# Office of Student Research

APPALACHIAN STATE UNIVERSITY

# 24th Annual Celebration of Student Research and Creative Endeavors

Full Program

April 15, 2021

# Office of Student Research

## APPALACHIAN STATE UNIVERSITY

Welcome to the 2021 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 pleased to utilize this virtual environment format to host our annual event. This year was certainly challenging as we navigated through the pandemic (COVID-19). However, we do hope this celebration is just another example of Appalachian's resiliency. Both faculty and students continued to move forward in these challenging times and have come together at this event to share their accomplishments. With 126 presentations we hope you engage with each presenter and learn more about the many amazing things that students have accomplished in the past academic year.

I do want to recognize the continued dedication of the faculty on campus. Without the support and mentorship of so many faculty in so many disciplines across campus we would not be able to showcase the work of the students. 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 change the world!

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

Provost for Undergraduate Education, and to the staff in the Office of Student Research which include Kathy Weaver Stevens our Graduate Assistant Michael Grant.

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

# Undergraduate Research Mentorship Excellence Award for Faculty

This award recognizes faculty members who have demonstrated an outstanding commitment to mentoring undergraduate researchers as well as supporting and promoting the undergraduate research initiatives on campus.

**Faculty nominated are recognized for the following:**
- Proven consistent track record of high quality mentoring provided to undergraduate students over the course of several years
- Demonstrated commitment to undergraduate research in encouraging and supporting research of their students at regional and national meetings as well as the Annual Celebration of Student Research and Creative Endeavors on campus
- Active in publishing in peer reviewed journals with undergraduates as the co-authors
- Applied for and/or earned grants to support research/creative endeavors being done with undergraduate students
- Viewed as a role model in their respective field of study

**Previous Awardees**
2017  Andy Heckert, Geological and Environmental Sciences
2018  Ellen Cowan, Geological and Environmental Sciences
2019  Maggie Sugg, Geography and Planning

**2020**
Howard Neufeld, Biology
Megen Culpepper, Chemistry and Fermentation Sciences

**Story from the Appalachian Today**
https://today.appstate.edu/2020/07/24/mentorship-excellence

**Neufeld advises patience and encouragement**
About the rewards of mentoring, Neufeld said, "To watch an undergraduate go from being naive about science and inexperienced in working with sophisticated scientific instruments,

to being technically competent, aware of the literature and savvy about how to do science, is one of the greatest thrills of being their mentor."

He recounted one experience with honors student and Chancellor's Scholar Rachel Jordan '18, who is now earning her Ph.D. at the University of Wisconsin–Madison.

"Rachel came to me looking for some guidance after a rough freshmen year, and I recognized right away just how bright and enthusiastic she was," he said. "After getting her feet wet working on a variety of projects in the lab, we settled on investigating whether red spruce and Fraser fir trees could take advantage of warm periods in the dead of winter to do photosynthesis, and to gain some carbon at a time of the year when most people think these trees are dormant."

This climate-related research, conducted by Jordan with Neufeld in wet and cold weather on Grandfather Mountain, helped inform the Christmas tree industry in North Carolina and was presented at several professional conferences. Jordan was awarded a National Science Foundation (NSF) Graduate Research Fellowship, which provides five years of full financial support toward her doctorate.

Neufeld said patience and encouragement were key to an effective mentorship. He advises other faculty to "be patient at first as students make mistakes, but encourage them and show them that they are not alone when they do make mistakes."

In his nomination form recommending Neufeld for the award, one of Neufeld's undergraduate student mentees said Neufeld encourages hands-on research — making it exciting and fun — and, while encouraging students to challenge themselves, also respects the limitations and obstacles a student might encounter.

**Culpepper applauds 'perseverance and internal push'**
"Mentoring students is hands-down the best part of my job," Culpepper said. "Students at this level of training are eager to learn and do an amazing job becoming scientists."



