmental, and economic impacts. As a result of their introduction into a novel habitat, invasive species may be released from selective pressures such as resource competition and predation. Thus, understanding how invasive species impact the environment in which they occur is an active area of study. One such species, Drosophila suzukii, is an invasive fruit fly that is becoming a major pest to fruit farmers. It uses a serrated ovipositor to lay eggs in undamaged fruit, resulting in the loss of crops and thus profit. Due to its serrated ovipositor, fast growth rate, and broad host range, D. suzukii is difficult to manage effectively. Recently, D. suzukii was detected in the southern Appalachian mountains, an area of both high biodiversity, and production for several known crop hosts. Given the recent documentation of D. suzukii in this region, not much is known about the fly's host preference and impact on endemic species. In this study, we assessed oviposition preference on six diets in ten inbred lines of locally collected D. suzukii. The results from our study will provide context for the impact of D. suzukii on host plants (endemic and agricultural) in this area. "

Erik Rangel Silva, Biology Graduate Student
Faculty Mentor: Andrew Bellemer, Biology
Co-Author(s): N/A
Title: THE ROLE OF RNA-BINDING PROTEINS IN NOCICEPTION AND NOCICEPTOR-SPECIFIC CAS9 GENE EDITING IN A DROSOPHILA MELANOGASTER MODEL.

Chronic pain is a major issue in the United States and across the globe: current opioid treatments are inadequate due to its addictiveness and inconsistent symptom management. To elucidate the underlying mechanisms of pain response, our lab studies the role of RNA-binding proteins (RBP). Drosophila is an effective model to study this due to its genetic manipulability, simple maintenance needs, and high percentage of genes that are human homologs. The neurons of interest are nociceptors which detect harmful stimuli. To determine the role of certain genes in nociception, manipulations are restricted to nociceptors with the GAL4/UAS system. RNAi then targets and degrades the mRNA of these genes, silencing them at the translational level. Although a powerful method, there are some faults: inconsistent phenotypes and off-target effects. A novel method uses Cas9 to silence expression and provides a new way to determine the function of specific genes in nociception. My research will create a transgenic fly line that incorporates both Cas9 and GAL4/UAS technologies to silence nociception-related genes exclusively in nociceptors, to be confirmed with genetic sequencing. I hypothesize that knocking down RBP reduces nociceptive function and silencing known nociception-related genes with Cas9 will create results similar to RNAi knockdown in both adult and larval models. This can be used as an additional tool to gain a deeper understanding of normal nociceptor function.

Gloria Rhoney, Biology Graduate Student
Faculty Mentor: Maryam Ahmed, Biology
Co-Author(s): Charley Fields, Dr. Darren Seals
Title: ANTI-INFLAMMATORY EFFECTS OF EIGHT WEEK CRANBERRY SUPPLEMENTATION IN OLDER OVERWEIGHT OR OBESE ADULTS
While many studies have reported anti-inflammatory effects of cranberry supplementation in humans, less is known about how cranberry consumption impacts immune cells such as macrophages. My project goal is to determine if cranberry serum metabolites alter the phagocytic function of THP-1 macrophages in an LPS-induced model of inflammation. Serum samples from older subjects (50-80 years of age, BMI >25 kg/m^2) ingesting cranberry or placebo supplements were tested. We hypothesized that cranberry polyphenols would decrease phagocytosis in LPS-stimulated THP-1 macrophages due to suppression of LPS inflammatory pathways. As expected, LPS enhanced THP-1 phagocytosis compared to unstimulated cells. Pre-incubation of THP-1 cells with serum from all subjects increased phagocytosis induced by LPS, but there was no difference between serum from cranberry versus placebo groups. Moreover, serum from both cranberry and placebo subjects did not negatively impact the viability of THP-1 macrophages, with serum from females and younger individuals showing greater cell protective ability compared to serum from males and older subjects. These results suggest supplementation does not alter the phagocytic function or viability of macrophages. Upcoming studies will examine the effect of serum from additional subjects on phagocytosis and determine if cranberry supplementation provides

immunological benefits to older adults via modulation of macrophage activation and cytokine production.

Rosemary Ronca, Biology Graduate Student
Faculty Mentor: Jon Davenport, Biology
Co-Author(s): N/A
Title: IDENTIFYING THE HABITAT PARAMETERS AND PREDICTORS OF THE SOUTHERN APPALACHIAN MOUNTAIN ENDEMIC, PLETHODON WELLERI
Plethodon welleri is a small-bodied salamander species that is endemic to mountains in the Southern Appalachian Mountains and considered threatened across its entire range. Initial descriptions indicated that this species was a high-elevation spruce-fir specialist only found above 1500m. However, there have been recent observations at 620m, suggesting that the limited ecological descriptions for this species are inaccurate. The goal of this study is to provide accurate habitat preferences and begin to build a comprehensive idea of where this species occurs and estimate population sizes. To do this, I am conducting population surveys across part of this species range (n=17). This data will be analyzed using occupancy and abundance models to estimate key environmental indicators of population presence. Preliminary data from May-June 2021 indicates that the most influential environmental covariates were the interaction between humidity and elevation. Populations found in summer are typically at high elevations due to cooler temperatures and lower evaporative rates. I expect that influential covariates will change by season, as lower temps allow populations to emerge with less threat of water loss. This study will build on the reservoir of knowledge for P. welleri and the salamander communities in this region. Having access to baseline knowledge for threatened species is necessary to develop comprehensive conservation management plans for this species and the landscape over all.

Connor Slifer, Biology Undergraduate Student
Faculty Mentor: Shea Tuberty, Biology
Co-Author(s): Jasper Yoke, Katherine Welsh, Travis Blevins, Tyler Grant, Sarah Taylor, Chelsea Blount, George Santucci
Title: PRE-REMEDIATION BIOPHYSIOCHEMICAL ASSESSMENT OF AN URBANIZED HEADWATER STREAM IN BOONE, NC
Hardin Creek flows from a small catchment in Boone, NC containing 1st & 2nd order streams and feeds into the South Fork of the New River. The New River Conservancy (NRC) is pairing with the Town of Boone on planned Hardin Creek remediation efforts. The watershed is impacted by runoff from impervious surfaces from US Hwy 421/221, 600 meters of stream flowing beneath New Market Center parking lot, and sedimentation from construction of Watauga Highschool, completed in 2010. To determine current stream health, six locations were sampled above and below the urbanized reach, from 1st order headwaters to confluence with the South Fork of the

New River. Multiple techniques, such as inductively coupled plasma-optical emission spectroscopy, ion chromatography, benthic macroinvertebrate sampling, and electrofishing were conducted in early spring 2022 to determine current stream condition and reported as metrics established by the North Carolina Division of Environmental Quality. Results from this study will be compared to data reported by the ASU Dept. of Biology from 2011 & 2015, to provide an 11-year historical understanding of impacts on Hardin Creek's aquatic assemblage health. It is hypothesized that Hardin Creek will score poorly on biological and physicochemical parameters, supporting the NRC's planned remediation efforts.

Lee Sturgis, Biology Graduate Student
Faculty Mentor: Andrew Bellemer, Biology
Co-Author(s): N/A
Title: THE ROLE OF NOTCH IN DROSOPHILA NOCICEPTOR MORPHOLOGY AND FUNCTION

Chronic pain affects much of the U.S. population and is a major expense, between medical costs and missed productivity. The cellular and molecular mechanisms causing chronic pain are not well understood, and existing treatments fail to address these underlying factors. To find new treatments targeting the root causes of pain, the molecular processes behind sensory neuron function and morphology must be understood. We are currently investigating Notch, a gene encoding the Notch receptor which is found in many cell types. The Notch signaling pathway is well-described in neuron developmental processes, but its role post-mitotically is poorly characterized. Our goal is to see how Notch signaling contributes to responses to noxious stimuli, and its structural role in pain-sensing neurons. To explore this topic, we are using Drosophila melanogaster as a model organism. The Drosophila genome is relatively simple, and many homologs exist between Drosophila and humans, including Notch. We are manipulating the genome by knocking down Notch through the silencing of Notch mRNA. We are conducting behavioral assays, where the animal is exposed to a noxious stimulus and its behavioral response is analyzed. We are also using confocal microscopy to explore the morphological role of Notch in pain-sensing neurons. These experiments will elucidate the role of the Notch in pain-sensing neurons, and we hypothesize that Notch mutants will exhibit a defective response to noxious stimuli, as well as defective dendritic branching.

Madison Suttman, Biology Graduate Student
Faculty Mentor: Shea Tuberty, Biology
Co-Author(s): N/A
Title: MACROINVERTEBRATE IMPACT AND RECOVERY FOLLOWING WEIR DAM REMOVAL

Dam removals are becoming an increasingly prevalent method of stream and river restoration. It's well understood that dam removals cause a temporary disturbance to aquatic ecosystems but variable characteristics complicate our ability to predict changes. Few studies have captured the short- and long-term effects, potentially overlooking a critical window of change. Research on macroinvertebrate populations indicate that these organisms are sensitive to alterations in flow regime as it relates to sediment and nutrient transport. This project aims to evaluate the impact and timeline of recovery of macroinvertebrate community structure following a weir dam removal on the Middle Fork of the South Fork New River, a third-order, cold-water mountain stream. Four sites above and four below the impoundment were selected. Sampling was conducted over the course of one year post-removal. Macroinvertebrates will be identified to the lowest taxonomic rank possible to calculate indices of diversity, abundance, community composition, and water quality. Sediment load will be analyzed by measuring total suspended solids, tubidity, and bed composition. In addition to providing insight into the spatiotemporal impacts and recovery of macroinvertebrate populations, results from this study will provide stakeholders with critical information regarding the changes that a dam removal has on aquatic ecosystem health.

Nicole Warnick, Biology Graduate Student
Faculty Mentor: Michael Opata, Biology
Co-Author(s): Tyler Olender
Title: EFFECTS OF MORINGA OLEIFERA ON MUCOSAL IMMUNITY DURING MALNUTRITION IN PLASMODIUM CHABAUDI INFECTED MURINE MODELS

Plasmodium falciparum, the most lethal of the plasmodium parasites, commonly occurs in the Sub-Saharan African region. This same endemic area is also home to more cases of malnutrition due to food insecurity. While it's known that malaria affects gut microbiota, the complex relationship between malaria and malnutrition and how it affects gut integrity and mucosal immunity is not well studied. Due to drug resistance and sometimes limited resources, use of natural plant products for treatment of malaria is encouraged in these areas. One of the commonly used plants is Moringa oleifera, which has been used for hundreds of years as tea or in curries and other foods. Little is known about this plant though in the scientific world about how it may impact the immune system. Here we investigated the effects of Moringa on gut immunity during malaria infection in moderately malnourished murine models. We utilized a food-restriction diet to induce moderate malnutrition and investigated mucosal tissue integrity as well as the adaptive immune response in the gut. We have observed that

overall malnourished mice, as opposed to those that were well-nourished, had increased expression of CD4, CD19, and GL7 in the small and large intestine. Those receiving moringa supplementation had slightly higher expressions of these same cells than those receiving a control diet. Future studies will investigate the effects of Moringa on inflammatory responses in the moderate malnourished mice.

Elyssa Winterton, Biology Graduate Student
Faculty Mentor: Jon Davenport, Biology
Co-Author(s): N/A
Title: INVESTIGATING REGIONAL OCCUPANCY OF SMALL TERRESTRIAL SALAMANDERS (GENUS PLETHODON) IN NORTHWESTERN NORTH CAROLINA AND NORTHEASTERN TENNESSEE DURING SUMMER MONTHS
As habitat availability declines and community assemblages change it becomes more important to understand the environmental parameters that restrict the livable habitat of individual species of Plethodon salamanders. By looking at the environmental parameters and the subsequent microhabitats that are created we are better able to determine which are filtering out species from a regional pool. Previous studies have looked at salamander niche environments and have found discernable differences between species' abilities to live outside of specific environmental parameters. This puts a stronger focus on abiotic factors as the main constraint for regional differences in community assemblages, thus, challenging the long-held idea that competitive interactions are the only reason for differences among community assemblages. I investigated the regional occupancy of Plethodon cinereus and Plethodon richmondi in the southern Appalachian Mountains, on 47 plots surveyed three times during the months of June, July, and August of 2021. I analyzed occupancy probability and detection probability, incorporating environmental covariates. Occupancy for P. cinereus was calculated to be 0.289. Occupancy and detection for both P. cinereus and P. richmondi were best explained by the null model.

Business Administration

Katherine Uva, Business Administration Graduate Student
Faculty Mentor: Jill Juris, Recreation Management and Physical Education
Co-Author(s): N/A
Title: OLDER ADULT WELLBEING IN APPALACHIA: A FOCUS ON COMMUNITY RESOURCES
Social isolation and loneliness are two health concerns prevalent among older adults in rural Appalachia. The physical distancing restrictions of COVID19 created increased challenges of social isolation and loneliness. To combat these conditions, the AppState Cyber-Seniors team engaged with community organizations in the Fall 2020 semester to develop and facilitate virtual intergenerational programs between undergraduate students and older adults residing in the High Country. Through a partnership with the

Canadian-based Cyber-Seniors organization, Appalachian State University students learned basic technology and interaction skills to assist an older-adult in how to use their smart device or computer. This is a multi-tiered study that includes the examination of health outcomes such as social isolation and loneliness of both age groups and evaluation of program implementation. Quantitative and qualitative analysis of student and older adult survey responses revealed benefits for both populations. Data from the pilot semester indicated social isolation and loneliness decreased among older adults. Analysis of student outcomes and future directions of implementation will be shared in this presentation. The AppState Cyber-Seniors team developed processes, resources, and discovered best practices to provide online intergenerational programing. This allowed for both students and community members to connect and engage through technology during COVID19.

Chemistry

Sarah Altman, Chemistry Undergraduate Student
Faculty Mentor: Nicholas Shaw, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: COMMERCIALIZING TECHNOLOGY AT ASU: THE UGI REACTION AND LIDOCAINE

Lidocaine is a commonly prescribed amino amide anesthetic that is known to have rapid onset action and intermediate duration of efficacy making it a viable option for surface, block and infiltration anesthesia. The synthesis of Lidocaine is non-trivial. Unlike the majority of chemical reactions that are bi-component reactions that require two reactants to collide with sufficient velocity and in the correct orientation to produce a product, the synthesis of Lidocaine is a multi-component reaction that requires four molecules to simultaneously react. The research conducted in my laboratory focuses on the use of swellable organically modified silica (SOMS) nano-reactors to facilitate synthetic organic reactions. This technology is groundbreaking because, instead of conducting reactions in large flasks, our nanoreactors provide small cavities for reactions. When used to facilitate bi-component reactions SOMS nano-reactors are capable of dramatically decreasing reaction time and increasing reaction yield. This presentation will discuss advancements in the use of SOMS nano-reactors to facilitate the Ugi reaction and the numerous synthetic challenges that were overcome - the use of formaldehyde (a gas) and water, which pose significant challenges as getting a gas into our nano-reactors is difficult and the use of water as a reactant has been prohibited as our nano-reactors are hydrophobic - along the development of this new pathway.

Matthew Bonacci, Chemistry Undergraduate Student
Faculty Mentor: Nicholas Shaw, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: COMMERCIALIZING TECHNOLOGY AT ASU: SYNTHESIS OF COSMECEUTICALS

Skin care has been a growing component of wellness and research in this area has identified a number of molecules (cosmeceuticals) of importance. Glycyl-Histidyl-Lysine, commercially known as tripeptide 1, is a synthetic precursor to multiple cosmoceutical therapeutics. Studies suggest tripeptide 1 exhibits wound healing and tissue regeneration properties while also displaying the ability to increase collagen. However, the synthesis of this cosmeceutical, and subsequent analogs is tedious at best. Current peptide synthesis requires the amino acid chains to be bonded to a resin as a support which must be cleaved, require non user friendly reagents, and require extensive purification. In the end, it takes a very long time to make tripeptide 1 (days) and the yield is low (<50%). We have developed a novel synthetic method that allows us to synthesize highly engineered peptides, such as tripeptide 1. Utilizing swellable organic modified silica (S.O.M.S) as nano-reactors, the physical space where reactants meet can be controlled to favor bond formation which dramatically decreases reaction times and increases reaction yield. Our method drastically outperforms current synthetic methods, in terms of yield (quantitative) and time (mere minutes). We will present our method for the synthesis of tripeptide 1, demonstrate how our method outperforms current synthetic methods, and contextualize our work in terms of peptide manufacturing and commercialization.

Alyssa Burgess, Chemistry Undergraduate Student
Faculty Mentor: Brooke Christian, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: THE STABILIZATION OF ALCOHOL DEHYDROGENASE ACTIVITY BY A TARDIGRADE ABUNDANT HEAT SOLUBLE PROTEIN

Protein-based therapeutics, such as insulin, are unstable and require refrigeration and excipients to maintain function. Common excipients can moderately increase stability but can also elicit unwanted side effects including allergic reactions. We plan to use CAHS D, a cytosolic abundant heat soluble protein from tardigrades, as an excipient to stabilize therapeutics. CAHS D has been shown to protect proteins from desiccation and lyophilization-induced inactivation in vitro. This project tested the ability of CAHS D to protect alcohol dehydrogenase (ADH) in solution from time and heat-induced inactivation. UV-vis spectroscopy was used to monitor the activity of alcohol dehydrogenase in the presence and absence of CAHS D over several days at room temperature. Michalis Menten kinetics analysis indicated that both CAHS D and BSA increase the Vmax of ADH without affecting its Km for ethanol. In the presence of CAHS D, ADH remained active for several days after the enzyme alone lost activity. When

heated to 42 °C in the presence and absence of CAHS D, ADH activity was protected from temperature-induced inactivation by CAHS D. Together, these data show that CAHS D has the potential to stabilize proteins, including therapeutics, in solution.

Emma Cain, Chemistry Undergraduate Student
Faculty Mentor: Christian Wallen, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: METAL-ORGANIC COMPLEXES FOR HYDROGEN SULFIDE COORDINATION
Hydrogen sulfide is a toxic gas that contaminates natural gas sources all around the world. The Claus process is used to remove hydrogen sulfide from natural gas feedstocks, but thermodynamic limitations necessitate secondary treatment of the tail-gas. This research project focuses on the synthesis of metal-organic complexes that bind hydrogen sulfide and facilitate oxidation to valuable products that are less dangerous. An asymmetric four-coordinate sulfonamidate ligand was synthesized from inexpensive reagents and used to prepare a series of novel complexes with abundant transition-metals that facilitate intramolecular hydrogen bonding with the axial ligand. These complexes were found to be excellent coordinators of protic small molecules. The complexes were characterized using 1H-NMR, infrared spectroscopy, and electronic absorption. Single-crystal x-ray-diffraction was performed for complete structural characterization of the metal complexes.

Casey Eberts, Chemistry Undergraduate Student
Faculty Mentor: Carol Babyak, Chemistry and Fermentation Sciences
Co-Author(s): Sophia Emmer, Danielle Dangelo
Title: ANALYSIS OF PESTICIDES USED ON CHRISTMAS TREE FARMS IN BOONE WASTEWATER
Up to this point, wastewater-based epidemiology (WBE) has mainly focused on drugs and agrarian pesticides. However, farms are not the source of pesticides in each community; in western North Carolina, the Christmas Tree Farm industry is potentially a very large source of pesticides in wastewater. Our research will use WBE to assess exposure to pesticides commonly used on Fraser fir tree farms in the local Boone, NC, community. Our objectives are to 1) optimize the separation conditions for pesticides using gas chromatography; 2) determine parent and daughter ions to monitor for each pesticide in tandem mass spectrometry; 3) optimize solid-phase extraction conditions of pesticides from wastewater; and 4) collect and analyze wastewater samples over a one year period from the local wastewater treatment plant (WWTP). The concentration of pesticides in local wastewater will be determined using analysis on a gas chromatography tandem mass spectrometer (GC/MS2). At this point, our research is focusing on establishing figures of merit (limit of detection, precision, bias, etc.) as well as the derivatization of certain pesticides of interest (Garlon and Stinger).

Rebecca Foley, Chemistry Undergraduate Student
Faculty Mentor: Christian Wallen, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: SYNTHESIS OF METAL-ORGANIC COMPLEXES TO BIND WITH HYDROGEN SULFIDE
In natural gas sources there is a problem with high concentrations of hydrogen sulfide, which is a toxic gas that also happens to be a greenhouse gas and a major contributor to acid rain. The Claus process, which is a major removal technique of hydrogen sulfide, is effective, but it leaves behind 2-5% of the hydrogen sulfide. The existing removal processes and catalysts are not effective enough to remove most of the remaining hydrogen sulfide and need improvement. This work explores a series of sulfonamidate-ether-metal complexes that leverage intramolecular hydrogen bonding functionalities to bind protic small molecules similar to hydrogen sulfide. The synthesis of multiple ether-sulfonamidate ligands and corresponding metal complexes will be presented. Additionally, the structural characterization of the metal complexes and their reactivity with sulfur compounds will be presented.

Sarah Freitag, Chemistry Undergraduate Student
Faculty Mentor: Aruna Weerasinghe, Chemistry and Fermentation Sciences
Co-Author(s): Travis Liontis and Nick Khorozov
Title: SYNTHESIS, CHARACTERIZATION, AND EVALUATION OF A NOVEL COUMARIN DERIVATIVE AS A NERVE GAS SENSOR
A novel coumarin based fluorescent sensor was synthesized to detect G-type nerve agents. The compound was fully characterized prior to testing against diethyl chlorophosphite (DCP) which is a nerve gas mimic. The sensor exhibited a strong absorbance at 470 nm in absence on DCP. Addition of DCP resulted in shifting the absorbance peak to 540 nm with a naked eye color change from yellow to pink. In addition, a new fluorescence peak appeared around 585nm upon excitation at 532nm. The linearity of the Benesi-Hildebrand plot confirms 1:1binding stoichiometry between sensor and DCP with the bonding constant of 1.4 x 103. Binding mechanism will be discussed during the presentation.

Hope Frohock, Chemistry Undergraduate Student
Faculty Mentor: Megen Culpepper, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: EXPRESSION, PURIFICATION, AND CRYSTALLIZATION OF A PUTATIVE MONOOXYGENASE KEY TO GLOBAL SULFUR CYCLING
Dimethyl sulfide (DMS) is a volatile organic compound that plays an integral part in sulfur cycling. DMS contributes to cloud formation which back-scatters ultraviolet radiation, contributing to climate cooling. Prokaryotic organisms metabolically breakdown this compound which decreases the amount of marine DMS. The effects of

this decrease in DMS counteract its climate cooling effects greatly. DMS monooxygenase is the enzyme that breaks down DMS into methanethiol and formaldehyde. This enzyme has been identified as a flavin monooxygenase containing two subunits. DmoA is a FMNH2-dependent monooxygenase in which it is supplied FMNH2 from its redox flavin reductase partner, subunit DmoB. Within subunit DmoA, oxygen is converted to formaldehyde via an oxidative reaction where FMNH2 is oxidized to FMN and DMS is demethylated to form methanethiol. Key reaction intermediates in the conversion of DMS to methanethiol can be determined by analyzing the protein crystal structure of DmoA. We aim to determine how the protein structure dictates the function of DMS monooxygenase which can be correlated to environmental trends in DMS biological sinks related to climate change. In this experiment DmoA was expressed, purified, and crystallized from the bacteria Arthrobacter globiformis. Protein crystals were screened for X-ray diffraction. The purpose of this research is to visualize substrate and cofactor binding sites at the enzyme to determine key amino acids involved in catalysis, all towards determining the mechanism by which DMS is converted to methanethiol by the enzyme DMS monooxygenase.

Ethan Harris, Chemistry Undergraduate Student
Faculty Mentor: Michael Reddish, Chemistry and Fermentation Sciences
Co-Author(s): Noah Arnold, Katie May, Lyndsay Snider
Title: ALLOSTERIC INHIBITION OF CYTOCHROME P450 27A1: A POTENTIAL MEANS FOR THE CREATION OF NOVEL CANCER THERAPIES
Cytochrome P450 27A1 (CYP27A1) is a human mitochondrial enzyme responsible for the hydroxylation of cholesterol in the liver and vitamin D3 in the kidneys. In postmenopausal women, 27-hydroxycholesterol, a product of the reaction of CYP27A1 with cholesterol, is an agonist for estrogen receptors. Activation of these receptors can facilitate hormone-responsive cancer growth. While inhibiting CYP27A1 to reduce 27-hydroxycholesterol levels could be an effective cancer treatment, this approach may also be problematic as it could disturb vitamin D3 metabolism. Inhibitors that act outside the active site, allosteric inhibitors, could potentially modulate these two reactions independently to where 27-hydroxycholesterol levels are controlled and CYP27A1 driven vitamin D3 metabolism is not disturbed. Previous studies have identified multiple FDA-approved drugs that inhibit CYP27A1 metabolism of cholesterol. Initial spectral studies indicate some of these drugs may not bind at the active site. This research project uses a steady-state enzyme kinetics approach to monitor the hydroxylation of vitamin D3 and cholesterol in the presence of various inhibitors to understand these drugs' mode of inhibition. To quantify product formation, HPLC-UV is utilized. If these drugs act as allosteric inhibitors, novel cancer therapies could be derived using their structures as starting scaffolds, so the 27-hydroxycholesterol agonist could be limited while vitamin D3 metabolism is maintained.

Morgan Hern, Chemistry Undergraduate Student
Faculty Mentor: Christian Wallen, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: METAL COMPLEXES OF ASYMMETRIC SULFONAMIDATE LIGAND FOR HYDROGEN SULFIDE HARVEST

Hydrogen sulfide is an important industrial chemical that is toxic and dangerous to the environment. The Claus process is able to oxidize hydrogen sulfide into elemental sulfur (yellow sulfur), but 2-5% remains unoxidized in the gas output. Metal complexes can act as catalysts, binding to the residual hydrogen sulfide to prevent it from escaping to the environment. This project explores the synthesis of transition metal complexes with asymmetric tetradentate sulfonamidate-ether ligands and earth-abundant metal ions (cobalt, copper, nickel, and zinc). The synthesis and structural characterization of these compounds will be presented, as well as their reactivity with hydrogen sulfide and other protic small molecules. To determine the effectiveness of these catalysts, their binding to hydrogen sulfide and similar sulfide compounds will be investigated by synthesis of hydrogen sulfide-metal complex crystals, which will be analyzed for their structure and stability. The ligand will be analyzed using 1H NMR spectroscopy, 13C NMR spectroscopy, and elemental analysis. The metal complexes will be analyzed using IR spectroscopy, crystallography, and elemental analysis.

Nicholas Khorozov, Chemistry Undergraduate Student
Faculty Mentor: Aruna Weerasinghe, Chemistry and Fermentation Sciences
Co-Author(s): Sarah Frietag, Travis Liontis
Title: DESIGNING AN EFFECTIVE FLUORESCENT SENSOR FOR NERVE GAS USING COUMARIN DERIVATIVES

Nerve gas agents are highly toxic compounds that can be deadly for humans upon exposure. Therefore, detection of these compounds is important at extremely low concentrations. We have synthesized three coumarin derivatives bearing naphthalene moieties with different binding pocket configurations to detect G-type nerve gas agents. All the compounds were characterized using 1H and 13C NMR before testing with diethyl chlorophosphite (DCP) which is a nerve gas mimic. Binding of DCP with these sensor molecules was evaluated using spectroscopic techniques such as UV-Vis, fluorescent and 1H NMR. Size and the presence of a hydroxyl group in the binding site of these sensors for the binding of DCP and subsequent signal generation were evaluated in this study. Nerve gas binding via the hydroxyl group in naphthalene moiety followed by a rearrangement with the coumarin moiety is theorized. Compound 1, where two moieties are closer to each other, produced a color change upon the addition of DCP followed by strong UV and fluorescence signal. Compound 2, in which two moieties are far apart, degraded in the presence of DCP with no UV or fluorescent change. Compound 3 with same binding pocket size as of compound 1 but no hydroxyl

functionality also showed UV and fluorescence enhancement in the presence of DCP. Binding constants and the effectiveness of structural variations of these sensors will be further discussed.

Sophie Knier, Chemistry Undergraduate Student
Faculty Mentor: Libby Puckett, Chemistry and Fermentation Sciences
Co-Author(s): Connor Schlaline
Title: DESIGN AND DEVELOPMENT OF A HOMOGENOUS PROTEIN-BASED ASSAY FOR THE DETECTION OF ORGANOPHOSPHATES BY UTILIZING A FUSION PROTEIN BETWEEN ORGANOPHOSPHORUS HYDROLASE (OPH) AND ENHANCED GREEN FLUORESCENT PROTEIN (EGFP)
Organophosphates are harmful neurotoxins that inhibit nerve impulse transmission. Even low-level exposure to these compounds can be detrimental to the environment and to human and animal health; therefore, their use is regulated by the EPA. It is estimated that organophosphates account for 40% of all of the insecticides used in the United States. This fact, along with the threat of chemical warfare agents, makes the detection of a wide range of organophosphates necessary. This project is designed to address the need to detect and quantify organophosphates by developing a fusion protein-based assay using organophosphorus hydrolase (OPH) and enhanced green fluorescent protein (EGFP). This protein-based assay will leverage EGFP's pH-sensitivity and highly quantifiable fluorescence in combination with the pH-decreasing effect of OPH-catalyzed organophosphate hydrolysis. The biosensing system will be able to detect these fluctuations in local pH by monitoring the decrease in fluorescence emission of the fusion protein and can be used to quantify total organophosphate concentration. Ongoing research involves utilizing recombinant DNA technology to design polymerase chain reaction (PCR) primers to facilitate the fusion and inclusion of OPH- and EGFP-encoding genes, from the pJK01 and pEGFP plasmids, respectively, into the pET-21a vector via an overlap extension method. This research will ultimately allow for the production, purification, and use of an OPH-EGFP fusion protein in developing a fluorescence-based assay for the quantification of organophosphates.

Emma McGibany, Chemistry Undergraduate Student
Faculty Mentor: Nicholas Shaw, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: COMMERCIALIZING TECHNOLOGY AT ASU: THE WITTIG REACTION AND RESVERATROL
Resveratrol is a naturally-occurring compound found in plant sources such as red grapes and berries. The compound has been tied to a number of health benefits including antioxidant, antiviral, anti-inflammatory, and anticancer properties. The synthesis of resveratrol involves the Wittig reaction to generate an alkene bridge connecting two phenol rings. Seemingly simple, the traditional methods of organic

synthesis often involve lengthy reaction times, extensive purification, and significant use of hazardous chemicals. Use of the Wittig reaction, in particular, poses additional concerns of stereoselectivity; the Wittig reaction co-produces an unwanted cis-isomer along with the desired trans-isomer. In fact, the current method for synthesizing resveratrol involving the Wittig reaction results in a 51% yield selective to the trans-isomer. Our research group seeks to use swellable organically modified silica (SOMS) as nano-reactors to overcome the challenges of traditional organic synthesis by ensuring reactivity through the restriction of reactants to nano-sized vessels which result in impressive reaction times (minutes) and yields (99%+). We report the development of a procedure for the use of SOMS to facilitate the synthesis of resveratrol, the procedure's impact on reaction time and yield, our efforts to control stereoselectivity, and implications for the commercial synthesis of resveratrol.

Anderson Noonan, Chemistry Undergraduate Student
Faculty Mentor: Nicholas Shaw, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: COMMERCIALIZING TECHNOLOGY AT ASU: FUNDAMENTAL PROCEDURAL DEVELOPMENT OF SOMS NANO-REACTOR FACILITATED DIELS-ALDER REACTIONS

The Diels-Alder (DA) reaction is one of the most important known chemical reactions as it is involved in the synthesis of countless pharmaceuticals, agrochemicals, food additives, and cosmetics. The DA reaction is particularly enticing to synthetic organic chemists because it is a reliable carbon-carbon bond forming reaction that proceeds under mild conditions. Given the DA reaction's ability to synthesize carbon-carbon bonds and its prolific use in multiple industries, attention has been focused on the use of our research group's novel swellable organically modified silica (SOMS) nano-reactors to facilitate DA reactions. The use of SOMS nano-reactors seeks to overcome the challenges of conducting synthesis by traditional means by ensuring reactivity through the restriction of reactants to nano-sized reactors. For example, in a traditional DA synthesis, solvent diluted reactants face the same reactivity challenges that you and I would face if we were trying to find each other while bobbing in an ocean that covers the surface of earth. The reactant molecules are magnitudes smaller than the traditional vessels that contain them and even well dispersed reactant molecules must navigate a large ocean of solvent to achieve reactivity. However, the chances of reactivity are greatly improved if the reactant molecules are restricted to nano-sized reactors. We will present advancements made, problems solved, and the current state of SOMS nano-reactors facilitated DA reactions.

Josh Petersen, Chemistry Undergraduate Student
Faculty Mentor: Brett Taubman, Chemistry and Fermentation Sciences
Co-Author(s): Christian Hammond
Title: QUANTITATIVE ANALYSIS OF ESTER FORMATION DURING KVEIK FERMENTATIONS UNDER VARYING CONDITIONS
Kveik is an ale yeast, Saccharomyces cerevisiae, isolated from Scandinavian farmhouse breweries, that is new to the U.S. market and can ferment at high temperatures without the overproduction of volatile aromatic esters. Little research has been done to quantify the effects that varying fermentation conditions, such as temperature and starting gravity (density of the solution due primarily to dissolved malt sugars prior to fermentation), has on the production of esters when using Kveik for fermentation. For typical ale yeast, fermentation temperatures range from 18-20 ℃ and anything above will produce undesirable esters. In excess, these compounds are responsible for off-putting flavors and aromas. Using solid phase microextraction (SPME) gas chromatography with a mass spectrometer, ester production from four Kveik strains was quantified. The effect that temperature and starting gravity had on the production of eight ester compounds was determined based on the results from the SPME-GC-MS. The results from this study can be used by brewers to determine brewing conditions necessary for the flavor and aroma profiles they desire.

Megan Pike, Chemistry Undergraduate Student
Faculty Mentor: Carol Babyak, Chemistry and Fermentation Sciences
Co-Author(s): Latetia Hoyle
Title: METAL SPECIATION AND COMPLEXING CAPACITY IN THE SOUTH FORK NEW RIVER ABOVE AND BELOW THE WASTEWATER TREATMENT PLANT USING ELECTROCHEMICAL AND SPECTROSCOPIC METHODS
Metals can exist as free metals and bound metals. When dissolved organic matter (DOM) enters an environment, the free metals can become bound to the DOM, because the DOM behaves as a ligand. Metal concentration samples upstream and downstream from the South Fork New River wastewater treatment plant will be measured. We hypothesize that the total metal and DOM concentrations will be higher downstream of the wastewater plant. We also predict there will be more total metals in the water source during the school year when the town has a higher population. The metals being observed are copper, cadmium, mercury, and lead. It is important to study these metals because free metals are bioavailable to aquatic life, which can in turn harm and lead to the death of these animals. Inductively Coupled Plasma/Optical Emission Spectroscopy will be used to identify total metal concentrations; Anodic Stripping Voltammetry will be used to measure the concentration of free metals present in wastewater samples; Ion Chromatography will be used to measure the concentration of chloride in the wastewater. Currently water samples are being collected every week from above and below the wastewater treatment plant. The collected samples are filtered to be used for

Anodic Stripping Voltammetry, a sample is filtered for Ion Chromatography, and two samples are acidified, and one is filtered to be measured on the ICP. In the future these samples will be evaluated, and a conclusion will be made.

Benjamin Samberg, Chemistry Undergraduate Student
Faculty Mentor: Andrew Bellemer, Biology
Co-Author(s): N/A
Title: EFFECT OF ENDOCANNABINOIDS ON SEIZURE SEVERITY
In the United States, it is estimated that about 3.4 million people suffer from epilepsy, with an estimated 400,000 individuals suffering from intractable or medication-resistant seizures. In Drosophila melanogaster, the endocannabinoids anandamide and 2-arachidonoylglycerol as well as their metabolites ethanolamine and arachidonic acid show promise in possessing seizure protective qualities. This is of particular interest due to the fact that fruit flies do not have cannabinoid receptors, where cannabinoids are expected to bind. This makes the protective effects displayed by these compounds surprising and a relevant topic for further research. Understanding the mechanism for cannabinoid receptor-independent effects may offer insight into unknown endocannabinoid properties in humans, possibly leading to new treatments for seizure diseases. To better understand the role these cannabinoid compounds play in seizure prevention, mutant lines of Drosophila have been used which allow the induction of seizures that model intractable seizures in humans. For comparison, data has been gathered regarding the average recovery time of control flies (W1118) and seizure-prone mutant flies (parabss1). Both genotypes (W1118 and parabss1) have been tested in the presence and absence of different cannabinoids and metabolites to discern what effects these compounds may have on seizure severity and recovery time.

Carson Shivers, Chemistry Undergraduate Student
Faculty Mentor: Nicholas Shaw, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: COMMERCIALIZING TECHNOLOGY AT ASU: THE BIGINELLI REACTION AND NOVEL PHARMACEUTICALS
This presentation discusses advancements made in the synthesis of Monastrol using novel nano-reactors developed here at ASU. Monastrol is a potent chemotherapeutic that targets the first stage of mitosis and is capable of arresting cancer cell proliferation. It is synthesized via the Biginelli reaction, a versatile reaction that can also be used to form other Biginelli products which fall under multiple pharmacological umbrellas including antiproliferatives, calcium channel blockers, antiepileptics and antimalarials. Unfortunately, traditional methods of synthesizing Biginelli products are energy intensive, feature long reaction times (hours to days), are low yielding (25% - 50%), and feature competitive pathways causing incomplete reactions or contamination via side products or unreacted reagents. We will report the development of a new synthetic

methodology to afford Monastrol using swellable organically modified silica (SOMS). SOMS offer an enticing solution to the difficulties faced with synthesizing Biginelli products using traditional methods through the restriction of chemical reactants to small nano-sized pores where they are more likely to collide which dramatically decreases reaction time and increases reaction yield. An improved synthetic pathway for monastrol and other chemotherapeutics will be reported and its implications for oncological research will be discussed.

Lindsay Vaughn, Chemistry Undergraduate Student
Faculty Mentor: Brooke Christian, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: STABILIZATION OF PROTEINS IN SOLUTION BY A TARDIGRADE CYTOSOLIC ABUNDANT HEAT SOLUBLE PROTEIN
Cytosolic Abundant Heat soluble (CAHS) proteins are tardigrade-specific intrinsically disordered proteins that play a crucial role in the ability for tardigrades to survive extreme environmental changes, such as desiccation. Previous work has shown that CAHS D can also protect proteins from desiccation and lyophilization-induced inactivation in vitro. We aim to use CAHS D to stabilize protein-based therapeutics, such as insulin. The ability of CAHS D concentration to protect alcohol dehydrogenase and insulin in solution was investigated. CAHS D increased the activity of alcohol dehydrogenase in solution, with peak activity observed in the presence of 8-12 g/L CAHS D. This result indicates that CAHS D can stabilize proteins in solution, without the need for desiccation or lyophilization. Stability of insulin was monitored at increasing temperatures using western blotting. Activation of Akt, a downstream target of insulin signaling, was reduced at 57 °C, indicating that insulin was non-functional above that temperature. Ongoing experiments will determine the ability of CAHS D to stabilize insulin in solution at varying temperatures.

Hailey Ward, Chemistry Undergraduate Student
Faculty Mentor: Cara Fiore, Biology
Co-Author(s): Hailey Ward, Karen Perez, Preston Charles, Cara Fiore
Title: ISOLATION OF BACTERIAL SYMBIONTS OF FRESHWATER SPONGES USING EUKARYOTIC-LIKE DOMAIN ENCODING GENES
Sponges are considered the earliest known living animal phylum and contain within them some of the most diverse microbes as symbiotic communities. Extensive research has been done to understand and exploit the symbiotic microbes of marine sponges due to the prevalence of bioactive compounds that they produce with a range of antimicrobial and therapeutic properties. There may be similar properties in freshwater sponge microbial symbionts; however, research on the microbes of the freshwater sponge has been limited due to sponges being more scarce and because they were presumed to lack a more robust diversity of microbes than marine sponges.

Additionally, it is difficult to cultivate the symbiotic microbes and differentiate them from free-living microbes in the surrounding environment. Therefore, this project aims to create a protocol to successfully isolate and culture bacterial symbionts of freshwater sponge tissue. The first challenge in this separation is to cultivate the symbiotic microbes, which are often fastidious and slow growing. The second challenge is to differentiate bacterial symbionts of the freshwater tissue from river water bacteria, which may out-compete our symbionts of interest. To address the first challenge, we employed several methods to reduce the carryover of free living microbes in our cultivation. To address the second challenge, we used previous works that indicated bacterial symbionts express certain genes with characteristic “eukaryotic-like domains”. The free-living bacteria are unlikely to have these genes. Thus, we designed and will test primers that will target several types of genes with this “eukaryotic-like” function (fibronectin type II domain and T9SS (Type IX secretion system) C-terminal target domains).This work has generated a protocol for screening new bacterial isolates from freshwater sponge samples for potential symbiotic bacteria, laying the foundation for future work in this system.