She said the reward comes in seeing her students recognized for their hard work, and she recounted the following story about a student working with her on a National Institutes of Health (NIH) grant:

"He was so bright and a first-generation college student like me. Graduate school hadn't worked out for him," she

said. Culpepper was helping the student explore job opportunities, one of which was a position testing cockroaches for specific diseases.

"I remember looking at him over my desk and seeing the despair on his face that this was going to be his job after four years of very hard work," she said. Culpepper encouraged him to push through and, "one week later he was awarded an NIH postbaccalaureate fellowship. He recently began graduate school at Yale in biochemistry. What a story of perseverance and internal push!" she said.

Culpepper advises young faculty choosing to mentor to "make yourselves vulnerable to your mentees. I have told countless stories of my own failures and successes. They see me struggle to keep it all together; they see my highs and lows, just like I see theirs. We are a team," she said.

Scott Hammers '20, a mentee of Culpepper's and a graduate of Appalachian's B.S. in chemistry–biochemistry program from Raleigh, said, "Culpepper strives to make sure everything is learned correctly and then pushes you to always do better. She helped give me insight and advice about graduate schools and the application process. She taught me laboratory techniques and the science behind them, which has in turn made my classes that much easier."

**A sincere THANK YOU to all Faculty Mentors for the work they do with Appalachian students!**

# 2021 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/. Additionally, please check out the portfolio's of the following winners (links provided below).

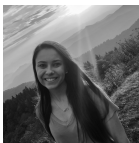**2021 Aportfolio Scholar winner**
**Devin Millins**
**Political Science**
https://appstate.digication.com/devin-mullins-copy/about-me

**2021 Aportfolio Runner Up**
**Stori Stefanac**
https://appstate.digication.com/stori-stefanac-copy/about-me

**2021 Aportfolio Honorable Mention**
**Kinsey Milsap**
https://appstate.digication.com/kinsey-milsap-aportfolio-copy/about-me

**2021 Aportfolio Honorable Mention**
**Alisa Duong**
https://appstate.digication.com/alisa-duong-copy/about-me

# College of Arts and Sciences

## Biology

Ishani Chattopadhayay, Biology, Undergraduate Student
Faculty Mentor:  Andrew Bellemer, Biology
Co-Author(s):  N/A
Title:  THE ROLE OF TNF ALPHA IN NOCICEPTIVE HYPERSENSITIZATION
Chronic pain is a prevalent global health concern that currently does not have a permanent cure. Therefore, it is important for the scientific community to contribute their knowledge on molecular pathways and signaling molecules involved in pain nociception. This can be useful in order to enhance our understanding of why chronic pain occurs and how we can improve the existing treatments. This research project aims to contribute by determining the role in nociception of the ligand - Eiger, a homolog of the tumor necrosis factor (TNF) alpha in Drosophila melanogaster, commonly known as the fruit fly.  This model organism allows us to make genetic manipulations that can modify components involved in nociception. The goal of this experiment was to confirm the role of Eiger - a signaling ligand that is expected to cause an increased sensitivity in nociceptors present in Drosophila to noxious stimuli. This was done in order to determine how Eiger contributes to pain nociception by regulating TNF alpha signaling. The results of the experiment did not support the predicted hypothesis and showed that overexpression of Eiger did not increase sensitivity in the nociceptors. This leads us to further investigate the signaling molecules that may be present downstream of the TNF-alpha signaling pathway in nociception hypersensitization.

Wheeler Davis, Biology, Undergraduate Student
Faculty Mentor:  Andrew Bellemer, Biology
Co-Author(s):  Amber Dyson
Title:  INVESTIGATION OF THE ROLE OF EIF2ALPHA IN NOCICEPTION IN DROSOPHILA MELANOGASTER
Chronic pain is one of the world's most prevalent health issues. It is the most common reason for missing work worldwide and is estimated to cost the U.S. around $8 billion annually. Drosophila Melanogaster is a model species for studying pain response; the molecular pathways that regulate nociception in flies and humans are similar. Eukaryotic Initiation Factor 2 alpha (eIF2α) is hypothesized to be a regulator of protein synthesis in sensory neurons. Decreasing phosphorylation of the eIF2α subunit in mice led to latency in response to noxious stimuli. In a previous experiment in Dr. Bellemer's lab, knockdown of eIF2α expression in Drosophila caused an increase in nocifensive response latency. The protocol was repeated and preliminary data corroborates these results, but more trials need to be conducted before validation is confirmed. If knockdown of eIF2α causes a increase in latency, it demonstrates that it is a significant factor in larval nociception, and deserves further study.

Gabrianne Ivey, Biology, Undergraduate Student
Faculty Mentor:  Darren Seals, Biology
Co-Author(s):  Austin Simmons, Maryam Ahmed
Title:  OPTIMIZATION OF DYE-LABELING TO DETERMINE THE IMPACT OF ONCLYTIC VSV ON T47D AND MDA-MB-231 BEAST CANCER CELLS
Tumor-associated macrophages (TAMs) of the M2 subtype support cancer cell proliferation, angiogenesis, and metastasis. We have recently shown that oncolytic vesicular stomatitis virus (VSV) induces the expression of anti-tumor M1 macrophage markers in M2 THP-1 macrophages. We hypothesize a similar repolarization

among macrophages within a simulated tumor microenvironment involving co-cultured macrophages and breast cancer cell lines. To distinguish breast cancer cells from macrophages in the co-culture system, CellTrackerTM Violet at concentrations of 5, 10, and 15 µM was used to label T47D and MDA-MB-231 breast cancer cells. In both breast cancer cell lines, the 10 µM dye solution resulted in the least changes in morphology and the clearest labeling with 100% of the T47D cells labeled at 14 hours, and a maximum of 64% of the MDA-MB-231 cells labeled at 0.75 hours. In addition, 81% of MDA-MB-231 cell remained viable by 48 hours. Increasing the concentration of dye to 15 µM enhanced cell killing. These data indicate the 10 µM concentration of CellTrackerTM Violet provides optimal labeling of T47D or MDA-MB-231 cells in the absence of cell toxicity. Current studies are focused on determining the infection profile of VSV strains expressing green fluorescent protein (GFP) in breast cancer cells and will be used in combination with CellTrackerTM Violet labeling in future studies to investigate the mechanism by which VSV modulates cells in a simulated tumor microenvironment.

Katie Krogmeier, Biology, Graduate Student
Faculty Mentor:  Howard Neufeld, Biology
Co-Author(s):  Erica Pauer
Title:  IMPACTS OF POLYPLOIDY ON THE ECOPHYSIOLOGY OF SOLIDAGO ALTISSIMA
The evolutionary importance of polyploidy in plants is still a subject of much research. Polyploidy could be an evolutionary dead end, or it could lead to reproductive isolation and creation of new species. Goldenrod (Solidago altissima) is a North American herbaceous perennial with diploid, tetraploid, and hexaploid populations: diploids (MWD) and tetraploids are restricted to the midwest while hexaploids occur in both the midwest (MWH) and east (EH). Polyploids generally have larger cells, which can affect stomatal densities, sizes, plant morphology, gas exchange, and plant hydraulics. In a common garden at Appalachian State University, EH had larger and more horizontally oriented leaves than MWD and MWH, but MWH were taller. EH plants had the lowest total chlorophyll amounts. MWD leafed out and flowered earliest, followed by MWH, while EH was the latest. A drought experiment was performed on greenhouse grown plants using a split-plot design. Gas exchange measurements were made using a Li-6800 and water potentials with a Scholander Pressure Chamber. Prior to imposition of drought, photosynthetic rates (A) were higher in MWH and MWD, and lowest in EH. As the experiment persisted through June and July, A and stomatal conductance (gs) declined in both treatments, but droughted plant rates dropped steeply 7 days after cessation of watering and were significantly lower than those for watered plants. By the end of the experiment, cytotype differences for A and water potential were absent in both treatments. However, gs remained higher in MWH for watered plants, which also had the lowest water use efficiency among all cytotypes. Light response curves were conducted on well-watered plants and aside from higher light saturated A for MWH plants, no other light response parameters differed among cytotypes. Why diploids do not occur in the east and why MWH and EH differ are currently being investigated.