Tatum Weishaar, Chemistry Undergraduate Student
Faculty Mentor: Megen Culpepper, Chemistry and Fermentation Sciences
Co-Author(s): N/A
Title: ISOLATION AND CHARACTERIZATION OF A PUTATIVE DIMETHYL SULFIDE (DMS) MONOOXYGENASE IN ARTHROBACTER GLOBIFORMIS
Dimethyl sulfide (DMS) is a volatile organic sulfur compound which is responsible for linking terrestrial and aquatic sulfur to the atmosphere. DMS is a major player in global sulfur cycling and has been linked to climate cooling. There is little known regarding the pathways, mechanisms, and metal-dependency of enzymes involved in DMS metabolism. This research investigates the A and B subunits of dimethyl sulfide (DMS) monooxygenase, an enzyme responsible for the breakdown of DMS. To date, only a single form of dimethyl sulfide monooxygenase from Hyphomicrobium sulfonivorans has been characterized biochemically and structurally. We aim to characterize new forms of the enzyme, and will start with a putative DMS monooxygenase from Arthrobacter globiformis. The A and B subunits of DMS monooxygenase have been expressed and purified recombinantly in E.coli. Development of a high sensitivity activity assay is underway. Previous activity assays utilized headspace gas chromatography with a low sensitivity flame ionization detector (FID); however, the FID was unable to efficiently detect the reaction product, methanethiol. In order to create a more sensitive assay, headspace gas chromatography coupled to a mass spectrometer will be utilized. Calibration curves of methanethiol have been generated and indicate a limit of detection of 2 uM. This is much more sensitive compared with the FID limit of detection of 200 uM. Enzyme kinetics of the putative A subunit will be determined and compared with the values obtained by H. sulfonivorans. It is our hypothesis that the

kinetics of the two forms of DMS monooxygenase will be similar as the forms of the enzymes share a 48% sequence identity, and catalytic amino acids are conserved. Characterizing new forms of DMS monooxygenase will provide a better understanding of the divergence of this family of enzymes and further the development of strategies to mitigate climate change.

Communication Sciences and Disorders

Andrew Madden, Communication Sciences and Disorders Undergraduate Student
Faculty Mentor: Jennifer Buff, Communication Sciences and Disorders
Co-Author(s): N/A
Title: TECHNOLOGY IMPACT ON YOUNG PHONOLOGICAL AWARENESS
The development of language requires explicit interaction with one's environment, specifically engaging in dialog with the people that surround the learner. In the early years of life, this dialog most often is with one's caregivers. As one grows and enters school, they experience new environments and interact with new peers including teachers, fellow students, etc. As technology develops at an accelerating pace, many questions are left unanswered on how this affects a new language learners' ability to effectively develop language skills pertaining to each domain of language. Can technology replicate interaction to stimulate language development, or does it take away from organic interactions with others? Does the age of the internet help young language learners develop pragmatic skills through connection to others online, or does it hinder pragmatic development by taking away the users attention from physical interaction? Do new forms of entertainment online help or hurt build one's lexicon in the early years of life?

Computer Science

Jordan Greene, Computer Science Graduate Student
Faculty Mentor: James Sherman, Physics and Astronomy
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.

Engineering Physics

Matthew Phillips, Engineering Physics Graduate Student
Faculty Mentor: Chris Thaxton, Physics and Astronomy
Co-Author(s): Joshua McNeill, Tomas Romero
Title: A REAL-TIME SEAFLOOR OBJECT SCOUR AND BURIAL MODEL: REVISING THE DMBP

Prediction of the burial and transport of objects on the seafloor has been a topic of interest to commercial, municipal, and military sectors for some time. Objects such as pilings and underwater cables undergo scour that may compromise structural integrity. Unexploded mines may become buried, making them difficult to detect and detonate. However, accurate model projections of object burial are elusive due to the diversity of object shapes and properties, the complexity of near-object forcing conditions, variabilities in seabed bathymetry and composition, and the scarcity of experimental or field data needed for model calibration and improvement. We present preliminary performance test results of the Deterministic Mine Burial Prediction (DMBP) system developed by the Naval Research Laboratory, re-coded and calibrated to reproduce results reported in the literature. We also present initial findings from simulations that include the pressure gradient force, not captured by existing parameterized models. These findings suggest that near-object sediment mobilization due to accelerations in the wave bottom boundary layer may enhance scour during extended periods of low forcing energetics. Future versions of the model will address the dependence of object shape on scour rates and equilibrium burial depths.

English

Madeline Scott, English Graduate Student
Faculty Mentor: Bethany Mannon, English
Co-Author(s): N/A
Title: ONLINE READER COMMUNITIES

Though research has been conducted on literature-focused communities in digital spaces, a specific kind of online literary community has yet to be explored academically. While these websites do not publish or sell books themselves, they contribute to the

marketing and promotion of specific titles while using recreational digital content like quizzes, videos, and blog posts to create an online community around literature. These communities do not exist outside of young adult literature (YAL); this and the stark contrast between themselves and the websites of their parent publishing companies raises questions about the nature of their existence. By way of a comparative website analysis of the four largest publishing companies in the US and their respective online community websites, this study answers foundational questions about these websites, which the author has elected to name "online reader communities." The author proposes defining an "online reader community" as an interactive online community consisting of readers that share a similar interest in a particular literary genre or category; in the case of the online reader communities studied in this study, the readers share an interest in YA literature. As this is the first apparent work of academic writing on online reader communities, it establishes a subset of digital and visual rhetorics studies that could lead to a deeper understanding of virtual communication and online community relationships in the digital age.

Environmental Science

Carly Bauer, Environmental Science Undergraduate Student
Faculty Mentor: Chris Thaxton, Physics and Astronomy
Co-Author(s): N/A
Title: CORRELATING THE INTENSITY AND DYNAMICS OF LANDFALLING HURRICANES WITH TIDES

We present a preliminary analysis of the correlations between tidal phase and the intensity and dynamics of landfalling hurricanes. We obtain hourly Atlantic-basin hurricane positional, wind, and pressure data from the National Hurricane Center, and hourly water level data from the University of Hawaii Sea Level Center for a subset of stations in the Atlantic Basin region. By interpolating water level data along the U.S. coastline, we can correlate tidal phases with tropical system measurables at the location of landfall. We limit our analysis to storms classified as Hurricanes at time of landfall. The presented results for hurricane landfalls in the date range 1900-2018 will show the existence and/or absence of statistically significant correlations between storm intensity and/or dynamics with tidal phase, as represented by the chosen datasets. We have not yet included other types of data that may show correlations, such as disaster or economic indicators. This study is of interest to policy makers and planners, as well as coastal commercial and military operations, and it may lead to new opportunities for student research in the Applied Fluids Laboratory at Appalachian.

Carter Smith, Environmental Science Undergraduate Student
Faculty Mentor: Cole Edwards, Geological and Environmental Sciences
Co-Author(s): Brianna Hibner
Title: USING PAIRED CARBON AND SULFUR ISOTOPES FROM CARBONATE ROCKS TO CONSTRAIN THE TIMING OF ANOXIA DURING THE LATE DEVONIAN IN THE GREAT BASIN REGION, USA: IMPLICATIONS FOR CHEMOSTRATIGRAPHIC CORRELATIONS

The Devonian is known both for the proliferation of forests and as a time of several extinctions of marine life. Though the Late Devonian (FFB) mass extinction is one of the "big five," the main driver(s) are not fully understood. Ocean anoxia was likely an important driver as black shales and positive carbon isotope excursions (δ13C) occurred during extinction pulses; however, black shales are not globally present and δ13C is prone to alteration. Thus, δ13C trends need to be coupled with other proxies to pinpoint anoxic occurrences and biodiversity trends. Stable carbon and sulfur isotopes (δ34S) – measured from carbonate associated sulfate and pyrite – were analyzed from four bio-stratigraphically constrained sections to test for anoxia in the Great Basin region, USA. Especially with δ13C, sulfur can be a valuable proxy as both systems are affected by anoxia as organic matter and pyrite burial increases. Because alteration affects each system differently, disparities can be distinguished from secular changes. In the studied sections, evidence for anoxia is preserved, and in some, slightly post-date the FFB. For example, δ34S values at Bactrian Mountain peak above the FFB. However, at Coyote Knolls, δ13C and δ34S excursions appear just above the FFB, yet the magnitudes are much smaller than Bactrian Mountain. These trends indicate anoxia occurring during the Late Devonian, but further work is needed to unravel why magnitudes vary and peak excursions differ in timing.

Skye-Anne Tschoepe, Environmental Science Undergraduate Student
Faculty Mentor: William Anderson, Geological and Environmental Sciences
Co-Author(s): N/A
Title: CHLORIDE TRAVEL THROUGH A BIORETENTION WETLAND SYSTEM IN BOONE, NC: DATA PROCESSING METHODS

The South Fork New River (SFNR) watershed in Boone, NC, includes the SFNR and other streams. Road salt affects streams in the watershed through stormwater runoff, and as Boone has urbanized, levels of salinity in the watershed have increased. Stream restoration efforts have not been able to remove salt from the environment. One such location, a bioretention system parallel to the SFNR called the Clawson-Burnley Wetland (CBW), is the site of our study. Although there is no significant source of salt in this watershed outside of sodium chloride (NaCl) used for road deicing, an explanation for year-round elevated salinity at this location is that reversed-gradient events, occurring during storms, drive saline water into floodplain aquifers, or in the case of CBW, move salt from the wetland to the SFNR through the floodplain aquifer. We have

begun to use the observed salinities and water levels between CBW and the SFNR to construct a mass-balance of salinity at the CBW to estimate the primary pathways for salt migration. In initial data collection, a salinity gradient has been observed through CBW. The upstream pond of CBW has violated the EPA's chronic chloride concentration maximum consistently throughout the winter, while the lower pond has less often been in violation. The loss of chloride between the upper and lower ponds suggests loss from the system between the two, most likely to the groundwater, and subsequently, the SFNR. Here I will investigate data processing methods for the mass balance within the CBW-SFNR system.

Jessica Wilson, Environmental Science Undergraduate Student
Faculty Mentor: Ellen Cowan, Geological and Environmental Sciences
Co-Author(s): Keith Seramur, , Zhen Wang, Avner Vengosh
Title: VARIABILITY OF COAL ASH MORPHOLOGY IN NORTH CAROLINA RESERVOIR SEDIMENT AS A FUNCTION OF TIME AND TRANSPORT DISTANCE
Coal ash is enriched in trace metals and has negative ecological impacts. Extreme weather events have historically resulted in the contamination of reservoirs due to flooding of adjacent coal ash impoundments. Gravity cores were collected from Hyco and Mountain Island Lakes to investigate the occurrence of coal ash. A polarizing light microscope at 500x magnification and a mounted point counter were used to manually point count 300 grains within slides made from core sediment. This enabled us to identify coal ash particles, sand-size mineral grains, clay particles, and biological matter, and to obtain the relative abundance of each within the sediment record. Morphologies of coal ash documented within the reservoirs are diverse and comparable with raw fly ash sourced from Appalachian Basin coals, including both spherical and amorphous forms. Spherical ash ranges in diameter from approximately 4 to 92 microns and includes, clear, black, orange, and plerospheres. Amorphous ash is larger and irregular in shape, consisting of opaque and clear forms. Trace elements leached from coal ash vary with morphology. Principle Component Analysis (PCA) was performed on the large multivariate data set. PCA of the counts showed systematic changes in ash morphology importance at different depths in cores and with transport distance. Abundance and changes in morphology can offer important information regarding ecological impact and advise clean-up procedures.

Exercise Science

Savannah Barbieri, Exercise Science Undergraduate Student
Faculty Mentor: Jonathan Stickford, Health and Exercise Science
Co-Author(s): Abby Stickford
Title: PAIN PERCEPTION DURING COLD PRESSOR TEST IS RELATED TO THE CHANGE IN EXPERIMENTALLY INDUCED DYSPNEA DURING EXERCISE

The purpose of this study was to examine the relationships between trait anxiety, the perception of pain during a cold pressor test (CPT), and experimentally-induced dyspnea in healthy young adults. METHODS: Participants were scored based on responses to the Generalized Anxiety Disorder (GAD-7) questionnaire. Systolic (SBP) and diastolic (DBP) arterial blood pressure via finger photoplethysmography and heart rate (HR) were measured at rest and during a 2-min CPT. Ratings of pain were collected after the CPT. Additionally, participants completed a cycling test at 50% of their predetermined maximal aerobic capacity for 6 min under a control condition (CON) and with the use of external dead space (DS). Ratings of perceived breathlessness (RPB) and unpleasantness of breathlessness (RPU) were collected during the last minute of exercise. RESULTS: GAD-7 scores were uncorrelated with the perception of pain and RPB ($P>0.25$). Yet, the perception of pain during the CPT was significantly related to the changes in RPB ($P=0.03$) and RPU ($P<0.01$) from CON to DS. GAD-7 scores were not correlated with changes to SPB, DBP, and HR during the CPT but were positively correlated with the change in breathing frequency from CON to DS ($P<0.01$). CONCLUSION: The level of trait anxiety is not related to perceptions of pain and breathlessness during cardiorespiratory stress. However, the perceptions of discomfort within each of the cardiovascular and respiratory stress tests are related to each other.

Jacob Barton, Exercise Science Graduate Student
Faculty Mentor: Alan Needle, Health and Exercise Science
Co-Author(s): N/A
Title: THE EFFECT OF PERIPHERAL SOMATOSENSORY STIMULATION ON ANKLE FUNCTION IN INDIVIDUALS WITH CHRONIC ANKLE INSTABILITY

Peripheral somatosensory stimulation (PSS) is a clinical intervention capable of improving neural and muscle function in injured patients. However, its effect in patients with chronic ankle instability (CAI) is unknown. PURPOSE: To conduct a preliminary investigation of a single-session intervention of PSS on neural excitability to the ankle in patients with CAI. METHODS: Ten participants with CAI were recruited (6M/4F, 22.1±3.8yrs, 174.7±10.6cm, 83.2±15.6kg). Reflexive excitability to the tibialis anterior (TA), peroneus longus (PL) and soleus (SOL) was determined as the ratio of maximal reflexive to maximal direct responses (Hmax:Mmax) from the Hoffmann-reflex. Resting motor threshold (RMT) intensities to the TA, PL and SOL were extracted from a stimulus-response curve from transcranial magnetic stimulation. Variables were measured at pre- and post-control, pre- and post-intervention and 24 hours

post-intervention. Participants received no stimulation for control and 60 minutes of PSS (100Hz, 1000μsec, suprasensory threshold) for intervention. RESULTS: Due to a low sample size, inferential statistics were not used, but rather descriptive statistics with effect sizes. Effect sizes (d) were defined as small (0.2), medium (0.5) or large (0.8). H:M Ratios revealed a medium effect size from pre-int (0.130±0.074) to post-int (0.195±0.126, d=0.631) and small effect sizes from pre-cont (0.137±0.037) to post-cont (0.153±0.069, d=0.274)) and pre-int to 24hr post-int (0.152±0.071, d=0.312) in the TA. RMT measures at pre-con (47.60±8.834), post-con (47.20±7.786), pre-int (46.30±8.538), post-int (46.30±8.327) and 24hr post-int (46.60±9.663) all revealed less-than-small effect sizes when compared. CONCLUSION: Preliminary results utilizing PSS appear to have an effect on reflexive excitability in the TA in patients with CAI, though their cortical excitability via RMT measures appeared unaffected.

Paige Bramblett, Exercise Science Graduate Student
Faculty Mentor: Kimberly Fasczewski, Health and Exercise Science
Co-Author(s): Powell, S. M.
Title: BEHAVIORAL ECONOMICS IN PHYSICAL ACTIVITY: EXAMINING MOTIVATION BETWEEN A PERSONAL CONNECTION TO A CAUSE AND PARTICIPATION IN A FUNDRAISING CHARITY EVENT

The positive health benefits of regular physical activity (PA) are widely known; for those living with multiple sclerosis (MS) these benefits are magnified. Unfortunately, no segment of the population meets recommended PA levels. Understanding motivation is critical to increasing PA. Behavioral economics (BE) theory posits that behaviors are not driven by a rational cost/benefit analysis but rather by activities that are perceived as enjoyable or beneficial. Research has demonstrated that a personal connection to MS (personal or friend/family with MS) may increase motivation to engage in a PA-based fundraising charity event. Therefore, the present research used a 12-week training program for a 5K walk or run charity fundraiser to benefit MS and focused on creating a personal connection to MS. Twelve participants with and without a connection to MS were randomized into two groups. Along with the 5K training, participants in the experimental group engaged in an MS education intervention. All participants received weekly email check-ins and online training resources. Upon completion, a monetary donation was given to the National MS Society in the participant's name. Preliminary results indicated participants in the MS education intervention were more likely to complete the program. Furthermore, participants with a connection to MS were less likely to drop out. By creating a connection to MS, this program demonstrated the ability to positively impact PA behavior of participants.

Olivia Chapman, Exercise Science Undergraduate Student
Faculty Mentor: Jared Skinner, Health and Exercise Science
Co-Author(s): Benji Pruitt
Title: COMPARATIVE ANALYSIS OF PREFRONTAL CORTEX ACTIVITY DURING KINESTHETIC IMAGERY AND OBSERVATIONAL LEARNING
Introduction: Aging has been shown to affect the prefrontal cortex and executive function negatively. Prior research shows that impaired executive function is associated with increased fall risk in older adults. Research shows that motor imagery training can increase prefrontal activation in normal adults. The proposed pilot cross-over study aims to acquire preliminary data on this approach. Methods: Participants (n=4) were college-aged individuals. Participants were instructed to walk across a standardized obstacle course, engaging in two blocks of kinesthetic imagery (KI), observational learning (OL), or both. Prefrontal activity was measured via oxygenated hemoglobin (Ohb) using fNIRS. Rest periods were standardized, and participants repeated each condition. Results: Increases in Ohb from resting values to those measured during KI and OL were recorded for each trial. KI involving obstacles elicited a 59.6% greater increase in Ohb compared to KI that involved only walking. OL combined with KI involving obstacles elicited a 95.3% greater increase in Ohb than OL with no KI. Discussion: Training the prefrontal cortex without physical intervention can benefit groups at a greater fall risk. Increasingly complex KI and OL elicited a higher cognitive load in the prefrontal cortex. Findings suggest that combining or incorporating more complex forms of KI and OL in an intervention may lead to more beneficial outcomes.

Wade Creech, Exercise Science Undergraduate Student
Faculty Mentor: Brooke Towner, Recreation Management and Physical Education
Co-Author(s): Rebecca A. Battista
Title: REASONS AND LOCATIONS FOR PHYSICAL ACTIVITY DURING THE COVID-19 PANDEMIC IN RURAL ADULTS AND FAMILIES
Since the COVID-19 pandemic began in the United States, public health measures (i.e. physical distancing, masks, closure or limited access to facilities) implemented by local, regional, and federal authorities for the protection of community health have influenced reasons and locations for physical activity (PA). In rural communities, access to recreational and PA resources, the environment and socioeconomic status can play a role in how, when, where and why parents and children engage in PA. These factors may have been influenced during COVID-19. The purpose of this investigation was to examine the locations for PA and the reasons for engaging in PA of parents and children living in rural communities during the COVID-19 pandemic. Rural parents (N=312) completed a survey about the location of their PA and reasons for engaging in PA during the COVID-19 pandemic. The survey included categorical variables and open-ended responses. Analysis will be completed by January 2022. Data will be analyzed using

nonparametric measures in SPSS and inductive coding of the open-ended responses. The discussion will address specific locations available to parents and children for PA, as well as the reasons for engaging in PA. We anticipate seeing a need for understanding how essential PA is on a personal level for managing daily life during a pandemic and improving PA resources in rural communities.

Matthew Fiedler, Exercise Science Graduate Student
Faculty Mentor: Herman van Werkhoven, Health and Exercise Science
Co-Author(s): Travis Triplett, PhD. Keane Hamilton, MS. Alan Needle,PhD.
Title: THE EFFECT OF DIFFERENT WEIGHT PLATES ON THE BIOMECHANICS OF THE BENCH PRESS
Anecdotal evidence suggests that bumper plates impact lifts in powerlifting and weightlifting different than standard cast iron plates, but very few studies have investigated how bumper plates affect the biomechanics of any lift. The aim of this study was to examine if there were any differences in bench press biomechanics when comparing lifts with bumper versus standard plates. Eleven resistance-trained participants performed the bench press using both bumper and standard plates at 70%, 80%, and 90% 1RM. The participants were blinded (boxes covering the plates on the barbell) to whether they were lifting bumper or standard plates. Motion data was captured by an eight-camera motion capture system and EMG (muscle activity) data was captured for the anterior deltoid, pectoralis major, and triceps brachii. Three-way repeated measures ANOVAs showed a significant main Weight effect for Time-Under-Tension (TUT) ($p < 0.001$), Total Work (TW) ($p < 0.001$), and EMG ($p < 0.001$), and a significant Weight x Joint interaction effect for average joint moment ($p < 0.001$), impulse ($p < 0.001$), and peak joint moment ($p <0.001$). However, there were no significant differences observed between the different weight plates for any of the measures. The main findings of the study suggests that there are no biomechanical differences between using bumper plates or standard plates during the bench press lift.