Dakota Lewis, Biology, Graduate Student
Faculty Mentor:  Andrew  Bellemer, Biology
Co-Author(s):  N/A
Title:  THE ROLE OF RNA-BINDING PROTEINS IN THE NOCICEPTIVE PROCESS
Nociception is the sensory detection of potentially tissue damaging stimuli and is necessary for animals to survive and navigate their environment. The neuronal circuity that regulates perception of potentially damaging stimuli is highly conserved across animals, including humans and Drosophila melanogaster but is not fully understood. Further understanding of how these nociceptive processes are regulated could be important for discovering new ways of treating sensory conditions in humans, like chronic pain. One potential regulator of nociception is the gene Sans-fille (SNF). Previous research has demonstrated that Drosophila  lacking SNF function exhibit decreased nociception. SNF expression is known to produce RNA binding proteins that localize

to specific spliceosome subunits, however the role it plays in nociception is unknown. In this experiment, RNA interference will be used to produce Drosophila with genetically knocked down versions of SNF. These offspring will undergo thermal analysis to confirm decreased nociceptive response. To study the morphological impact of SNF knockdown, the dendrites will be fluorescently imaged using Green Fluorescent Protein. To study possible downstream effectors, I will fluorescently tag transcripts that are known to both, play a role in nociception and bind SNF, and see if knockdown affects their activation. These experiments will elucidate SNF's role in nociception and contribute to further understanding of the nociceptive process.

Katherine Machen, Biology, Graduate Student
Faculty Mentor: Andrew Bellemer, Biology
Co-Author(s): N/A
Title: NOCICEPTOR SENSITIVITY AND PLASTICITY IN DROSOPHILA LARVAE IS REGULATED BY TRANSLATION INITIATION FACTORS
Although chronic pain is a billion-dollar issue, current treatments are not always effective. For more effective treatments to be made, the molecular mechanisms behind chronic pain must be uncovered. My research explores changes in the sensitivity of sensory neurons that results from changes in gene expression. One way to regulating gene expression is via phosphorylation of the mRNA cap-binding protein, eIF4E, which controls translation initiation. I am exploring eIF4E as a possible translational control for sensory neuron sensitization following tissue damage. Using Drosophila melanogaster and its genetic tools, gene function can be changed within sensory neurons, causing observable behavioral changes. Changes can be quantified via thermal nociception experiments, where a larva is touched with a heated probe as response latency is recorded. I have used this approach to test the sensitization role of patched, known to be involved with sensitization via the hedgehog signaling pathway. I showed that the overexpression of a dominant-negative patched resulted in a hypersensitive phenotype. Separately, I targeted eIF4E for knockdown resulting in a partial loss of nociception and sensitization, suggesting that eIF4E is involved with thermal nociception and sensitization. Currently, I am testing whether eIF4E is downstream of patched via genetic interaction experiments.

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

Noah Murr, Biology, Graduate Student
Faculty Mentor:  Michael Opata, Biology
Co-Author(s):  Tyler Olender, Amari Smith
Title:  MODERATE MALNUTRITION EXACERBATES PLASMODIUM CHABAUDI INDUCED GUT DEFORMITIES AND ALTERATIONS IN MUCOSAL INNATE IMMUNITY

Gastrointestinal problems are among the most reported symptoms in serious cases of malaria infection. Gastric mucosal changes have been reported but the influence of moderate malnutrition, common in malaria endemic areas, has not been well explored during infection. Here, we used a rodent mouse model to investigate how moderate malnutrition affects gut integrity and mucosal innate immunity during malaria. Utilizing a well-established low protein diet that is deficient in zinc and iron to induce moderate malnutrition, we investigated mucosal tissue phenotype and integrity, and mucosal innate immunity in the gut. We observed that the infected moderately malnourished mice had lower parasite burden at the peak of infection, but high levels of FITC-Dextran concentration in the blood serum, indicating increased intestinal permeability. The small intestines were also shorter after infection with malaria. To this effect, H&E staining indicated that moderately malnourished infected mice had increased epithelial disorganization. There were also lower numbers of CD11b+ macrophages, CD11b+CD11c+ myeloid cells, and CD11c+ dendritic cells in the small and large intestines. Despite the lower number of innate immune cells, macrophages in the malnourished mice were highly activated as determined by MHCII expression and IFNγ secretion. Thus, our data suggests that malaria infection may exacerbate the deformities in the gut induced by moderate malnutrition.

Erik Rangel Silva, Biology, Graduate Student
Faculty Mentor:  Andrew Bellemer, Biology
Co-Author(s):  N/A
Title:  CRISPR/CAS9 GENE EDITING AS A NOVEL METHOD  FOR NOCICEPTION-RELATED GENE MANIPULATION IN DROSOPHILA MELANOGASTER

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. The underlying mechanisms of pain sensation remain elusive. Our lab studies nociception in Drosophila, an effective model due to its high genetic manipulability, relatively simple maintenance needs, and high percentage of genes that are human homologs. The specific 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: leaky and inconsistent phenotypic expression, and off-target effects. A novel method uses CRISPR/Cas9 to modulate expression and provides an extra 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 silencing known nociception-related genes with this method will create results similar or better than that of RNAi knockdown. This can be used as an additional tool to determine the role specific genes play in, and gain a deeper understanding of, normal nociceptor function.

Cameron Rentz, Biology, Undergraduate Student
Faculty Mentor:  Andrew Bellemer, Biology
Co-Author(s):  N/A
Title:  REGULATION OF SEIZURE SUSCEPTIBILITY AND NOCICEPTION SENSITIVITY IN DROSOPHILA

Epilepsy is an issue worldwide; in fact, it is one of the most common neurological conditions with the root of the cause being unidentified. Epilepsy is a disorder where one has spontaneous seizures, which is caused by the nervous system firing abnormally. This can be debilitating for a person trying to obtain a job and be a part of society. It is important that we learn more about the formation of seizures and how genetic manipulations can

cause one to recover from a seizure faster than others. This will allow progression in the overall understanding of seizure susceptibility and recovery, as well as possible insights to chronic pain. For this project, seizure susceptibility will be analyzed in wild-type and genetically susceptible flies. Measuring the seizure recovery time in flies can be used to help analyze the experimental manipulations made and how they affect seizure severity. Changes in the flies' diet will be made and the influences on seizure recovery time will be measured, with the hypothesis that a ketogenic diet may help to reduce the incidence of seizures. Flies with mutations in metabolism will also be analyzed to see if they also share a reduction in seizure recovery time when exposed to the ketogenic diet. Further research may involve testing sensory behavior sensitivity though mechanical stress assays. This will be to see if diet in both wildtype and genetically susceptible flies also influences sensory behavior.

Austin Simmons, Biology, Graduate Student
Faculty Mentor:  Maryam Ahmed, Biology
Co-Author(s):  Darren Seals
Title:  VESICULAR STOMATITIS VIRUS SUPPRESSES THE PHAGOCYTIC CAPACITY OF A TUMOR-PROMOTING MACROPHAGE POPULATION
Tumor-associated macrophages (TAMs) are a unique sub-population comprising up to 50% of a tumor's mass. TAMs can exist as tumor-promoting M2 macrophages or as tumor-fighting M1 macrophages. We believe that alteration of macrophage populations by vesicular stomatitis virus (VSV) has promise as a cancer therapeutic. Our preliminary data suggest that the recombinant wild type strain of VSV (rwt) kills up to 70% of M2 macrophages, while a mutant strain of VSV (rM51R-M) promotes the upregulation of M1 markers (STAT1 and TNFα) in this population. However, it is unclear whether these changes would still occur in the presence of breast cancer cells in a simulated breast tumor microenvironment. The goal of this study is to determine whether VSV modulates the phagocytic capabilities of different THP-1 macrophage subtypes when co-cultured with MDA231 breast cancer cells. To address this, THP-1 monocytes were terminally differentiated and subsequently polarized to generate either M1 or M2 macrophages. These populations were then infected with either rwt or rM51R-M virus (MOI 10 pfu/cell), and analyzed for their ability to take up fluorescently-labeled E. coli. Results indicate that infection of M1 macrophages with either rwt or rM51R-M virus did not lead to significant alterations in measurable phagocytosis. In contrast, the phagocytic capacity of M2 macrophages infected with rM51R-M virus decreased by 43% (over mock-infection) while those infected with rwt virus decreased by 91%.