Roman Galaska, Exercise Science Graduate Student
Faculty Mentor: Caroline Smith, Health and Exercise Science
Co-Author(s): Killian Wustrow, Nelson Vinueza, Sui Xinyi, Morgan Demmler, Emiel DenHartog, Scott Collier
Title: INTRADERMAL MICRODIALYSIS AS A NOVEL APPROACH FOR RECOVERY OF POLYCYCLIC AROMATIC HYDROCARBONS
Polycyclic aromatic hydrocarbons (PAHs) are toxicants produced during combustion and are linked to cancer. Dermal absorption of PAHs has been minimally investigated due to the complexities of in vivo sampling. PURPOSE: Determine optimal procedures for PAH recovery utilizing microdialysis (MD) for recovery of the non-carcinogenic PAH Anthracene (ANT). METHODS: In vitro testing utilized two MD fibers (BASi, 30 KDa MWCO; CMA, 55 KDa MWCO) fully submerged in a 2% ANT solution. ANT recovery

was quantified following alterations in the following variables: 1) duration of equilibration time (10 min, 20 min), 2) concentration (0%, 5%, and 10%) of 2-hydroxypropyl-beta-cyclodextrin (2-beta-CD), and 3) perfusion rate (1.5, 1.0, or 0.5 uL/min). MD fibers were submerged in the ANT solution and dialysate samples were collected. RESULTS: No ANT was detected in the CMA fiber samples. Greatest ANT concentrations sampled from BASi fibers occurred during the 10 min Eq./1.0 ul/min rate/10% 2-beta-CD and 10 min Eq./0.5 ul/min rate/10% 2-beta-CD conditions. ANT was detected but was lower than the limit of quantification under the 10 min Eq./1.0 ul/min rate/0% 2-beta-CD and 20 min Eq./0.5 ul/min rate/0% 2-beta-CD conditions. CONCLUSION: Careful consideration should be given to variables affecting substance recovery utilizing intradermal microdialysis. Optimal procedures for ANT recovery utilized the BASi MD fiber under the 10 min Equilibration/0.5 ul/min perfusion rate/10% 2-beta-CD conditions.

Hope Gamwell, Exercise Science Graduate Student
Faculty Mentor: Jared Skinner, Health and Exercise Science
Co-Author(s): N/A
Title: EFFECTS OF AGING ON GAIT AND CORRELATING PHYSICAL ACTIVITY LEVELS FOR ADULTS IN THE HIGH COUNTRY
Background: Gait and balance decline with age, but data that distinguish between generations is limited. Within the high country community, we aim to identify how individual gait parameters change with age and how physical activity plays a role in these changes. Methods: 53 adults (age=18-90yr) completed a Simple Physical Activity Questionnaire (SIMPAQ) and gait assessment. We analyzed the mean and coefficient of variation (CV) for spatiotemporal variables of gait. SIMPAQ data were analyzed for each of 4 age groups (Young Adults (18-35), Middle-aged (36-55), Older Adults (56-74), Oldest Older Adults (OOA: 75+)) to determine correlations between participant responses and gait variables. Results: Data revealed significant differences ($p<0.05$) between OOA and other groups in mean and CV. OOA had lower stride length and speed than other groups and increased stride length and velocity variability. Significant correlations were observed within the OOA group between item 4 of the SIMPAQ and CV of stride length ($r=.54$), mean stride velocity ($r=-.58$), and CV of stride velocity ($r=.57$). Conclusions: This data indicates that our community experiences an overall decline in gait with age, most significantly in the 75+ age group. Additionally, more time spent in recreational activity was related to reduced variability in stride length and velocity, and an increase in mean stride velocity. Increasing physical activity could preserve functionality in individuals above 75 years.

Austin Gooch, Exercise Science Graduate Student
Faculty Mentor: Jonathon Stickford, Health and Exercise Science
Co-Author(s): Marc Augenreich, Aaron McMichael, Jayvaughn Oliver
Title: ACUTE ELECTRONIC CIGARETTE USE DOES NOT ALTER INDICATORS OF THORACIC GAS COMPRESSION

Electronic cigarette (EC) use can increase airway resistance, which could impact thoracic gas compression (TGC) volume during maximal expiratory maneuvers. Purpose: To investigate the acute effects of EC use on indicators of TGC volume. Methods: Participants inhaled from an EC with (EC+) or without (EC-) the nicotine cartridge in a randomized order. After EC+ and EC-, participants completed pulmonary function testing. The differences (Δ) between the area under the curve (AUC) of the maximal expiratory flow–volume loop (MEFVL) free of gas compression (MEFVLCF) and the gas-compressed MEFVL (MEFVLCOM) were examined in EC+ and EC-. The Δ in forced expiratory flows at 25% (FEF25%), 50% (FEF50%), and 75% (FEF75%) of forced vital capacity, as well as the Δ in lung volume at peak expiratory flow (PEF), FEF25%, FEF50%, and FEF75%, between MEFVLCF and MEFVLCOM were evaluated in EC+ and EC-. Results: The ΔAUC was not different between EC+ and EC- ($P>0.05$). The ΔFEF25%, ΔFEF50%, and ΔFEF75% also were not different between EC+ and EC- (all $P>0.05$). However, the ΔFEF decreased with lung volume independent of condition ($P<0.05$). Additionally, the Δ in lung volumes at FEF50% and FEF75% were less than at PEF and FEF25% ($P<0.05$) but were not different between EC+ and EC-. Conclusion: The amount of gas compressed during a maximal maneuver decreases with lung volume but is not affected by acute EC use. Thus, the clinical evaluation of airway function after acute EC use is not confounded by TGC.

Jay Harrell, Exercise Science Graduate Student
Faculty Mentor: Matthew Rogatzki, Health and Exercise Science
Co-Author(s): Hannah Blankenship
Title: CONCUSSION AND FLUID-BASED BIOMARKERS: WHERE DO WE STAND AND WHERE ARE WE HEADED?

Accurate sideline concussion diagnosis is important for two primary reasons: 1) to remove concussed athletes from play to prevent further brain injury and 2) to allow concussion-free athletes re-entry into the game or match. This puts tremendous pressure on certified athletic trainers to make the correct diagnosis as quickly as possible. Currently, the Sports Concussion Assessment Tool-5th Edition (SCAT5) is used to diagnose concussion. However, the full SCAT5 assessment is tedious and time dependent. For instance, a recently concussed athlete may perform satisfactorily on the SCAT5 but an hour later may perform much worse. Therefore, research is ongoing to improve speed and accuracy of concussion diagnosis. Fluid-based biomarkers have been under investigation as a potential objective tool for aiding concussion diagnosis. Recently media outlets have glamorized the findings that come from this research with

claims such as “FDA authorizes marketing of first blood test to aid in the evaluation of concussion in adults”. These headlines may garner readership but create confusion amongst the public and practitioners who may be led to believe that concussion can be diagnosed simply through a finger prick when research is still far off from creating such a test. This poster will provide a background into the potential utility of fluid-based biomarkers in concussion diagnosis and give insight into fluid-based biomarker current and future state of affairs.

Blake Koeval, Exercise Science Graduate Student
Faculty Mentor: Alan Needle, Health and Exercise Science
Co-Author(s): Dr. Jennifer Howard, Dr. Jared Skinner
Title: REACTIVE HOPPING FOR ASSESSMENT OF INJURY RISK IN INDIVIDUALS WITH CHRONIC ANKLE INSTABILITY
Introduction: Neurocognitive and motor tasks have been shown to discriminate between people with and without CAI with some success since people with CAI show both neurocognitive and motor deficits; however, a task in which neurocognitive and motor tasks are being performed simultaneously could be even more effective at differentiating between groups. If successful, a neurocognitive/motor dual task could be beneficial for clinicians for assessing reinjury risk when making return-to-sport calls.
Methods: There were two groups, individuals with healthy ankles, and those with CAI. A reactive hopping test was performed in which the individual had to balance, perform cognitive tasks, and then hop laterally on one foot in the midst of performing the cognitive tasks. Measures of neurocognitive function, muscle activity, and balance performance were assessed to compare between groups. Findings: There were no significant differences in neurocognitive function, and individuals with CAI performed slightly better on the balancing task. However, muscle activity data revealed that individuals with CAI were contracting their peroneus longus muscle more, indicating that individuals with CAI might have been overcompensating leading to the better balance performance despite none of the other variables showing significant differences.

Karen Meza, Exercise Science Undergraduate Student
Faculty Mentor: Christopher Seitz, Health and Exercise Science
Co-Author(s): Carolina Avila-Tovar , Julianna Rodriguez-Cruz
Title: PATIENT COMPLAINTS ABOUT FACE MASK COMPLIANCE: A CONTENT ANALYSIS FROM THREE CLINICIAN REVIEW WEBSITES
BACKGROUND: Although face masks can prevent COVID-19’s spread, research shows that not everyone adheres to wearing of face masks due to a variety of reasons. This study’s purpose was to explore patients’ views of face masks not being worn in healthcare settings. METHODS: During February of 2021, the websites healthgrades.com, ratemds.com, and vitals.com were searched using the terms “not wearing a mask” and “not wearing masks.” Each resulting patient review was defined as

a unit of data. The research team developed a codebook, which was used by the researchers to reach consensus in coding the data and refining themes.
RESULTS: Five themes emerged from the data: (1) Patients felt uncomfortable (felt shocked and unsafe from clinicians, receptionists, and other patients not wearing masks), (2) Incorrect mask wearing (patients reported others wore masks incorrectly), (3) Patient-led initiative (patients asked others to wear masks), (4) Inaccurate reasoning (others had misinformed reasons for not wearing masks, such as personal/political views, or unscientific logic), and (5) Impact on patient loyalty (patients left appointments, stated they would not return, and discouraged others to make appointments). DISCUSSION: These findings present the challenges to enforcing face mask mandates; however, the websites used in this study could be used by public officials to investigate clinical healthcare settings that may not be adhering to guidelines regarding face masks.

Mackenzie Millett, Exercise Science Undergraduate Student
Faculty Mentor: Scott Collier, Health and Exercise Science
Co-Author(s): Denise Martz
Title: HOW MOTIVATION FROM PHYSICAL THERAPISTS AFFECTS PATIENT TREATMENT ADHERENCE
Patients' adherence to treatment plans created by physical therapists (PTs) is critical for successful therapy outcomes. Patient motivation is one of many factors influencing treatment adherence. PTs play a major role in developing therapeutic alliances with patients and directly motivating patients to adhere to treatment plans. These therapist interventions lead to positive outcomes for therapy. Theoretically, PTs have an opportunity to exponentially motivate increased treatment adherence and in turn, positively impact treatment outcomes. In a pre-post therapy study of 8 PTs and 21 patients, three surveys- a demographic survey, the Direct Motivator Survey, and the Sports Injury Rehabilitation Adherence Scale- were distributed to physical therapy clinics in a mountainous region in Western North Carolina. Correlation statistics were computed. While no statistically significant results were found, therapeutic alliance and PTs' use of direct motivators was high along with patients' clinic-based treatment adherence. A ceiling effect and small n contributed to the statistically insignificant results. There is no one direct link or one way to increase patient treatment adherence. This study looks at one aspect, how patient perception of PTs motivation affects in-clinic treatment adherence, and adds to the broader picture of how PTs, patient motivation, therapeutic alliance, and treatment adherence are linked to treatment outcomes.

William Norris, Exercise Science Undergraduate Student
Faculty Mentor: Jonathon Stickford, Health and Exercise Science
Co-Author(s): Marc Augenreich, Janet Cope, Cynthia Bennett, and Stephen Ratchford
Title: PULMONARY FUNCTION FOLLOWING ACUTE FORMALDEHYDE EXPOSURE IN YOUNG ADULTS
Background: Formaldehyde (FA) is commonly utilized preservation agent contained within many household and industrial products, as well as in the solutions common to medical laboratories and mortuaries. Yet, FA is also a known carcinogen and pulmonary irritant. Purpose: To investigate the effects of FA exposure during a cadaver dissection laboratory on pulmonary function and biomarkers of inflammation.
Methods: Students from two regional universities were recruited to perform pulmonary function testing and provided blood samples prior to and following a 90-min 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. Plasma / serum concentrations of 15-hydroxyeicosatetraenoic acid (15(S)-HETE) were analyzed using the enzyme-linked immunosorbent assay technique. Pre- and post-FA exposure data were subsequently examined using Student's t tests and Pearson's correlational analyses.
Results: Before entering the laboratory, subjects (N=16; two males; 24±3yr; 24±4kg·m-2) displayed normal pulmonary function, as indicated by the percent predicted values for FVC (96±9%), forced expiratory volume in one second (FEV1; 95±11%), and MVV (100±15%). Subjects were exposed to 177±118 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±3%Δ; FEV1, 0±4%Δ; MVV, 0±0%Δ). Further, there were no correlations between the percent changes in FVC or FEV1 and FA exposure concentrations ($r^2<0.06$). No correlations between changes in pulmonary function and 15(S)-HETE were found. Conclusion: Acute exposure to FA over the course of a single dissection laboratory does not impair pulmonary function.

Jessica Schmid, Exercise Science Undergraduate Student
Faculty Mentor: Kimberly Fasczewski, Health and Exercise Science
Co-Author(s): Bramblett, P.N., Powell, S. M.
Title: DEVELOPMENT OF A PHYSICAL ACTIVITY TRAINING PROGRAM USING BEHAVIORAL ECONOMICS: THE PACES RACES FOR MS VIRTUAL 5K
The theory of behavioral economics (BE) posits that decisions are not driven by a rational cost/benefit analysis, but rather based on emotions, personal bias, and environmental factors. In the context of physical activity (PA), individuals are more likely to participate in an event that is fun, full of social interaction, and meaningful personal achievement. One particular type of event that can facilitate this connection is a charitable cause. The positive emotional connection that individuals have to these

events provide an ideal environment to examine the connection between BE and PA. Previously, our lab explored the relationship between BE and PA motivation to participate in a PA-based multiple sclerosis (MS) fundraising charity event. Results indicated a personal connection to MS may increase an individual's motivation to participate in PA, and proposed a personal connection could be curated via education about MS. Using these data, we designed a virtual 5K training program with an educational component to foster a personal connection MS. A Google Site was created as a platform to disseminate information and included an MS education program, additional run/walk training resources, and zoom link for weekly check-ins. Program enrollment was designed to occur on a rolling basis so participants can begin at their convenience and can include individuals with and without a connection to MS. Program implementation is currently ongoing, and being assessed for feasibility.

Amy Sheldon, Exercise Science Graduate Student
Faculty Mentor: Jonathon Stickford, Health and Exercise Science
Co-Author(s): Barbieri, S.J.*, Augenreich, M.A.
Title: POLAR LOOP CONSTRUCTION OF THE MAXIMUM EXPIRATORY FLOW VOLUME LOOP DOES NOT CHANGE QUANTIFICATION OF EXPIRATORY FLOW LIMITATION
Purpose: To investigate different methods of flow volume loops (FVL) construction on indicators of the mechanical limitation to exercise ventilation.
Methods: Eight participants completed an incremental exercise test on a cycle ergometer. Inspiratory capacity maneuvers were performed each minute of exercise in order to measure operational lung volumes and assess ventilatory dynamics. FVL were analyzed and constructed using two techniques: 1) a single representative breath (TYP) and 2) a composite / polar loop using 8-10 breaths (MEAN) during each stage of the exercise test. Results: The minute ventilation and operational lung volumes were not significantly different between techniques ($p>0.05$). The end-expiratory and end-inspiratory lung volumes, expressed as absolute lung volumes and as percentages of total lung capacity, were significantly different between some techniques ($p<0.05$) independent of exercise intensity. Similar patterns were observed for the changes in operational lung volumes that accompanied the increased ventilation during exercise between the two techniques. Total area of the FVL relative to the maximum FVL during expiration was different between the two techniques, in part, due to the different operating lung volumes. However, the technique for construction of the FVL did not alter the quantification of expiratory flow limitation (POL: 20.1±24.7%, TYP: 16.5±24.4%, $P=0.49$). Conclusion: These findings indicate that the technique used to construct exercise FVL alters the expression of operating lung volume but does not impact clinical indicators used to assess mechanical limitations to ventilation.

Wesley J. Smith, Exercise Science Graduate Student
Faculty Mentor: Kimberly Fasczewski, Health and Exercise Science
Co-Author(s): Bramblett, P.N., Gamwell, L.E., Schmid, J.H., Skinner, J.W.
Title: EXAMINING THE IMPACT OF COVID-19 ON MENTAL HEALTH, SOCIAL LIFE, AND PHYSICAL ACTIVITY LEVELS IN INDIVIDUALS WITH PARKINSON'S DISEASE
INTRODUCTION/RATIONALE: Physical activity (PA) is known to improve motor and non-motor symptoms in patients with Parkinson's disease (PD). Due to the restrictions from COVID-19, gyms, fitness, and recreation centers were closed to the public, leading to many individuals with PD to lose access to facilities to participate in their regular physical and social interactions and community engagement. Therefore, this study aimed to examine the mental, social, and physical impact the restrictions from COVID-19 had on individuals with PD. METHODS: Subjects were recruited from the local Parkinson's Support Groups, Parkinson's Association of the Carolinas, and through the BCBS IHHS Interprofessional Clinic. Phone Interviews were conducted and questioned centered on how COVID-19 has affected individuals' daily physical activity levels, quality of life, mental health status, and social support. 11 subjects consented to partake in the study, 5 female and 6 male. RESULTS: Seven main themes emerged from the phone interviews: mental health, life changes due to COVID-19, importance of group/social support, importance of PA, motivation for PA, COVID-19 adaptations/impact on PA, and functioning. DISCUSSION: The themes represent the challenges that those with PD were exposed to during this time and highlight the importance of those with PD to continue to engage in PA to maintain and improve across multiple domains of health, including both physical and mental health.

Rachel Szeghy, Exercise Science Graduate Student
Faculty Mentor: Jonathon Stickford, Health and Exercise Science
Co-Author(s): Nina L. Stute, Stephen M. Ratchford, Abigail S.L. Stickford
Title: COLD PRESSOR TEST BLUNTS REACTIVE HYPEREMIA DURING PASSIVE LIMB MOVEMENT
The cold pressor test (CPT) augments sympathetic outflow, causing systemic vasoconstriction. While CPT-stimulated sympathetic activity is known to impair brachial artery reactive hyperemia, less is known about its impact during passive limb movement (PLM). Purpose/Methods: This study measured hemodynamic responses to PLM, as assessed by ultrasound, in the seated upright position under a controlled, non-water, condition (CON) versus a CPT condition in young healthy adults. The order of CON and CPT conditions was randomly assigned. In each condition, femoral artery blood velocities and diameters were continuously measured during the 60s of PLM (1 Hz). Total blood flow (BF), mean arterial pressure (MAP), and vascular conductance (VC) were calculated offline. Student's t tests were performed to analyze differences between conditions. Results: The total BF response to PLM, calculated as the 60s area

under the curve, was significantly reduced during CPT (171±207ml/min) compared with CON (237±193ml/min) (p=0.04). MAP during PLM was significantly elevated during CPT (93±9mmHg) compared with CON (CON: 77±11mmHg; p<0.01). There was a significant reduction in VC during PLM in the CPT (2±3m/min/mmHg) condition compared with CON (3±2m/min/mmHg; p<0.01). Conclusion: These results suggest a sympathoexcitatory stimulus impairs the hyperemic response to PLM. The microvascular assessment of lower limb, NO-mediated vasodilation may be influenced by varying levels of sympathetic tone.

Dristen Trate, Exercise Science Graduate Student
Faculty Mentor: Caroline Smith, Health and Exercise Science
Co-Author(s): Killian D. Wustrow, Nelson R. Vinueza, Xinyi Sui, Morgan Demmler, Emiel A. DenHartog, Scott R. Collier
Title: TIME COURSE OF DERMAL ANTHRACENE ABSORPTION UTILIZING INTRADERMAL MICRODIALYSIS

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous pollutants of concern. Limited data are available regarding dermal PAH absorption. PURPOSE: Using the PAH anthracene (ANT), we assessed 1) time course of dermal ANT absorption, 2) effects of local skin temperature on dermal absorption. METHODS: Two intradermal microdialysis (MD) fibers were inserted into the forearm of 6 subjects (32±5 yrs, 5 male, 1 female) and perfused with 10% 2-hydroxypropyl-β-cyclodextrin with lactated Ringer's at 1 ul/min. A 2% ANT solution was applied to each site with local heaters (LH) and laser Doppler probes to assess skin blood flow (SkBf). Dialysate, SkBf, BP and HR were collected over 4h 15 min (baseline LH 33°C, followed by site 1) 43°C (Hot, HT) and 2) 33°C (thermoneutral, TN)). Atmospheric pressure chemical ionization (ACPI) tandem mass spectrometry was used to quantify ANT concentrations. RESULTS: No ANT was present at baseline. From 1h30-1h45 min, ANT was detected in 3 of 6 HT and 0 of 6 TN samples. One HT sample was quantifiable at 317.5 ppm. Sampling from 4h-4h15 min, ANT was detected in all HT samples and quantified in 1 (344.9 ppm). ANT was detected in 1 of 6 TN samples. SkBf was significantly higher at HT versus TN at both 1h45 min (8.7 ± 5.7 and 29.2 ± 20.5 CVC%max, P<0.05) and 4h15min (12.8 ± 8.3 and 42.8 ± 22.3 CVC%max, P<0.05). CONCLUSIONS: Dermal ANT absorption is increased when skin in heated versus thermoneutral and during longer periods of exposure when the skin is heated.

Audrey Viso, Exercise Science Undergraduate Student
Faculty Mentor: Jared Skinner, Health and Exercise Science
Co-Author(s): Hunnicutt, L., Bramblett, P.N.,Collier, S.R.
Title: THE EFFECT OF A SINGLE SESSION OF RESISTANCE TRAINING ON NOCTURNAL BLOOD PRESSURE IN PERSONS WITH PARKINSON'S DISEASE
Introduction: Persons with Parkinson's disease (PD) experience disabling non-motor symptoms such as abnormal nocturnal blood pressure patterns (NBP) due to autonomic dysfunction. Resistance training (RT) improves cardiac autonomic dysfunction both at rest and under stress. The objective of the current study was to evaluate the impact of a single RT session on abnormal NBP in persons with PD. Methods: This study included 5 persons with PD and 7 older adults (OA). Participants took part in a standardized RT intervention and wore an ambulatory blood pressure monitor for three days. Data was extracted and analyzed using custom software. Results: OA participants had a greater drop in systolic NBP compared to those with PD at baseline (16.6 vs 9.4, p=.04). After RT, there was a greater drop in systolic NBP in OA compared to the PD group (19.7 vs 3.9, p=.049). There was no change in systolic NBP between groups one day post RT intervention (p>.05). There was no significant time interaction for the OA group; however, there was a significant time interaction for the PD group from day 1 to 2 (p=.02) and day 1 to 3 (p=.04). Discussion: Non-dipping NBP patterns are commonly seen in PD patients due to degeneration of the cardiac sympathetic nerve. Non-dipping NBP patterns in the PD group decreased significantly on the third night after RT intervention and were comparable to NBP patterns in OA. These results suggest that RT could potentially reduce abnormal NBP patterns in persons with PD.

Geography

Josh Platt, Geography Graduate Student
Faculty Mentor: Derek Martin, Geography and Planning
Co-Author(s): Michael Mayfield, William Armstrong
Title: IMMEDIATE CHANGES IN CHANNEL MORPHOLOGY FOLLOWING A DAM REMOVAL IN SOUTHERN APPALACHIA
Dam removals are a growing trend in the United States with an average of 90 per year in the past decade. Current removal studies largely indicate that ecological benefits of river re-connectivity outweigh the economic benefits and the costs of maintaining aging infrastructure. However, there is a lack of comprehensive studies in certain regions of the United States, including Southern Appalachia. The deconstruction of the Ward's Mill Dam (5m) on the Watauga River, North Carolina took place in May 2021. Sample collection for total suspended sediment (TSS), and in-situ measurement of bed sediment particle sizes began 18 months prior to the removal, and is currently ongoing to determine post-removal effects. TSS concentrations were monitored pre removal, during the breach, and post removal at 500 meters upstream and 2000 meters

downstream of the dam. Upstream and downstream TSS concentrations were not significantly different prior to dam removal. However, downstream concentrations were significantly higher during deconstruction of the dam ($p < .001$). Particle size distributions were determined using a modified Wolman pebble count at two upstream sites and four downstream sites before removal and after the deconstruction process was complete. Immediately following the removal, median particle sizes (D50) directly below the dam and 600m downstream experienced significant fining ($p < .0001$) and became more heterogeneous. Within 6 weeks, these sites experienced significant coarsening ($p < .01$) of material but still remain finer than pre-removal conditions.

Sophia Ryan, Geography Graduate Student
Faculty Mentor: Maggie Sugg, Geography and Planning
Co-Author(s): Jennifer Runkle
Title: GREENSPACE AND MENTAL HEALTH RELATIONSHIPS IN RURAL AND URBAN NEIGHBORHOODS OF NORTH CAROLINA
Greenspace positively impacts mental health, is a low-cost health intervention to mitigate the impacts of high temperatures, and encourages physical activity and social cohesion. Most past and current research focuses specifically on the greenspace mental health relationship in urban areas. Yet, little work has looked at rural areas, despite rural areas reporting similar rates of poor mental health outcomes and higher rates of suicide mortality compared with urban areas. Given the high case counts and often lower density of mental health care facilities in urban areas, focusing attention on low-cost mental health interventions, such as greenspace, is important when considering rural mental health care. This research will address this gap with the following research questions: (1) Do public and/or private greenspace affect mental health outcomes in North Carolina? (2) Does this relationship change in rural areas versus urban areas? Mental health is quantified utilizing a novel dataset of mental health outcomes that provides complete spatiotemporal coverage of (1) anxiety, (2) depression, (3) mental illness, (4) mood disorders, (5) substance abuse (6) suicide ideation/self harm and (7) suicide across North Carolina. Findings from spatial and ordinary least squares regressions show that both public and private greenspace are beneficial for mental health in rural and urban neighborhoods throughout North Carolina. The strength of the greenspace mental health relationship varies with urbanity and between public and private greenspaces, suggesting a more complex relationship. This work furthers foundational knowledge on the impacts of greenspace quantity on greenspace mental health relationships in both rural and urban areas.

Taylin Spurlock, Geography Graduate Student
Faculty Mentor: Maggie Sugg, Geography and Planning
Co-Author(s): Tyler Minor, Jennifer Runkle
Title: A SPATIALLY EXPLICIT ANALYSIS OF EXTREME WEATHER RISK ON VULNERABLE POPULATIONS IN THE SOUTHEASTERN UNITED STATES
With climate change increasing the frequency of extreme weather events, it is essential to understand which vulnerable individuals will be affected. These extreme weather events endanger critical health infrastructure, and many individuals rely on infrastructure to meet their basic needs, such as heat, water, and medical devices. The purpose of this study is to identify spatially-explicit vulnerable populations' risk for power outages due to these extreme weather events. To accomplish this, we have used the HHS emPOWER Emergency Planning Dataset, which was created to help public health authorities plan for and address the needs of community-based at-risk populations. Using Geographic Information Systems (GIS) we overlay emPOWER data with the frequency of extreme weather events, including wildfires, hurricanes, tornadoes, and ice storms. Final products include a bivariate map product and multi-criteria evaluation of vulnerable populations and extreme weather events. Our results will identify populations most at risk for severe power outages caused by extreme weather events. Public health interventions can target these populations to ensure continuity of care at the community level.

Luke Wertis, Geography Graduate Student
Faculty Mentor: Maggie Sugg, Geography and Planning
Co-Author(s): Jenifer Runkle
Title: EXAMINING HURRICANE IDA'S IMPACT, IMPLICATIONS OF THE EFFECT OF CONCURRENT DISASTERS ON MENTAL HEALTH
Crisis text lines have proven to be an effective low-cost means for obtaining mental health support. Research has shown a well-established mental health effect after natural disasters, yet few studies have established this effect among crisis text services. Moreover, even less research has evaluated the mental health effects during compounding disasters, or when disasters occur simultaneously. This study examined changes in the mental health of help-seeking individuals in Louisiana, USA before and after Hurricane Ida (2021) which occurred during the COVID-19 pandemic using a novel dataset, Crisis Text Line. Paired t-tests and AutoRegressive Moving Average (ARIMA) were used to examine pre- and post- Hurricane Ida changes in crisis text volume among help-seeking individuals in Louisiana who received individual and public assistance following the hurricane. The following outcomes were looked at: 1) substance abuse, 2) suicidal thoughts, 3) stress/anxiety, and 4) bereavement. Results showed a significant increase for crisis texts concerning suicidal thoughts, stress/anxiety, and bereavement in the first 60 days following Hurricane Ida. In the 120 days following Hurricane Ida, there was a significant increase in substance abuse, suicidal thoughts, stress/anxiety,

and bereavement. Overall, in the first 60 days there was a 8.5% increase in crisis texts for suicidal thoughts (p = 0.001), a 10.8% increase in stress/anxiety (p=0.004), and a 22.5% increase in substance abuse (p=0.009). Text volume in the first 120 days for substance abuse increased by 30.4% (p=0.039), suicidal thoughts increased by 13.4% (p=0.017), stress/anxiety increased by 14.4% (p=0.012), and bereavement increased by 30.4% (p=0.019). A low-cost crisis texting platform provided 24/7 mental health support to the residents of Louisiana who were affected by Hurricane Ida. These findings highlight the need for more mental health support when it comes to residents being affected by concurrent disasters. "

Geology

"Shamsuddin Ahmed, Geology Undergraduate Student
Faculty Mentor: Andy Heckert, Geological and Environmental Sciences
Co-Author(s): Sage Langston-Stewart, Katharina Pfaff, Kelsey Livingston, Sean Muller, Thomas Monecke
Title: THE OCCURRENCE AND SEQUESTRATION OF GOLD AT THE CROSS MINE IN THE GRAND ISLAND MINING DISTRICT, BOULDER COUNTY, COLORADO
Precious metal-bearing veins in the magmatic-hydrothermal Cross deposit are predominantly hosted in the Precambrian quartz-biotite-sillimanite Idaho Springs Gneiss; the occurrence and sequestration of precious metals, however, is not well-understood. This survey aimed to improve our understanding of the occurrence of ore minerals and the nature of the hydrothermal alteration associated with the veins in the deposit by sampling select drill core intercepts with high precious metal grades. As part of my UNAVCO internship, we investigated six samples using facilities at the Colorado School of Mines. We did mapping μXRF (micro x-ray fluorescence) analysis on drill core slabs prior to thick section preparation to evaluate the location and association of ore minerals while preserving textural context. We then investigated polished thick sections using reflected light petrography and SEM (scanning electron microscopy) methods including FE-SEM BSE imaging, EDS analysis, and automated mineralogy mapping. High grades correlate with the occurrence of Ag-bearing native Au-forming grains that are ≤20-30 μm in size, commonly associated with pyrite, galena, sphalerite and barite. Alteration haloes (mm-cm scale) predominantly consist of K-feldspar and muscovite. This reconnaissance survey forms part of a larger study of the mining district that will shed light on the processes involved in the formation of this magmatic-hydrothermal deposit and aid in further brownfield exploration efforts.

Tyler Bland, Geology Undergraduate Student
Faculty Mentor: William Anderson, Geological and Environmental Sciences
Co-Author(s): N/A
Title: SEA-LEVEL RISE IMPACTS ON BARRIER-ISLAND AQUIFER MIXING-ZONE MORPHOLOGY
Barrier-island aquifers are unique for coastal aquifers because they contain an interface between fresh and saline groundwater on each side of the island. These dynamic mixing zones are controlled by many factors including aquifer permeability, topography, recharge rate, tidal oscillations, overwash events, and sea-level rise (SLR). The fate of these freshwater aquifers is important because not only do people utilize these freshwater resources worldwide, but they also provide ecosystem services to freshwater marshes and affect the nearshore environment through submarine groundwater discharge. We use the U.S. Geological Survey's finite-element numerical model of groundwater flow and solute transport, SUTRA, to simulate the effects of SLR and tidal oscillations on saline distribution within a barrier island aquifer based on conditions in Duck, North Carolina, which has the highest rate of SLR in the state. Our model uses an island width of 1000 meters with ocean and sound conditions extending 500 meters in each direction from the island. Model outputs allow us to quantify the salinity distribution at various times using projected rates of SLR. Comparing SLR model outputs run without sea level rise, tides, or overwash events to those run with these factors tell us the main drivers of mixing zone morphology in barrier islands.

Katie Haven, Geology Undergraduate Student
Faculty Mentor: William Anderson, Geological and Environmental Sciences
Co-Author(s): Tyler Bland
Title: GROUNDWATER RESOURCES OF WATAUGA COUNTY
The U.S. Geological Survey's North Carolina Water Science Center did a study of groundwater usage in Watauga and Avery Counties in 2008. Their study primarily mapped the location and properties of groundwater wells in that region. Since 2008, however, Watauga County has grown and well drilling has continued for rural residents of the County, who are served by local wells from various units of the Blue Ridge Crystalline Rock Aquifer System. In order to better understand the strain of this growth on the County's groundwater resource, we analyzed the number, location, and yield of wells drilled since 2008 in order to have an understanding of groundwater use, availability, and sustainability. We mapped well data acquired from the Watauga County GW-1 forms using ArcGIS Pro and combined these data with the original U.S.G.S. data to spatially and numerically analyze over 50 years of well data. We calculated maximum, minimum, and mean yield amounts by river basin and hydrogeologic unit. We also created a time series of wells drilled per year in order to determine groundwater development through time. These data show that the yield of wells throughout Watauga County ranges from 0 to 400 gallons per minute, well depth varies from 500 to 2058

feet, and peak years of development were 2008 (215 wells drilled) and 2009 (131 wells drilled).

Randall Karcher, Geology Undergraduate Student
Faculty Mentor: Ellen Cowan, Geological and Environmental Sciences
Co-Author(s): Stefanie Brachfeld, Zhen Wang, Avner Vengosh
Title: MAGNETIC ANALYSIS AS A NOVEL METHOD FOR COAL ASH DETECTION IN RESERVOIR SEDIMENT
Coal-fired power plants produce distinct morphologies of ash from combustion, many of which are magnetic. A rare earth magnet was used to separate two raw Appalachian basin fly ash samples into three magnetic fractions: strongly magnetic, weakly magnetic, and non-magnetic. Each fraction was characterized with scanning electron microscopy, polarized light microscopy, energy dispersive X-ray spectroscopy, inductively coupled plasma mass spectrometry, and magnetic granulometry. Raw fly ash particles have a diverse assortment of morphologies and sizes, ranging from several hundred to less than one micrometer. Morphologies present in the magnetic fractions include rounded vesicular ash, amorphous angular ash, plerospheres (larger spheres that encase smaller spheres), iron enriched smooth spheres, and ferrospheres (spheres containing magnetite and/or hematite crystals). Clear spherical ash particles are exclusive to the nonmagnetic fraction and are amongst the smallest particles found in fly ash. The non-magnetic fraction is moderately more enriched in As, Se, and Pb than the magnetic fraction, whereas the latter is more enriched in Co, Ni, and Cu. Coal-ash bearing sediments have considerably higher magnetic susceptibility values than natural watershed sediment. Our study shows that magnetic properties of coal ash correlate with ash content and morphology, which may help with tracing the distribution of ash-related heavy-metals in reservoir sediment.

Isaac Pugh, Geology Undergraduate Student
Faculty Mentor: Andrew Heckert, Geological and Environmental Sciences
Co-Author(s): N/A
Title: OCCURRENCE AND SIGNIFICANCE OF DREPANOSAURS (REPTILIA:ARCHOSAUROMORPHA) FROM AN UPPER TRIASSIC (TRIASSIC:MID-NORIAN) MICROVERTEBRATE SITE IN EAST-CENTRAL NEW MEXICO
The Homestead site, a new Upper Triassic microvertebrate locality near Garita Creek, New Mexico, has yielded a diverse assemblage of fossils. Among the most recognizable elements are claws and vertebrae of drepanosaurs, a bizarre group of archosauromorphs thought to be mostly arboreal and insectivorous. Drepanosaurs are known only from the Upper Triassic of the northern hemisphere. While their unusual anatomy makes single elements easy to identify, it has left their life mode and phylogenetic relationships murky despite multiple known articulated skeletons. Homestead has thus far yielded 35

isolated definite drepanosaur specimens, including 6 tail claws, 16 manual/pedal claws of at least 3 morphotypes, a femur fragment, and 12 vertebral fragments. The tail claws indicate at least 6 individuals are present in this assemblage, and 2 species appear to be present based on claw morphotypes. The tail claws and large hand claws indicate these are derived members within Drepanosauridae, similar to Drepanosaurus, although likely a distinct taxon. Curiously, the majority of claws lack the lateral compression of most other drepanosaurs, more closely resembling the suspected burrower Skybalonyx. Drepanosaur specimens are rare and often preserved as 2D slabs, making Homestead a unique site for the number of elements and claw morphotypes preserved in 3D. While difficult to reconstruct Homestead drepanosaurs without articulated specimens, one or more unnamed species may be present.

Luke Rose, Geology Undergraduate Student
Faculty Mentor: Andrew Heckert, Geological and Environmental Sciences
Co-Author(s): N/A
Title: LUNGFISH (SARCOPTERYGII:DIPNOI) TOOTH PLATES FROM THE UPPER TRIASSIC HOMESTEAD SITE OF EAST-CENTRAL NEW MEXICO, U.S.A., AND OTHER TRIASSIC LOCALITIES ACROSS THE AMERICAN SOUTHWEST
One of the rarer clades within the Homestead Site of east-central New Mexico is the order Dipnoi. Lungfish tooth plates have a distinct shape, making them easily recognizable and diagnostic. There are currently 4 tooth plates and 14 tooth fragments from the Homestead Site, Garita Creek Fm, NM. I have compared them to the 2 tooth plates of Bluewater Creek Fm, NM; 3 tooth plates of Blue Hills, Petrified Forest Fm, AZ; and 4 tooth plates of Monitor Butte Fm, UT. The teeth in this collection are Late Triassic, specifically Adamanian (early-mid Norian), in age. Lungfish teeth vary immensely in shape and size between genera and species. Because of this variation, assigning them to a position and taxon is difficult. Position assignments are based on the direction, number, size, and shape of the crests and the furrows separating them. The Homestead Site yielded a left splenial, right palatal, and 2 left palatal tooth plates. The Bluewater Creek Fm site yielded a right splenial and a right palatal tooth plate. The Petrified Forest Fm site has a right and 2 left palatal tooth plates. Finally, the Monitor Butte Fm site has 3 left splenial and a right palatal tooth plate. I have hypothesized that the collected tooth plates belong to the genus Arganodus, with the possibility of some belonging to the genus Ceratodus. This is based on the palatal tooth plates exhibiting a singular mesial angle and 6-7 crests, since palatal Ceratodus teeth generally have 2 mesial angles and 5 crests.

Anthony Smith, Geology Undergraduate Student
Faculty Mentor: Andrew Heckert, Geological and Environmental Sciences
Co-Author(s): Isaac Pugh
Title: THE PRACTICALITY OF 3D PRINTING IN PALEONTOLOGICAL RESEARCH
Most fossils are rare, creating many challenges for paleontological studies at institutions with less funding, including school systems in regions such as the Blue Ridge where naturally occurring fossils are essentially nonexistent. Of these challenges, accessibility and affordability are at the forefront. Digitization and 3D printing has made paleontology more accessible to diverse audiences by creating digital replicas of fossils from around the world. With 3D printing, it is possible for parties that are unable to obtain original fossil specimens to replicate them while maintaining their scientific integrity. While 3D printing does not preserve finer details of anatomy, such as serrations or microscopic textures, the technology has proven a viable option for reproduction of otherwise accurate fossil replicas at reasonably low cost. These prints are also scalable, and 3D printing can produce more, and less fragile, specimens that are valuable, yet relatively inexpensive, teaching tools. This technology has already been put to use in AppPaleo (paleontology classes and outreach) with multiple 3D prints of rare specimens on display. For example, the McKinney Museum has a life-sized T. rex skull exhibited above the entrance to the museum that was printed and assembled for just $700 in material costs. As 3D printing is a relatively new avenue for paleontology, we will explain how this new visualization method is beneficial to both current and future paleontologists alike.

Lily Vowels, Geology Undergraduate Student
Faculty Mentor: William Armstrong, Geological and Environmental Sciences
Co-Author(s): Brianna Rick, Irina Overeem, Dan McGrath
Title: QUANTIFYING CHANGES IN SUSPENDED SEDIMENT CONCENTRATION IN GLACIER-FED STREAMS USING LARGE SCALE REMOTE SENSING
Glaciers are prolific sediment producers, and climate-forced glacier retreat, often accompanied by proglacial lake formation, will impact downstream sediment dynamics. In this work, we characterize changes in fluvial suspended sediment concentration (SSC) following glacier retreat using satellite data, which enables SSC estimation at large scale in remote environments where in situ measurements are too costly or otherwise infeasible. We extend a previously-developed technique for satellite-derived SSC estimates and find it performs well in proglacial systems ($r^2 = 0.80$). Combined with a previously-published inventory of Alaskan proglacial lakes and their change over the Landsat-era, we analyze SSC trends as these glacier-lake-stream systems have evolved in response to modern climate warming. We use Google Earth Engine to generate SSC time series spanning 1984 - 2021 downstream from glaciers with and without proglacial lakes. Further, we compare SSC in these systems to rivers without headwater glaciers. Results show that some sites showed a statistically significant change in SSC over the

study period. In order to determine the effect of temporal sample bias on our results, we ran a Monte Carlo simulation to investigate how sampling at different points during the year would affect trends in SSC. These findings present a first-order estimate of how sediment fluxes in Arctic rivers are changing in a warming world, with impacts for aquatic habitat and water resources.