Brooke Stevens, Biology, Undergraduate Student
Faculty Mentor:  Khadija Fouad, Biology
Co-Author(s):  Rafat Shahbain
Title:  COMPARATIVE ANALYSIS BETWEEN CULTURAL BACKGROUNDS AND EVOLUTIONARY BELIEFS
The scientific community has widely accepted evolution and its principles for decades. As evolution continues to rise in popularity, so do the controversies surrounding the ideology. The groups of people who disagree with evolutionary beliefs are broad and comprehensive, defying race, age, religion, and nationality. The purpose of this study is to compare and evaluate cultural backgrounds to people's perspectives on evolution. This research aims to have a greater understanding of the relationship between an individual's ideas about biological evolution, the nature of science, and their overall relationship between religion and evolution. It's essential to have a greater understanding of what the individual actually thinks about these issues and their acceptance of evolution.
Key findings from this study will be presented with the goal to better understand where the scientific divide lies and how to make evolution and its principles more inclusive.

Lee Sturgis, Biology, Graduate Student
Faculty Mentor:  Andrew Bellemer, Biology
Co-Author(s):  N/A
Title:  THE ROLE OF THE NOTCH SIGNALING PATHWAY IN DROSOPHILA NOCICEPTION
Chronic pain affects much of the adult U.S. population and is a major expense, between medical costs and missed productivity. The intricate cellular and molecular mechanisms causing chronic pain are not well understood, and existing treatments fail to address these underlying factors. In order to find new treatments targeting the root causes of pain, the molecular processes behind sensory neuron development and function must be investigated. We are currently investigating Notch, a gene involved in neuron differentiation. The Notch signaling pathway functions through lateral inhibition, where differentiation of a neuron inhibits differentiation of its neighbors. Our goal is to see how Notch signaling contributes to behavioral responses to noxious stimuli, and its role in the development of 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 mammals, including Notch. We are manipulating the genome in this experiment by knocking down Notch through the silencing of Notch mRNA. We are conducting thermal assays, where the animal is exposed to a potentially noxious stimulus and their behavioral response is analyzed. These experiments will elucidate the role of the Notch signaling pathway in pain sensation, and we hypothesize that Notch knockdown mutants will exhibit a defective response to the potentially noxious stimulus.

Emily Xiong, Biology, Graduate Student
Faculty Mentor:  Michael Opata, Biology
Co-Author(s):  N/A
Title:  MODERATE MALNUTRITION DECREASES MALARIA-SPECIFIC EFFECTOR CD4+ T CELLS
Malnutrition is known to predispose people to infections by affecting immune cell populations, but it is not known how moderate malnutrition affects the survival of effector CD4+ T cells that could be protective against chronic infections such as malaria. In our current study, we hypothesized that moderate malnutrition leads to a reduction of malaria-specific CD4+ T cells resulting in lower numbers of effector CD4+ T cells. Using flow cytometry, we determined effector and malaria-specific CD4+ T cells in the spleens of mice, after Plasmodium chabaudi infection. We observed that moderate malnutrition does not decrease the total number of lymphocytes and polyclonal CD4+ T cells, but the moderate malnourished mice had lower spleen weights compared to well-nourished mice. Using adoptive transfer technique, we found that moderate malnutrition decrease effector malaria-specific CD4+ T cells that express Thy1.2 molecule, along with reduced numbers of activated malaria specific effector CD4+ T cells and their cytokine production. These findings suggest that malnutrition does impair pathogen specific CD4+ T cell populations during chronic infection, which may have a significant effect on other immune cells.

# Computer Science

Jakobe Bussey, Computer Science, Undergraduate Student
Faculty Mentor:  Andrew Polonsky, Computer Science
Co-Author(s):  N/A
Title:  FROM POSETS TO BOOLEAN ALGEBRAS: A CASE STUDY  OF FORMALIZING MATHEMATICS IN DEPENDENT TYPE THEORY
The formalization of mathematics is a new field whose goal is to eventually represent the entire body of mathematical knowledge on the computer.  Over the years, a number of languages for computerized mathematics have been developed, achieving major milestones in formalizing proofs of important results in pure mathematics.  One recent addition is the Agda language based on Dependent Type Theory, which is

particularly well-suited for representing computational logics and proof systems.  Working in this system, we have developed a library of formalized results about Lattice Theory.  Our results include equational and inequational characterizations of the basic structures appearing in the theory, and relationships between them. We prove that they form a strict hierarchy, arranged from the general to the particular:

Partial orders > Semilattices > Lattices > Distributive Lattices > Heyting Algebras > Boolean Algebras

The latter two structures feature in the algebraic semantics of intuitionistic and classical propositional logic. Our results therefore provide a basis for further development of a computerized library of mathematical logic. This library will potentially make formalizing proofs much easier for mathematicians.

Abdel Issa, Computer Science, Undergraduate Student
Faculty Mentor:  Andrew Polonsky, Computer Science
Co-Author(s):  N/A
Title:  METATHEORY OF LAMBDA CALCULUS USING THE NESTED TYPE REPRESENTATION
A recent report by the Consortium for IT Software Quality has found that software bugs cost the U.S. economy $2.08 trillion in 2020 alone.  Functional programming languages provide a systematic way to prevent a large number of programming errors, by placing restrictions on when unsafe instructions can be executed.  These languages moreover admit mathematical models, which allow various safety properties to be rigorously proved. In particular, the Church-Rosser property ensures that the result of executing a program written in a functional language will be independent of the order in which various components are executed.
In this work, we present a complete formalization of the Church-Rosser theorem in the Agda proof assistant. This is proved for the full untyped lambda calculus -- the core of every functional programming language.  The novelty of our approach lies in the use of recently introduced Nested Types to represent variable binding, which avoids the issues of alpha conversion that have plagued earlier approaches.  Our proof is completely constructive, which allows the proof assistant to automatically compute an explicit confluence witness for any divergent pair of beta reductions.
This result leads us to believe that this representation could be used for formalizing more advanced metatheoretical results about the untyped lambda calculus that other approaches fail at achieving.

Wilson Styres, Computer Science, Undergraduate Student
Faculty Mentor:  Jay Fenwick, Computer Science
Co-Author(s):  N/A
Title:  MAPPALACHIAN: AN IOS APP THAT MAPS THE INTERIOR  SPACES OF APP STATE BUILDINGS
Apple Maps helps students and visitors to the Appalachian State campus find buildings, but cannot help them find specific rooms inside of buildings. Ask any freshman student how important that is as they frantically search Rankin Science or Anne Belk for their first class of the semester!
Mappalachian is an iOS application using Apple Maps technology to show the interior spaces of App State buildings. The Indoor Mapping Data Format (IMDF) uses a GeoJSON file to encode the footprint of each level, rooms, and doors of a building. Annotation icons highlight notable spaces such as elevators, stairs, and restrooms. Rooms are color-coded to indicate their primary use, such as offices, classrooms, and mechanical rooms. All of this data has been gathered using real-world floor plans and coordinate data in a program called JOSM so that they can be converted into a format readable by the application.
Mappalachian presents a standard Apple Maps interface to view campus showing a footprint outline of buildings, roads, green spaces, etc. However, as a user zooms in on a building, Mappalachian opens the building by replacing the opaque building outline with a detailed room map of the building top floor. A new level control simultaneously appears allowing the user to change to other floors. Any user can search for a room in a building. For students, the app retrieves their current schedule, allowing a search by schedule feature. Currently, Mappalachian shows all floors of Anne Belk Hall.