Alyssa Wurtz, Geology Undergraduate Student
Faculty Mentor: Andrew Heckert, Geological and Environmental Sciences
Co-Author(s): N/A
Title: NEW VERTEBRATE ASSEMBLAGE FROM UPPER CRETACEOUS, WILLIAMS FORK FORMATION, NORTH WESTERN COLORADO
Rebecca's Hollow is a microvertebrate fossil site in the Williams Fork Formation in northwestern Colorado. The Williams Fork Formation is a unit of the Upper Cretaceous Mesaverde Group. We collected surface fossils and sediment from Rebecca's Hollow; the larger surface fossils were sorted and identified while the sediment was broken down and picked for smaller fossils. The Rebecca's Hollow assemblage includes osteichthyans (bony fish), turtles, crocodiles, dinosaurs, and mammals. Most of the tetrapod diversity is preserved in specimens < 1 cm maximum length. Osteichthyans are represented by scales, vertebrae, and teeth. Most abundant are the hundreds of Lepisosteidae (gar) scales. Reptile fossils include turtle osteoderms and bones and crocodile osteoderms and teeth, including a robust (durophagous) aff. Brachychampsa sp. tooth. The largest fragments (> 2 cm) are mostly turtle shell (Trionychidae). The dinosaurs consist of hadrosaurs, theropods, and possibly ceratopsians, all identified from small teeth. Mammals are represented by a 1 mm tooth, probably an upper right molar of Alphadon sp. Miscellaneous bones and coprolites are also present. Much more sediment needs to be processed, but so far has not broken down well from traditional screen washing. New strategies need to be employed such as the use of hydrogen peroxide. Once the sediment is broken down many more microfossils should be recovered, improving our knowledge of vertebrate diversity in this interval.

Interior Design

Kaylor Mead, Interior Design Undergraduate Student
Faculty Mentor: Chelsea Helms, Applied Design
Co-Author(s): Esmerelda Benitez-Ibarra, Emily Blackmon, Makenzie Garbert, Hugo Hernandez, Beth Hicks, Emily Johnson, Kim Julison, Shea Marlowe, Cate Mehrer, Grace Neve, Lacodia Reid-Jackson, Daniel Scruggs, Lily Smoot, Rachel Walker, Tahj Walker
Title: RE-ENVISIONING SMALL TOWN POLICE ARCHITECTURE AND DESIGN SOLUTIONS TO FOSTER COMMUNITY RELATIONS, SUPPORT MENTAL HEALTH, AND INCREASE WORKPLACE PRODUCTIVITY.

Through an interdisciplinary sponsored design studio, Appalachian State's IDEXlab is partnering with the Town of Burnsville to redesign an existing fire station into a police station workplace. The building will be used as a workspace for the Burnsville Police Department, will house evidence storage and evidence processing, and will be open to the public for accident reporting and victim/witness interviews.
Research and design strategies will address how to foster community engagement in the built environment amidst turbulent times between police and the public, how to improve the mental health and wellbeing of police officers in the workplace, best design practices for secure spaces, and how to increase productivity in the workplace.
Research methods include evidence-based design strategies, comparative research strategies, analyzing scholarly articles and precedent studies, client interviews, and referencing state and local building codes. This research will inform a comprehensive design that utilizes innovative solutions to provide a refuge for the public and police officers, provide safety and security, and increase productivity in the workplace.
Creative solutions for this project will provide a precedent for future designs within small town police workplaces.

Isaac Wood, Interior Design Undergraduate Student
Faculty Mentor: Chelsea Helms, Applied Design
Co-Author(s): N/A
Title: A FACILITY FOSTERING THE CULTIVATION OF COMMUNITY AND HOME EDUCATION
During the remote learning transition due to Covid-19, South Carolina saw a significant increase of homeschool numbers; the population rose nearly 10% above the 3.3% national average. This climb in the homeschool student population provides an urgent opportunity to respond to a growing need for community development and resources for a diverse array of homeschool households. The purpose of this project is to design a community center tailored to the needs of homeschool households in York County, South Carolina, as the current traditional homeschool profile is unfit for the growing diversity of the community. The scope of this project will provide the community with augmented inclusivity, diversity, accessibility, technology, and facilities in order to cultivate sustainable engagement and education. This project employs an evidence-based design approach by applying understandings from research in studies such as child development, child education, play-based-learning, effects of indoor air quality, architectural case studies, impact of daylight, and the impact of color on education to develop the best educational community space for the households of York County. This research and application process will discover strong ties between community engagement and education and link these two concepts together in order to develop an innovative community-wide philosophy of educational and environmental stewardship, proposing a forward shift for the future of homeschool pedagogy.

Mathematics

Gavin Cusack, Mathematics Undergraduate Student
Faculty Mentor: Kevin Shirley, Mathematical Sciences
Co-Author(s): Vicky Klima <klimavw@appstate.edu>
Title: THE MATRIX FACTORIAL IN THE CONTEXT OF SOLVING SYSTEMS OF DIFFERENTIAL EQUATIONS

We explore the matrix factorial and analyze systems of differential equations with matrix factorial solutions. We first consider a well-studied case; an ordinary system of differential equations solved by the matrix exponential and consider its phase portrait. We then define the matrix factorial, consider a system it solves, examine its phase portrait, and contrast it to the portrait of the system solved by the matrix exponential. One of the most notable differences is the dynamic slope field in the phase portrait of the matrix factorial system. The matrix exponential has been used to inform our understanding of the system of differential equations it solves. Conversely, our exploration of the matrix factorial takes an innovative approach to this relationship by using systems of differential equations with solutions represented using the matrix factorial as a way to further understand the matrix factorial itself.

Music Therapy

Emily Jones, Music Therapy Undergraduate Student
Faculty Mentor: Jared Skinner, Health and Exercise Science
Co-Author(s): Lizzie Gamwell, Alexis King, and Dr. Kim McCullough
Title: STRONG BODY, STRONG MIND; A COMMUNITY BASED PROGRAM FOR THE HIGH COUNTRY

Strong Body Strong Mind (SBSM) is an interprofessional community support program offered by the Institute for Health and Human Services at Appalachian State University. SBSM is an innovative 10-week community program designed to enhance physical and cognitive function through progressive physical and mental exercises in those concerned with memory loss and decline in mobility. The program consisted of a physical activity session and a cognitive training session. The physical component of SBSM consisted of 15 mins of complex walking that progressed in duration and difficulty throughout the program. This included activities like walking through an obstacle course while performing a cognitive task, i.e., counting backward by 7. The cognitive training component consists of wellness education and is taught to use cognitive performance strategies to sustain memory, attention, organization, and communication function. In the Fall of 2021, 12 participants completed the multimodal program, with a 90% adherence rate. After completion, participants improved their walking speed, which is a predictor of overall quality of life in older individuals, and self-reported overall better quality of life and well-being. After completing the program, many participants wanted to continue to engage in exercise, and 80% would participate in the program again. The

success of the interprofessional collaboration seems to positively affect the well-being of the people of the high country.

Macel Reising, Music Therapy Graduate Student
Faculty Mentor: Cathy McKinney, Music
Co-Author(s): N/A
Title: MUSIC THERAPY FOR PATIENTS WHO ARE MECHANICALLY VENTILATED: A PHENOMENOLOGICAL STUDY
The purpose of this study is to describe how music therapists provide care for adult patients in the intensive care unit on mechanical ventilation. A short electronic survey was sent to board-certified music therapists to gather data on those working with patients on mechanical ventilation in adult medical settings. The researcher interviewed five music therapists who responded to the survey about their clinical work with patients on mechanical ventilation. Most results were parallel to existing literature: interviewees described types of patients supported, interventions and related goals, family support, challenges, interactions with staff, music selection, and seeking best practices. Interviewees discussed contraindications of using patient-preferred music, however, which deviates from prior findings. Future research is warranted to examine the nuances of music therapy within the spectrum of life support. Additionally, exploring patient perspectives of music therapy during mechanical ventilation after extubation may provide insight into the styles of music best suited for patients on mechanical ventilation. Finally, as the presence of family members seems to have a significant impact on patients' experience of MV, future research could investigate outcomes of incorporating families and caregivers into sessions.

Nutrition

Grace Anderson, Nutrition Graduate Student
Faculty Mentor: Brook Harmon, Nutrition and Health Care Management
Co-Author(s): Jamie B. Griffin, PhD, RDN, LDN and John Arrowood, MS, RDN, LDN
Title: ASSOCIATIONS BETWEEN MINDFULNESS AND PERCEIVED STRESS AMONG A COLLEGE CAMPUS SAMPLE
The purpose of this study was to examine associations between engagement in mind-body practices and perceived stress in a sample of university faculty/staff and students. Participants completed online surveys to asses engagement in mind body activities, stress, and lifestyle behaviors. Mind-body practice type and engagement history, in addition to Perceived Stress Scale (PSS), were analyzed using SPSS software. Practice type was categorized as meditation, prayer, multiple forms. Practice duration was categorized as <1 year, 1-5 years, and >5 years. One-way ANOVA tests examined associations between mind-body type and duration with total PSS score. Participants (n=31) were on average 33 (15.54) years old (range 18- 63), (84% female, 68% students).

Prayer was the most reported practice (45%) and most participants (64%) were long-term (>5 years) practitioners. PSS scores were on average 18 (4.94), indicating a moderate perceived stress score. Associations were not statistically significant for practice type (H (2) =1.75, p=0.42) or duration (H (2) =4.21, p=0.12) and PSS score. While no statistically significant associations were found, mind-body practices generally benefit overall health. Prayer has been found to have similar effects on the brain as meditation, which is important for health professionals to note given the high rate of prayer in this sample and the South in general. More research is needed to understand associations between types of practices/duration.

Taylor Beck, Nutrition Undergraduate Student
Faculty Mentor: Laurel Wentz, Nutrition and Health Care Management
Co-Author(s): N/A
Title: DIETARY PRACTICES OF COLLEGIATE WRESTLERS ACROSS THE SEASON
Introduction: Although literature has been published to quantify weight loss in combat athletes, little research has investigated the dietary practices of collegiate wrestlers. Purpose: To assess dietary habits at different points in the competitive season and their effect on body composition of collegiate wrestlers. Methods: 9 wrestlers consented to participate in the study and completed all assessments during weight certification and in-season, including DXA, 3-day food records, and survey about fruit/vegetable intake. Paired t-tests were computed to analyze differences between measurements. Wrestlers were categorized as lightweight (LW; n=4), middleweight (MW; n=3), and heavyweight (HW; n=2) for analysis. Results: Mean 3-day energy intake was 26.4±7.4 kcal/kg at weight certification and 27.7±11.5 kcal/kg in-season, which did not differ by weight class. Trends showed that MW increased overall energy preceding competition, while HW decreased energy, and LW had minimal change. All wrestlers decreased total body mass (BM) preceding competition, reducing fat-free mass (FFM) and fat mass (FM). 6/9 athletes ate ≥2 servings of vegetables/day, and 3/9 ate ≥2 servings of fruit/day. Discussion: Wrestlers show losses in BM, FM, and FFM, despite modest changes in overall energy intake. Previous studies have documented losses in BM from a combination of fluid and energy restriction, but the current study did not find significant energy restriction.

Olivia Carman, Nutrition Graduate Student
Faculty Mentor: Melissa Gutschall, Nutrition and Health Care Management
Co-Author(s): Jamie Griffin, PhD, RD; Danielle Nunnery, PhD, RD
Title: IMPACT OF A VIRTUAL EDUCATIONAL PRESENTATION ON FOOD ACCEPTABILITY IN CHILDREN WITH AUTISM SPECTRUM DISORDER IN RURAL WESTERN NORTH CAROLINA
Children and adolescents with Autism Spectrum Disorder (ASD) are more likely to exhibit feeding difficulty and picky eating behaviors as compared to their peers. If these

eating behaviors are extreme and/or if children do not receive intervention to promote dietary diversity, nutritional deficiencies and chronic disease can occur later in life. Previous studies have shown the efficacy of food chaining and repeated exposure in improving extreme food selectivity, but more research is needed for nutrition education with this population. The objective of this study was to evaluate the content and delivery of a virtual educational presentation on gastrointestinal (GI) health and mealtime behavior associated with ASD in western North Carolina. The Hub for Autism and Neurodiversity (HANd) was utilized to recruit parents and educators of children with ASD to attend a virtual presentation about GI health and mealtime behaviors. The session was led by two graduate students with guidance by a faculty member with expertise in this area. Participants were asked to complete a post-online survey about their demographics, presentation content, and GI symptoms/mealtime behaviors. Out of the 8 participants who finished the survey, 75% reported that their children do not experience GI issues and 100% observed issues in mealtime behaviors. 75% of respondents prefer future educational resources in the form of a live online presentation and 25% preferred recorded videos. Mealtime behaviors was a valid topic to discuss based on participant feedback. A need for GI issues was not identified, which could be due to the small sample size. Future interventions should be offered in a format flexible to parent schedules and include topics for which both parents and educators of children with ASD need greater support.

Ellen Carpenter, Nutrition Graduate Student
Faculty Mentor: Paul Moore, Nutrition and Health Care Management
Co-Author(s): Melissa Gutschall, PhD, RDN; Kyle Thompson, DCN, RDN, LDN; Alyssa Clement, MS, RDN, LDN
Title: QUALITY AND ACCURACY OF IDDSI DIET AT A REGIONAL HOSPITAL IN WESTERN NORTH CAROLINA
Intro: An ongoing Quality Improvement (QI) project to assess quality and accuracy of International Dysphagia Diet Standardization Initiative (IDDSI) diets for patients, as well as temperature control standards (TCS) was implemented at a health care facility in western NC. The foodservice staff within the health care facility prepares IDDSI diet levels 4 through 7. It is important that the facility follows the IDDSI guidelines to ensure the safety of patients with dysphagia.
Methods: Test trays were collected twice a week at lunch between 11:30am-12:30pm for 7 weeks from September - November 2021. A data collection tool was used to assess quality and accuracy in IDDSI diet orders prepared by the food service team.
Results: Out of the 14 test trays only one hot starch and hot vegetable (7.14% of hot starches and hot vegetables) did not meet point of service temperatures, indicating 95.24% of the food groups analyzed met point of service standards.
Most notably, 100% of test trays met IDDSI standards for their prospective IDDSI Level requirements. Conclusion: This regional hospital in western North Carolina proved to

meet quality and accuracy of IDDSI diets for patients. Implementation diet assessments can ensure adherence to the IDDSI framework. More studies are needed to determine the effect of delivery time on temperature with IDDSI diets and strategies to decrease the time between preparation and delivery.

Kyle Carter, Nutrition Graduate Student
Faculty Mentor: Laurel Wentz, Nutrition and Health Care Management
Co-Author(s): Sarah Radman, Amy Perkinson, Alisha Farris PhD, RDN, Zachary Farris PhD
Title: DIFFERENCES IN MUSCLE MASS, ADIPOSE MASS, AND BONE STRUCTURE BETWEEN ELITE AND INTERMEDIATE CLIMBERS IN WESTERN NORTH CAROLINA
Introduction: The purpose of this study was to investigate and compare anthropometric measurements such as muscle mass, adipose mass, and bone structure between climbers. Methods: Full International Society for Advancement of Kinanthropometry (ISAK) level 2 profiles were completed and analyzed on 44 intermediate/elite climbers between the ages of 18-49 in Western North Carolina from 2019-2020.
Results: 27 climbers were classified as intermediate level climbers while 17 were classified as elite. Muscle mass was significantly higher in elite climbers vs. intermediate climbers (31.4 6.4 kg vs. 27.3 5.4 kg, p = 0.03). Adipose mass was significantly lower in elite climbers vs. intermediate climbers in both men (14.2 ± 1.4 kg vs. 16.4 ± 3.1 kg, p=.048) and women (16.5 ± 2.2 kg vs. 19.7 ± 2.9 kg, p=.021). Additionally, mean skin fold measurements were significantly lower in elite men vs. intermediate men (44.0 ± 9.2 mm vs. 60.0 ± 21.3 mm, p=.039). Men fell into the ecto-mesomorph somatotype category while women were more endo-mesomorphic. Discussion and Conclusions: Elite climbers possessed significantly less adipose mass and more muscle mass than the intermediate climbers, along with having an ecto-mesomorph somatotype build. This allows us to explore improvement of these modifiable characteristics. Further research could contribute to the development of specific diets/training regimens in order to achieve these desirable characteristics and improve performance.

Lexi Chimera, Nutrition Graduate Student
Faculty Mentor: Melissa Gutschall, Nutrition and Health Care Management
Co-Author(s): Alisha Farris, Laurel Wentz, Tara Harman, Aston Dommel, Kelsey Rushing, Lee Stowers, Christian Behrens Jr
Title: FOOD INSECURITY AMONG DIVISION-1 STUDENT ATHLETES IN THE SOUTHEAST: A MULTI-SITE STUDY
Collegiate student athletes are a highly vulnerable subset of population of college students at risk for experiencing food insecurity due to their additional athletic obligations, secondary to other coexisting factors associated with food insecurity. This research aims to measure the prevalence and magnitude of food insecurity among

college student athletes in the southeast. The study population was gathered from Appalachian State University and the University of Alabama at Birmingham. Participants were all eligible student athletes 18 years of age or older. A cross sectional, online questionnaire including 10 USDA verified food insecurity questions and descriptive statistic questions was created by Qualtrics software. Laptops were provided in a private area for students to complete the questionnaire. Total number of completed surveys was 426. Data was analyzed using SPSS and a descriptive statistics table was created. Combined data from both institutions revealed approximately 50% of participants reporting some level of food insecurity out of a study population of 426 completed surveys. This result was estimated by combining the very low food insecure, low food insecure and marginal food insecure outcome measures. A descriptive table was created to represent demographic information about the participants at each institution. The level of food insecurity found at two college institutions in the southeast region is significant and indicative of the need for nutritional resources to support student athletes. The significance of these findings magnifies the importance for continued research in food insecurity among student athletes at other institutions. This research could benefit other institutions in identifying the prevalence of food insecurity to develop future interventions to compromise the challenges student athletes experience. This research was funded by an IRB approval.

Krista Clarke, Nutrition Graduate Student
Faculty Mentor: Alisha Farris, Nutrition and Health Care Management
Co-Author(s): Danielle Nunnery PhD, RDN, Manan Roy PhD
Title: EXPLORING CORRELATIONS OF DISORDERED EATING, ADVERSE CHILDHOOD EXPERIENCES, AND WEIGHT BIAS IN COLLEGE NUTRITION STUDENTS

Orthorexia and weight bias have been reported as high as 70% in nutrition students. Adverse Childhood Experiences (ACEs) are linked with eating disorders, but there is little understanding of their relationship with orthorexia and weight bias.

This study explored correlations between orthorexia, ACEs, and weight bias in college nutrition students. Students enrolled in nutrition programs in twelve mid-southeast states were recruited to participate in an anonymous survey. The ORTO-R was used to measure orthorexia tendencies, ACE questionnaire to measure ACE's, and the Weight Attitude Implicit Association Test to measure weight bias. Data were analyzed using descriptive statistics, regression analysis, and raw correlations, with a significance level of $p < 0.05$. Of the 164 students who completed the survey, 92% were female, 82% were white, and 54% had a moderate/strong weight bias. Around 50% identified as from a dysfunctional family, and 43% experienced emotional abuse. Orthorexia tendencies were associated with ACEs such as domestic abuse ($p = 0.02$), divorce ($p = 0.03$) and incarceration ($p = 0.04$). For weight bias, sexual abuse was the only ACE that was statistically significant ($p = 0.01$). No significant relationships were found between

orthorexia tendencies and weight bias. The inclusion of ""Health at Every Size"" in nutrition curriculum, and activities that dispel weight-based stereotypes are needed to bring awareness and prevent bias and orthorexia among nutrition students.

Darcy Dean, Nutrition Graduate Student
Faculty Mentor: Laura McArthur, Nutrition and Health Care Management
Co-Author(s): Morgan Adkission, Melissa D. Gutschall, PhD, RD, LDN, Alisha Farris, PhD,
Title: FOOD INSECURITY STATUS AND CORRELATES AMONG MARRIED STUDENTS AT APPALACHIAN STATE UNIVERSITY BEFORE AND DURING THE 2020 COVID-19 PANDEMIC
Food insecurity (FI), or the lack of regular access to safe and nutritious food, is a public health problem among college students. Research conducted at seven post-secondary institutions in the Appalachian region found a 31% average rate of FI, and the rate at AppState in 2016 was 46%. There is limited research on the food security status of married college students. The aims of this study were to measure the rate of FI among married students attending AppState during the 2020 COVID-19 pandemic year, and to compare dietary, health, academic, and food access correlates between FS and FI students before and during the pandemic. Data were collected using a cross-sectional online questionnaire. FS was measured using the USDA Adult Food Security Survey. Scales measured correlates, chi-square analyses compared FS and FI students before and during the pandemic, and regression modeling identified predictors for FI. Statistical significance was $p<0.05$. 169 married students submitted questionnaires, of whom 30% were FI. Undergraduates were more likely to be FI than graduate students ($p<0.001$). A significantly greater proportion of FI than FS students, rated their food access during the pandemic as worse ($p<0.001$), and the healthfulness of their households' diet as less healthy ($p<0.001$). Greater proportions of FI than FS students also consumed foods from all food groups less often ($p<0.05$), and rated the mental health and academic performance of household members as worse ($p<0.05$) during compared to before the pandemic. These findings reinforce the need to expand policies and programs for improving access to nutritious foods by married college students.

Jackson Dellana, Nutrition Graduate Student
Faculty Mentor: Melissa Gutschall, Nutrition and Health Care Management
Co-Author(s): Lexi Chimera1, Alisha Farris1, Danielle Nunnery1, Tara Harman2, Aston Dommel2, Kelsey Rushing2, Lee Stowers2, Christian Behrens Jr1
1Appalachian State University. 2The University of Alabama at Birmingham.
Title: THE IMPACT OF SEXUAL ORIENTATION ON FOOD INSECURITY AMONG DIVISION 1 STUDENT ATHLETES
Food insecurity (FI) in U.S. college students is a growing health concern. Among this population are LGBTQ+ students and student athletes. Individuals identifying as

LGBTQ+ are disproportionately affected by FI. However, data on student athletes and LGBTQ+ student athletes is lacking. Inadequate access to consistent, nutritious food can present barriers detrimental to success in the classroom as well as competitive athleticism. Objectives were to measure the prevalence and severity of FI among heterosexual (HS) and LGBTQ+ student athletes and to identify possible reasons for observed differences in FI. Eligible Division 1 NCAA student athletes 18 years of age or older were included in this multi-site cross-sectional survey study. Data collected using an anonymous online questionnaire, with food security (FS) status measured via the 10-item USDA survey. 404 total participants completed the survey, 380 identifying as HS and 24 identifying as LGBTQ+. A total of 15.5% HS student athletes experienced low FS and 17.6% experienced very low FS in the past 12 months. Conversely, 8.3% LGBTQ+ student athletes experienced low FS with 4.2% having experienced very low FS in the past 12 months. These results illustrate the high prevalence of FI among student athletes at two southeastern universities. LGBTQ+ student athletes experienced less FI than the HS athletes. Overall, these results demonstrate a need for strategies and interventions that increase access to consistent food resources.

Meghan Dempsey, Nutrition Graduate Student
Faculty Mentor: Laurel Wentz, Nutrition and Health Care Management
Co-Author(s): Michelle Rockwell, PhD, RD, CSSD
Title: SUPPLEMENTAL OMEGA-3 FATTY ACIDS AND THE OMEGA-3 INDEX: A SCOPING REVIEW
Introduction: The majority of the population does not consume adequate n-3 FA, leading to global deficiencies. An O3i ≥8% has been associated with reduced risk of chronic disease, most notably cardiovascular disease. Thus, a synthesis of current research summarizing the effects of n-3 FA intake on O3i is warranted. The purpose of this scoping review was to evaluate the effect of n-3 FA interventions and estimate sufficient n-3 FA intake to meet O3i ≥8%. Methods: Search criteria were human studies published in English from 2004 to 2022 that assessed O3i at baseline and following n-3 FA intervention. 56 studies were identified. Protocols included fortified foods as well as supplements containing single or combination n-3 FA. Dietary supplements varied in chemical composition; the most common were triglycerides or ethyl esters. The lowest intervention protocol was 200 mg/day DHA, and the largest was 4,400 mg/day EPA and DHA. Interventions ranged from 3 weeks to 3 years. Results/Discussion: 3 study samples had mean baseline O3i ≥8%, although most increased O3i to ≥8%. The lowest dose was 200 mg/day DHA for 5 months. DHA is efficiently incorporated into erythrocyte membranes and improves O3i at lower doses than other n-3 FA. Supplements composed of triglycerides were more bioavailable and more effective than other formulas. Based on the data evaluated, practical recommendations to improve O3i to ≥8% are consumption of 1,000-1,500 mg/day of predominantly DHA as triglycerides.

Sydney Fischer, Nutrition Graduate Student
Faculty Mentor: Kyle Thompson, Nutrition and Health Care Management
Co-Author(s): Melissa Gutschall, Margaret Barth, Amanda Hege
Title: FOOD PANTRY VOLUNTEER OPERATIONS AND COVID-19: A SURVEY OF 25 PANTRIES IN WESTERN NORTH CAROLINA AND SOUTHWESTERN VIRGINIA
Introduction: The purpose of this research was to investigate food pantry volunteer operations both pre- and during the Covid-19 pandemic.
Materials and Methods: Based on the results of a literature review, a 23-question survey was developed. A convenience sample of 25 food pantry directors in the western North Carolina region was surveyed on volunteer operations. Survey data were analyzed using descriptive and comparative statistics. Results: Pre-pandemic was defined as before March 2020; during pandemic was defined as during or after March 2020 up to the time of the survey. There were statistically significant changes in the median age of volunteers pre- and during Covid ($p = 0.012$) and in food distribution methods ($p = 0.007$). There was an increase in pantries using pre-packed distribution options (+30.33%) and a decrease in client choice options (-33.5%). The average number of households served per month by the combined pantries increased (+3073), but not significantly. 52% of participants reported declines in volunteer numbers by 25 – 75% during the pandemic. Discussion and Conclusions: This study found the Covid-19 pandemic had a profound impact on volunteer operations, age, and availability in participating food pantries. A majority of surveyed pantries demonstrated flexibility in using innovative strategies to address changed operational needs. This research suggests that food pantries should develop strategies to cope with both natural and operational emergencies.

Rebecca Hambright, Nutrition Graduate Student
Faculty Mentor: Alisha R. Farris, PhD, RDN, Nutrition and Health Care Management
Co-Author(s): Danielle L. Nunnery, PhD, RDN; Zachary J. Farris, PhD
Title: EXPLORING THE PRACTICES & BEHAVIORS SURROUNDING PREGNANCY IN TRADITIONAL MIDWIVES & COMMUNITY HEALTH WORKERS IN ANDASIBE, MADAGASCAR
Maternal and neonatal mortality are at alarming rates in Madagascar and healthcare is lacking. Cultural beliefs impact healthcare decisions, but are not well understood, nor are the practices of maternal health providers. This qualitative study explored the healthcare practices and recommendations during pregnancy to postpartum care in Andasibe, Madagascar. Thirteen traditional midwives and community health workers were invited to complete a semi-structured interview on practices and recommendations for pregnancy to postpartum clients. A thematic analysis was conducted to identify themes and subthemes using Nvivo. The majority of participants were nurses trained as midwives. Five broad categories emerged: training/job responsibilities, pregnancy, labor/delivery, postpartum, and modern medicine versus traditional medicine. Most

began maternal care at 4 months, and equipment was perceived as a high need. Practices combined modern medicine and traditional culture recommendations. Nutrition recommendations followed healthful guidelines, however traditional medicine incorporated herbals with unknown effects. Addressing complications was limited by location and lack of resources. This exploratory study highlights how practices of healthcare providers are shaped by a low-resource setting. Interventions to increase adherence to standards should focus on improving access to and adequacy of resources, and educational outreach on seeking evaluation earlier than 4 months could improve outcomes.

Maura McClain, Nutrition Graduate Student
Faculty Mentor: Danielle Nunnery, Nutrition and Health Care Management
Co-Author(s): Nicole Arnold PhD; Manan Roy PhD; Alisha Farris PhD, RD; Amber Welborn PhD, RN; Lauren Sastre PhD, RD, LDN; Hope Lima PhD, RD, LDN
Title: MEDICAL PROVIDER PERCEPTIONS OF NUTRITION EDUCATION AND REFERRAL TO REGISTERED DIETITIANS FOR PREGNANT CLIENTS
Background: Research shows that nutrition education improves the knowledge and motivation of pregnant individuals to eat a healthy diet. The purpose of this study was to explore OB-GYN- based medical practitioners' perspectives on nutrition knowledge and behaviors of pregnant clients, to determine the types of nutrition information provided, and the frequency of referrals. A convenience sample of practitioners were recruited by contacting medical school directors nationwide, and asking these directors to forward the survey to current obstetric providers in their residency and any alumni. Descriptive statistics were obtained using Stata 15 and frequencies reported. Out of 31 respondents, the majority were female (n=26), MDs (n=25), and had worked with pregnant and lactating populations for 5 years or less (n=17). Of providers who responded (n=28), 57% spent less than five minutes per visit discussing nutrition topics. Participants reported referring to Registered Dietitians (71%). Roughly 67% of providers felt prepared to provide nutrition education, and 97% felt that their clients would benefit from nutrition counseling by a dietitian. OB-GYN medical practitioners have limited time to provide nutrition education to their clients and value the benefit of nutrition counseling. Further research should examine how interprofessional care teams can be leveraged and incorporated in this vulnerable population.

Lindsie Miles, Nutrition Graduate Student
Faculty Mentor: Danielle Nunnery, Nutrition and Health Care Management
Co-Author(s): Taylin Spurlock; Nadia Livesay; Macy Henry; Maggie Sugg; Alisha Farris; Manan Roy
Title: SPATIAL ANALYSIS OF PERINATAL FOOD ASSISTANCE RESOURCES IN RELATION TO FOOD DESERTS IN NORTH CAROLINA

Access to perinatal resources and healthy foods could limit the impact of maternal and infant health. Geographic Information Systems (GIS) is used to capture, store, and analyze geographic data, and can be used to reveal perinatal food assistance gaps. Allowing for informed decisions about intervention and resource placement in the areas where disparities exist. The objectives of this study were to locate perinatal food assistance resources and determine if there was a spatial correlation between density of resources and USDA food deserts. A comprehensive list of WIC clinics, WIC-approved vendors, SNAP offices and SNAP retailers available in North Carolina was compiled. These resources were geocoded to create a spatial distribution of the locations into ArcGIS Pro by ESRI. WIC/SNAP locations were spatially merged with USDA and American Community Survey Data to create a relational GIS database. Bivariate map products were used to determine the spatial relationship between USDA food deserts and WIC/SNAP locations. Preliminary findings show limited WIC and SNAP offices/retailers located in rural, underserved areas within food deserts in NC. Spatially, variations in this association vary across the state with limited access in the Eastern and Western regions of NC.GIS and other simple spatial analysis allow for critical evaluation of WIC and SNAP offices/retailers and their relationship to food deserts, which could inform policies around support for more offices/retailers.

Bryn Mohn, Nutrition Graduate Student
Faculty Mentor: Melissa Gutschall, Nutrition and Health Care Management
Co-Author(s): Danielle Nunnery PhD, RD and Sydeena Isaacs PhD, RD
Title: VIRTUAL NUTRITION EDUCATION SERVICES DURING COVID-19 FOR FOOD BANK CLIENTS IN RURAL WATAUGA COUNTY, NC
Introduction: During the Covid-19 pandemic, an addition of 500 new clients was seen at the Hunger and Health Coalition (HHC), in Watauga County, NC, where 1 in 5 residents are considered to be food insecure. The purpose of this research was to offer several forms of virtual nutrition education to clients during the Covid-19 pandemic and identify the effectiveness of each. Materials and methods: Nutrition initiatives included 1) weekly text messages, 2) individual nutrition counseling via phone, 3) medically-tailored food boxes, and 4) virtual nutrition education; all initiatives were launched between June 2020 and February 2021. Data included participation rates, client surveys, and observational field notes. Outcomes included acceptance, feasibility, and overall effectiveness of each virtual education format. Data were analyzed using descriptive statistics and qualitative comparative analysis. Results and discussion: Text messaging was the most feasible form of nutrition education, with a reach of 1,856 clients. Fifty-five clients expressed interest in individual nutrition counseling, and 15 of those requested continued contact for information and support. Clients appreciated the personal connection and ability to voice preferences for medically-tailored food boxes, which 20 clients regularly received. Online nutrition education videos and demonstrations seem to be the most convenient option for clients to obtain nutrition

information, each receiving between 23 and 188 views. Thirty percent of clients felt they gained much more information and forty percent felt they had a lot more access to nutrition information since the programs began. Conclusions: Overall, it is important to meet clients where they are in regards to resources, needs and timing for nutrition services. While text messages and recorded educational videos were the easiest resources to access, client contact was highly beneficial for individualizing food boxes that meet nutrition therapy needs.

Anne Richardson, Nutrition Graduate Student
Faculty Mentor: Sandi Lane, Nutrition and Health Care Management
Co-Author(s): Dr. Paul Moore
Title: THE IMPACT OF RESIDENT PARTICIPATION IN DAILY FACILITY ACTIVITIES ON WEIGHT LOSS, DEUBITUS ULCERS, ADL FUNCTION, AND DEPRESSION IN NURSING HOMES. A CASE STUDY.
Many interventions have been utilized to assist older Americans in enjoying a better quality of life while residing in long term care facilities. Much of the literature on this subject focuses on these interventions, but very few, if any, examine the relationship between quality-of-life outcomes and attendance at daily activities. This case study explores residents' attendance at the scheduled daily activities in their nursing homes and quality of life outcomes. Unwanted weight loss, presence of decubitus ulcers, presence of depressive symptoms, level of cognition and loss of late loss ADLs were examined in a convenience sample in one North Carolina nursing home. A small sampling of data obtained through individual MDS records and daily activity attendance rolls at the nursing home was collected. This data was then analyzed using regression analysis. The statistical analysis of this small sample size is not indicative of general findings within the literature, but there is a proof of concept here which deserves further study. The literature supports the value of resident participation in daily activities and highlights the need to further investigate additional programs that encourage resident engagement.

Cailey Estridge, Nutrition and Foods Graduate Student
Faculty Mentor: Danielle Nunnery, Nutrition and Health Care Management
Co-Author(s): Dr. Melissa Gutschall and Dr. Laurel Wentz
Title: THE EFFECT OF EXPERIENTIAL LEARNING ON UNDERGRADUATE NUTRITION AND DIETETICS STUDENTS' SELF-EFFICACY
In recent years, the field of Health Sciences has been the focus of research for incorporating experiential learning (EL) within undergraduate and clinical curricula; however, to the best of this author's knowledge, very few studies have been done on the application of EL within the nutrition and dietetics curricula. The purpose of this study was to measure the effect(s) of an EL assignment on undergraduate nutrition and dietetics students' self-efficacy in providing nutrition counseling services. In a

semester-long nutrition counseling class, undergraduate nutrition and dietetics students were surveyed in Week 11 before an EL assignment. Students repeated the survey in Week 16 following an EL assignment. All recorded surveys were checked for completion in their entirety. Of the 31 students who completed both surveys, there was a significant difference in students' self-perceived confidence in three nutrition constructs between Week 11 (M=35.15; SD=10.12) and Week 16 (M=38.38; SD=10.73); t(2)=[-9.138], p=[0.006]. It is important for colleges and universities to recognize the benefits of incorporating EL opportunities into nutrition and dietetics curricula as an effective learning strategy. The findings from this study are supported by both theory and literature and provide a foundation for collegiate organizations that have nutrition and dietetics curricula to expand on EL opportunities for current and future students.

Physics

Samuel DeMay, Physics Graduate Student
Faculty Mentor: Roshani Silwal, Physics and Astronomy
Co-Author(s): Anthony Calamai
Title: RUBY PHOSPHORESCENCE SENIOR LAB:
CR 3+ 2E LIFETIME AND 4T ABSORPTION STUDIES
Our lab previously reported that many existing advanced laboratory experiences associated with the metastable 2E term of Cr3+ in ruby, which gives rise to the R-lines at 692.7 and 694.3 nm, focus on a room-temperature measurement of the radiative lifetime of the 2E term. We have since published [1] techniques for students to make a consistent Cr3+ 2E lifetime measurement without systematic errors associated with the Cr concentration of the ruby samples. Our result for the room-temperature radiative-lifetime for the 2E term is 3.3 ± 0.1 ms [1]. This type of senior lab exercise typically uses commercially available ruby spheres for which the manufacturer(s) only state an ~2% Cr3+ concentration. The uncertainty in Cr concentrations in commercially available ruby spheres has motivated our lab to begin a detailed study of the Cr3+ 4T absorption bands, near 410- and 544-nm, using commonly available advanced-physics lab equipment. We provide a status report on this aspect of our work to enhance this senior-level laboratory activity.

Psychology

Madison Belk, Psychology Undergraduate Student
Faculty Mentor: Reagan Breitenstein, Psychology
Co-Author(s): N/A
Title: CORRELATIONS BETWEEN CORTISOL AND MULTIPLE INDICATORS OF EXECUTIVE FUNCTIONING IN CHILDREN

Studies show that cortisol levels are related to deficits in cognitive functioning like attention and memory, but most studies have tested these links in younger children and adults (Raffington et al., 2018; Blair et al., 2005). We examined links between multiple aspects of salivary cortisol and executive functioning measures in school-aged children. We collected data via home visits and questionnaires from a large twin study (N = 710; Mage = 8.43 yrs; 51.5% female). Salivary cortisol was collected three times a day for three days. Cognitive functioning was measured with the Temperament Questionnaire in Middle Childhood (TQMC; attentional focusing, attentional control, and inhibitory control), digit span to assess working memory, and computerized Continuous Performance (CPT) and Flanker tasks to assess inhibitory control. There was no association between morning, evening, daily cortisol slopes, and total cortisol output with digit span, CPT or Flanker tasks. Total effortful control and attentional focusing were negatively correlated with morning cortisol slope and total cortisol output with morning cortisol slopes, suggesting that greater effortful control and attentional focusing were linked with more negative, or steeper declines, in cortisol slopes from morning to afternoon on average and steeper declines in daily slopes. These initial findings suggest that children with greater cognitive regulation may also have better physiological regulation.

Surratt Elizabeth, Psychology Undergraduate Student
Faculty Mentor: Shawn Bergman, Psychology
Co-Author(s): Isabella Lopez, Taylor Berry, Riggs Matthews, Timothy Ludwig, Yalcin Achigoz
Title: THE EFFECTS OF LAGGING INDICATORS ON LEADING INDICATORS FOR SAFETY OUTCOMES

Workplace incidents are a detriment to both organizational financial costs and the safety of employers and employees. Beyond the immediate physical and mental harm to employees, reduction in workplace safety has been shown to decrease employee productivity, commitment, and overall trust in the organization. The implementation of predictive models in research has shown promise for reducing safety outcomes. By using safety data from two large construction and manufacturing companies between 2017 and 2019, this study examines leading-indicator differences between functional groups with high- or low- lagging indicators. To conduct our analysis, we ran ANOVAs to look at the variance between the leading variables based on the high and low lagging variable groups. We concluded that the groups were significantly different if the p value was

below .05. Results show that overtime hours are significantly different between the high and low incident groups and the high and low near miss groups, indicating that functional groups with greater overtime hours are more at-risk for safety incidents. This study further supports the use of analytics in the manufacturing and construction industries.
Jule, J. G. (2020). Workplace Safety: A Strategy for Enterprise Risk Management. Workplace Health & Safety, 68(8), 360–365. https://doi-org.proxy006.nclive.org/10.1177/216507992091665

Rachel Fink, Psychology Undergraduate Student
Faculty Mentor: Andrew Smith, Psychology
Co-Author(s): N/A
Title: MORALITY OF ENVIRONMENTAL ATTITUDES: A REPLICATION AND EXTENSION OF MORAL ROOTS OF ENVIRONMENTAL ATTITUDES
One way to encourage pro-environmental attitudes is through messages conveying the importance of protecting and preserving nature. Moral Foundations Theory (MFT) details five domains for morality and suggests that liberals and conservatives have different fundamental moral beliefs (Graham et al., 2013). For example, liberals value limiting harm and conservatives value purity. This theory has been extended to apply these moral domains to political beliefs. Feinberg and Willer (2013) found that reframing environmental messages in terms of limiting harm or preserving purity could increase environmental attitudes. Specifically, they found that both messages were effective for liberals, but the purity message was more effective for conservatives than the harm message. We replicated their study by having participants read either a harm or purity message and measured their environmental attitudes. We found that liberals had more positive environmental attitudes and intentions than conservatives, but neither message significantly influenced conservatives' attitudes. It is possible that we did not find the same results as Feinberg and Willer (2013) because of increasing polarization of general political beliefs or higher awareness of environmental issues.

Mackenzie Law, Psychology Undergraduate Student
Faculty Mentor: Shawn Bergman, Psychology
Co-Author(s): Madison Sexton
Title: UNCOVERING THE RELATIONSHIP BETWEEN SUSTAINABLE HRM AND ONBOARDING
Sustainable human resource management is an emerging practice in the future of global business environments. Research into this topic has been accelerated as businesses are moving away from the standard business model, caused by factors such as the triple bottom line. Onboarding is one of the first touch points where employees are introduced to an organization's values and culture. The importance of aligning values between sustainable companies and prospective candidates may contribute to a more sustainable

and successful business model. Our current research goal is to investigate the effect of individual differences and specific types of onboarding on organizational outcomes like behavior intentions and perceived importance. Based on Social Identity Theory, employees with sustainable values and cultures are more likely to retain and act in line with what they were on-boarded on. Signaling Theory may further develop the link between employees and organizations by understanding how individuals understand information given to them by organizations and conversely what organizations want individuals to perceive from the information they provide. Using these theories, we expect to find relationships between ideal candidates and onboarding types along with positive organizational outcomes.

Camille Powers, Psychology Undergraduate Student
Faculty Mentor: Reagan Breitenstein, Psychology
Co-Author(s): Mary Ballard, PhD
Title: ADVERSE CHILDHOOD EXPERIENCES, ATTACHMENT STYLE, AND EMOTION REGULATION

Adverse Childhood Experiences (ACEs) have been linked to many health, psychological, and social issues, as well as later attachment patterns and emotion regulation (Bowlby et al., 1956; Ainsworth & Bell, 1970; CDC, 2020; Erozkan, 2016). Yet, studies mostly examine individuals experiencing maltreatment, omitting traumatic experiences of household dysfunction. We tested how ACEs were associated with attachment in childhood and adulthood and emotion regulation. Participants were college students recruited via convenience sample (N = 421; Mage = 19.6 yrs; 77.2% female identifying; 85.5% Caucasian). They completed a 30-minute questionnaire via the SONA database. Measures were the Adverse Childhood Experiences (ACEs) Questionnaire, the Adult Scale of Parental Attachment-Short Form (ASPA-SF), the Experiences in Close Relationships (ECR) Questionnaire and the Difficulties in Emotion Regulation (DER) Questionnaire. We found that ACEs were significantly positively related with emotion regulation problems, significantly positively linked with insecure attachment patterns in childhood and adulthood, and significantly negatively correlated to secure patterns in childhood. Difficulties in emotion regulation were linked with attachment in childhood and adulthood in the same directions. This indicates that our early experiences, especially traumatic ones, are related to different aspects of our lives, including our ability to regulate emotions and how we interact in relationships.

Shraddha Selani, Psychology Graduate Student
Faculty Mentor: Denise Martz, Psychology
Co-Author(s): Lisa A. Curtin, Doris G. Bazzini, Sushmita Chatterjee
Title: SKIN COLOR DISSATISFACTION SCORES PREDICT SKIN BLEACHING BEHAVIORS IN U.S. WOMEN OF COLOR

Women of color in the U.S are impacted by both racism and colorism – forces that sometimes translate into dissatisfaction with their skin tone and the dangerous practice of skin bleaching. A novel measure of skin color dissatisfaction called the Skin Color Discrepancy (SCD) scale – a metric meant to be sensitive and inclusive of darker skin tones was developed in this study. To test the construct validity of the SCD scale, it was compared to two other existing, but flawed, skin color dissatisfaction measures- Skin Color Satisfaction Scale (SCSS) and Skin Color Questionnaire (STQ). Each of these scales were then compared to perceived racism, perceived colorism, and history and severity of skin bleaching behaviors. U.S. Women of color (N = 346; 43.6% Asian, 16.8% Black, 14.5% Latin/Hispanic, 13.3% African American, 9.5% Biracial, 1.2% Native American, 0.6% Caribbean, 0.6% Other) were recruited from Prolific. To test for construct validity for only the women who reported skin bleaching, 3 regressions with 3 predictors (SCD, STQ, SCSS) and 1 outcome each (racism, colorism, & bleaching frequency) were run. Results of the regression analyses revealed several significant relationships. SCSS (β = 2.41; p = 0.02) and SCD (β = -1.98; p = 0.05) predicted racism scores. SCSS (β = 4.39; p < .001) and STQ (β = - 3.08; p = 0.002) predicted colorism scores. SCD (β = -3.07; p = 0.002) and SCSS (β = 2.09; p = 0.04) predicted frequency of bleaching behaviors. These results suggest that the novel SCD scale has good predictive validity for bleaching behaviors. As the women who have used bleaching products - compared to those who had not – also reported more skin tone dissatisfaction (SCD, SCSS, STQ: p < .001) and colorism scores and more perceived colorism (p < .001), the body image construct of SCD might be beneficial in screening women of color and informing interventions to reduce the harmful practice of skin bleaching in the future.

Aidan Todd, Psychology Undergraduate Student
Faculty Mentor: Shawn Bergman, Psychology
Co-Author(s): Paige Farmer, Alexa Sterling, Jenna Hochstetler, Shawn Bergman
Title: LINKING PSYCHOLOGICAL CURRICULUM WITH CAREER KSAOS

Undergraduate psychology graduates obtain knowledge, skills, abilities, and other characteristics (KSAOs) that are sought after by employers. However, they remain chronically underemployed. One possible reason for this may be that those who graduated with an undergraduate degree may not recognize which KSAOs they obtained and developed over the course of their undergraduate career. For these reasons, this study aims to determine the KSAOs students acquire from specific psychology courses and upon degree completion. Ratings were collected from psychology faculty at Appalachian State University who teach undergraduate psychology courses in order to

evaluate the extent to which students develop 41 specific KSAOs in each course. In order to maintain the validity of the study, any ratings between the faculty members who rated the same course that differed by more than one point were reconciled. The ratings were then classified as either “core” or “supplemental” based on O*NET cutoff values. Preliminary results indicate individuals with a psychology bachelor’s degree indeed obtain sought-after KSAOs. These results will culminate into a crosswalk that undergraduates can utilize in order to determine the KSAOs that they have developed in specific courses and upon degree completion. This study will provide undergraduate psychology students a roadmap that will address their chronic underemployment through the identification of KSAOs.

Public Health

Abby Cope, Public Health Undergraduate Student
Faculty Mentor: Jennifer Schroeder Tyson, Health and Exercise Science
Co-Author(s): Amber Welborn, Sarah Martin, Hailey Phillips
Title: UTILIZING MICROLEARNING FOR MATERNAL, CHILD AND FAMILY HEALTH KNOWLEDGE ACQUISITION: MCFH|APPALACHIAN

MCFH|Appalachian is based on the MCH 20|20 curricula that have proven effective with public health professionals. With a focus on Maternal, Child, and Family Health (MCFH) professional development, this microlearning project utilizes the MCH Navigator's MCH 20|20 resources and localizes them to the rural Appalachian context. Microlearning is a way of delivering information and providing resources in small segments that build upon each other. It aims to be idea generating, collaborative, adaptable and low commitment. MCFH|Appalachian is available to practitioners and students who are interested in exploring the content in an easy, accessible, and equitable manner. This is achieved through a short weekly microlearning opportunity where one question is posed per week for 13 weeks for the practitioners and students to reflect on and then answer. We ask a series of 11 questions with a pre and a post check-in, to jump-start learning and sharpening of skills.Throughout the program, professionals in the field and students share their learning goals, areas where they need to grow, and learning aspirations with us. We assemble resources around each of the questions and their responses, addressing the expressed needs for professional development in MCFH. Through a collaborative partnership between faculty and students, 69 students and learners were enrolled and 58 completed all questions. We are currently reviewing the responses and modifying it to launch again in Fall 2022.

Sophia Filiault, Public Health Undergraduate Student
Faculty Mentor: Jennifer Tyson, Health and Exercise Science
Co-Author(s): N/A
Title: FROM A STUDENT'S PERSPECTIVE: PERSONAL AND COMMUNITY DISASTER PREPAREDNESS, RESPONSE, MITIGATION, AND RECOVERY.
Disasters are not exclusive to any specific population or part of the world and they give very little warning. This poster will outline and promote disaster preparedness, response, mitigation, and recovery as it relates to public health emergencies.
Eight students have committed to a year long Public Health Preparedness Fellowship led by Jennifer Schroeder Tyson. We have explored preparation strategies for a number of unexpected emergencies but our main focus this semester has been on disaster response training in collaboration with the UNC Gillings School of Public Health's "Gillings on the Ground" program. Through this training, led by a number of distinguished guest speakers, we have become proficient in disaster management from a Public Health perspective, Psychological First Aid with leaders from the American Red Cross, infant feeding in emergency shelters, and a multitude of other necessary skills. At the conclusion of this program, we will attend a disaster shelter simulation field experience with students from UNC Chapel Hill and UNC Wilmington.
This poster aims to encapsulate our research and experience. As the title indicates, we will discuss preparedness as it relates to communities and personal households, response as it pertains to being helpful in a disaster, mitigation of damages and injuries, and recovery of victims and communities. Through this and other credible research, we strive to educate the community on the importance of disaster preparedness and service to others during unfortunate times.

Morgan Keitt, Public Health Undergraduate Student
Faculty Mentor: Christopher Seitz, Health and Exercise Science
Co-Author(s): Lydia Waddel , Holden Cobb
Title: COUNTRY ADHERENCE TO WHO FCTC GUIDELINES FROM 2007 TO 2018 REGARDING GRAPHIC WARNINGS AT THE TOP OF CIGARETTE PACKS
Introduction: The purpose of this study was to assess country adherence to the World Health Organization's (WHO) Framework Convention on Tobacco Control (FCTC) treaty regarding the placement of graphic cigarette pack warnings at the top (versus bottom) of cigarette packs. Methods: Country-level data from nations that have signed the FCTC treaty was collected from the WHO's Global Health Observatory database. Only countries that had graphic warnings were included in the study. Data was analyzed based from placement of the graphic warnings at the top or bottom of cigarette packages. Countries were further classified by income level according to the World Bank and the date that the FCTC treaty was signed. Results: From 2007 to 2018, the number of countries that placed graphic warnings at the top of cigarette packages compared to the bottom increased (8 to 66 countries, 8 to 43 countries, respectively). Most (95%)

countries with warnings placed at the top of cigarette packs were high-income and middle-income countries. Nearly every (97%) of countries with warnings placed at the bottom of cigarette packs signed the FCTC treaty in 2009 or earlier.
Conclusions: Even though there was an increase in the number of countries that have placed warnings at the top of cigarette packs, there are still several counties without graphic warnings or with warnings placed at the bottom of packs. These findings indicate that several countries are in violation of the FCTC treaty.

Studio Art

Brooke Drury, Studio Art Undergraduate Student
Faculty Mentor: Frankie Flood, Art
Co-Author(s): N/A
Title: THE TRUTH ABOUT SPRING

I am creating a series based on the theme of accepting emotional pain as a natural part of healing throughout life. I conceptualized this theme through my own relationship with nature, and how I have accepted my own growth and vulnerability with honesty. The paintings will be based upon the emotions I feel within the four seasons. I am interested in the many connections between personal change, cyclical changes of seasons, and the regenerative forces of the natural world. Nature does not treat change as negative, but allows it as an essential part of its own cycle.
Although oil is an expensive means of painting, I believe that it is necessary for this project because it allows for more of a flow than other types of paint. Oil takes an extended amount of time to dry, which allows the artist to work on it over a period of time instead of rushing. It also allows for a smooth gradation of color as well and a richness that replicates life. Through this project I am seeking to explore the relationship between fabrication and painting. I will create 5 paintings that explore my theme. These will be done on wood canvases. They way in which each canvas is cut will be strategically done in order to create a narrative between each painting. The negative space between canvases will interact with each other, the pieces will reach into each other and be layered on top of one another. This will provide emphasis on the periods of growth that are breakthroughs throughout the process. The canvases will be mounted on the wall to create a staggered effect where additional emphasis on specific pieces will be provided. I plan on framing 3 of the paintings to create a moment of solitude, specifically in the paintings speaking on springtime. My goal in this work is to extend what it can mean to be a painter, and show the way in which concentrating on different mediums within the department can reinforce the main medium that you work within.

Sustainable Development

Becca Glebus, Sustainable Development Undergraduate Student
Faculty Mentor: Brian Zimmer, Geological and Environmental Sciences
Co-Author(s): N/A
Title: CHANGE DETECTION AT THE WARD DAM REMOVAL SITE

River flow pathways and sediment distributions are altered whenever an existing dam is removed. Our research seeks to analyze such changes at the Ward Dam site on the Watauga River. The dam was removed on May 16th, 2021 to allow for free flowing water throughout this part of the river. We used a drone to shoot aerial footage of the river valley at various times during 2021 to compare morphological changes through time. After the footage was captured, we performed a photogrammetric reconstruction to transform our two-dimensional photos into three-dimensional models. We compared the 3D models to identify change over time. Change was apparent on three levels; change visible in orthophotographs, gradational change across the entire modeled area, and statistically significant change (beyond analytical errors and surface noise) in isolated areas. Though daily changes are not significant, change over longer durations showed greater statistical significance.

Sustainable Technology

Jacob Ekstrand, Sustainable Technology Graduate Student
Faculty Mentor: Jeremy Ferrell, Sustainable Technology and the Built Environment
Co-Author(s): N/A
Title: DEMAND RESPONSE STRATEGY FOR INDOOR VERTICAL FARMING

Available farming land is diminishing due to land competition and population expansion and soil quality is depleting due to effects from climate change. To answer the demand for food given these conditions, controlled environment agriculture grows food indoors. However, the major drawback of this type of agriculture is the high cost for artificial lighting. Thus, this research investigates the effect of using an intermittent lighting schedule on the growth of African Blue Basil in an indoor vertical farming setting. Using an intermittent lighting schedule provides flexibility for when to run the lights for the plants and can allow indoor vertical farms to avoid peak demand or absorb additional solar energy. By comparing the growth under the intermittent lighting schedule compared with the traditional continuous schedule, the potential for this flexibility in lighting can be determined.

Alex Gray, Sustainable Technology Graduate Student
Faculty Mentor: Jeremy Ferrell, Sustainable Technology and the Built Environment
Co-Author(s): N/A
Title: CHARACTERIZING EFFECTS OF CHARGED BIOCHAR ON SOIL QUALITY AND PLANT GROWTH IN DEGRADED NORTH CAROLINA HIGH COUNTRY SOILS
Significant land degradation and topsoil loss has threatened agricultural production, ecosystem function, and soil-based carbon sinks. Climate change threatens all ecosystems and communities on Earth. Reducing carbon emissions is not enough – carbon must be drawn down from the atmosphere and sequestered. Biochar addresses each of these issues, providing a foundation for healthy, long-term soil regeneration and sustainably sequestering carbon within the soil for millennia. While interest in biochar is rapidly increasing, the actual product itself as well as its effect on various soil types can vary, necessitating local studies on specific feedstocks, pyrolization methods, and soils. This study investigates biochar made in a TLUD from hardwood chips, which, alongside four organic amendments (compost, vermicompost, aerated compost tea, and anaerobic digester effluent), was applied to a degraded sandy soil in Zionville, North Carolina. A single growth of spinach was used to compare yields from the various applications. The application of biochar alone increased the yield of spinach. The organic amendments further increased yields, but with different effects due to the biochar. Compost and vermicompost saw reduced yields due to the addition of biochar, while aerated compost tea and anaerobic digester effluent saw increased yields due to biochar.

Patrick Kelly, Sustainable Technology Graduate Student
Faculty Mentor: Brian Raichle, Sustainable Technology and the Built Environment
Co-Author(s): N/A
Title: A COMPARATIVE ANALYSIS OF PERFORMANCE BETWEEN PV, ST, AND PVT SYSTEMS AND THEIR ABILITY TO PASTEURIZE WATER
Clean drinking water is a finite resource that may prove to be the most valuable resource worldwide in the years to come. This makes uncontaminated water one of the most vital resources on the planet. Even though humans are aware of this necessity, still one in four people out of the global population do not have access to safe drinking water, and unsafe water is responsible for 1.2 million deaths each year.
In this research, I compare the performance of PV, ST, and PVT configurations based on the amount of water they are able to pasteurize. I use TRNSYS modeling software to compare these configurations' performance based on the amount of water pasteurized in gallons, over the course of a year. All of the energy gain produced by each system will be transferred into heat energy to pasteurize the water within them. This data will be based on a TMY3 file used as the solar resource. The results for the models so far have pointed towards the solar thermal collector model to be the highest producing system. The PV is not far behind but does lack in production. I am working on the PVT model now and am

trying to get the electrical production to be incorporated into the thermal heat gain. Once this is accomplished, I hypothesize that the PVT system will outperform both of the other systems in their ability to pasteurize water.

Ron Kitchings, Sustainable Technology Undergraduate Student
Faculty Mentor: Jeremy Ferrell, Sustainable Technology and the Built Environment
Co-Author(s): N/A
Title: AN ENERGY PERFORMANCE ANALYSIS OF A SMALL-SCALE ANAEROBIC DIGESTER IN THE LATE FALL
Anaerobic digestion (AD) has been shown to be a practical way to generate biogas for cooking and heating for communities in warm climates. However, “four season” climates, such as in Boone, North Carolina, are unable to support the AD process late into agricultural seasons due to average temperatures being well below 20°C, which is insufficient for most AD applications. This study examines the late-season energy performance and feasibility of the small-scale (1200L) AD system at Appalachian State’s NEXUS greenhouse during November, where the average temperature within the greenhouse was 9.0°C. The daily biogas production and its methane content were used to determine the energy value of the biogas produced. An electric heating pad was used to quantify the energy needed to maintain a psychrophilic slurry temperature of 21.1°C (70°F) within the digester. During the 18-day trial (217 HDD), a total of 177.5kWh of energy were used by a heating pad to keep the digester operational at 21.1°C (70°F), and only 12.8kWh of energy were produced in the form of biogas. Overall, the Energy Return on Invested (EROI) for this experiment was 0.073:1, or 7.3%. As such, it was determined that it does not make practical sense from an energy standpoint to keep this digester operational late into the growing season, but that other considerations such as the value of the liquid effluent and on-site waste management may still make late-season AD suitable for some communities in these climates."

Technology

Summer Gee, Technology Graduate Student
Faculty Mentor: Jeremy Ferrell, Sustainable Technology and the Built Environment
Co-Author(s): N/A
Title: CHARACTERIZING THE EFFECTS OF VENTILATION FANS, DOUBLE GLAZING, AN INSULATED GROUND SKIRT AND AN AUTOMATED SIDEWALL ROLL UP SYSTEM ON HIGH TUNNEL GREENHOUSE MICROCLIMATE IN THE HIGH COUNTRY
In cold weather climates, agricultural producers must rely on greenhouses to extend growing seasons and maintain profits through the winter. Regions that experience temperate climates, such as the High Country region of North Carolina, rely on greenhouses through the winter, fall and spring seasons to provide a regulated

environment when temperatures are in high fluctuation outdoors, and to minimize crop loss and freezing. In the summer season, these greenhouses are also used for crop production and must be retrofitted for the warmer weather. This study investigates the effectiveness of multiple greenhouse technologies in achieving and maintaining an optimal microclimate inside of high tunnel greenhouses located in temperate regions. The effects of the individual technologies on greenhouse microclimate will be quantified through comparison of temperature and humidity levels in the greenhouse from before and after the system's installations. The systems will be designed with a focus on low budget, low-tech construction to find solutions for small scale farmers. Multiple systems will be analyzed, including two ventilation fans with intake shutters, an automated sidewall roll up system, a double layer air inflation system, and an insulated ground skirt system. The study is taking place at the Nexus facility owned by Appalachian State. Results are expected to reflect that these technologies contribute to maintaining desirable temperature and humidity levels in the greenhouse.

25th Annual Celebration of Student Research and Creative Endeavors
By the Numbers

Undergraduate and Graduate Student Presentations	
Undergraduate	82
Graduate	63

College of Faculty Mentor	**Students**
Arts and Sciences	90
Fine and Applied Arts	7
Health Sciences	47
Music	1

Major	UG and GR Students
Athletic Training	1
Biology	41
Business Administration	1
Chemistry	21
Communication Sciences and Disorders	1
Computer Science	1
Engineering Physics	1
English	1
Environmental Science	4
Exercise Science	20
Geography	4
Geology	9
Interior Design	2
Mathematics	1
Music Therapy	2
Nutrition	16
Nutrition and Foods	1
Physics	1
Psychology	7
Public Health	3
Studio Art	1
Sustainable Development	1
Sustainable Technology	4
Technology	1