Yuanbo Zhou, Computer Science, Graduate Student
Faculty Mentor:  James Fenwick, Computer Science
Co-Author(s):  N/A
Title:  POCKET TURCHIN
Due to the pandemic in early 2020, People began to work online, and art museums were no exception. People began to visit exhibitions through the website on their phone and PC. Research shows that people are more inclined to use apps instead of browsing the website when using mobile phones. This project aims to develop a mobile application that helps people with a better user experience when they participate in the exhibition virtually.

To develop the mobile application for  the IOS development environment, a developer tool called Xcode is needed. In order to store the information of the exhibition, such as the picture and introduction of the artwork, we need to use a cloud database. In this project, we use Google's firebase database. The methodology we use is called Agile Software development.

The use of agile is manifested in continuous improvement, so that every cycle of software development has progressed in the weekly summary. The conclusion is that after multiple development cycles, the functionality and practicality of the software increase so that the final goal is to be able to publish to the public.

# Geography and Planning

Ben Capell, Geography, Graduate Student
Faculty Mentor:  Jeff Colby, Geography and Planning
Co-Author(s):  Dr. Derek Martin
Title:  GIS ANALYSIS FOR MICROHYDROELECTRIC POWER ESTIMATION
Hydroelectric technology utilizes the energy resource of falling water to produce power. Micro-hydroelectric technology produces power from small streams for local consumption by diverting a portion of streamflow to a generator turbine at a downhill site. The Appalachian region, including Watauga County, is characterized by areas of significant relief and streamflow making it suitable for the development of this technology. Increasing the number of micro-hydroelectric installations on streams throughout this region will enable more users to utilize the electrical production capacity of vertically stored water without requiring significant investments in large infrastructure, or significantly altering ecological functions. Determining the suitability of a stream for implementing a micro-hydroelectric system previously required fieldwork to provide an initial assessment of streamflow, head, penstock length, and wiring length. The efficiency and thoroughness of this initial assessment will be improved through the analysis capabilities of geographic information systems by executing a remote process using EPA, USGS, and AppAqua datasets. Implementing the process will save the expense of a site visit, and provide a more thorough understanding of streamflow beyond the single visit snapshot.

Sarah Hajnos, Geography, Undergraduate Student
Faculty Mentor:  Maggie Sugg, Geography and Planning
Co-Author(s):  Dr. Jennifer Runkle
Title:  UNDERSTAND THE CONCURRENT RISK OF MENTAL HEALTH, POOR AIR QUALITY, AND DANGEROUS WILDFIRE EVENTS IN THE COVID19 PANDEMIC
Scientists have dubbed the latest wildfire crisis in the western United States an unprecedented climate change-related occurrence. The ongoing COVID19 crisis adds to the complexity of the situation, making it difficult for children and adolescents to navigate. Crisis hotlines and other text-based counseling services offer a successful and low-cost form of offering mental health resources to youth struggling with suicidal thoughts, hopelessness, and psychological pain. The objective of this study is to evaluate the mental health impacts of the recent 2020 wildfire events in the context of the COVID19 pandemic and poor air quality. An interrupted

time-series design is implemented to examine the changes in daily counts of crisis texts aggregated at the area-code level in response to the 2020 wildfire season in the western United States. We also perform a sub-analysis of suicide-related crisis conversations following the events. We expect to see an increase in crisis-related texts in the following days of the event in area-codes impacted by wildfire events compared to those not exposed. We expect to identify multiple mental health outcomes such as stress, anxiety, and self-harm in response to the wildfire events. This research helps to fill in important gaps in the literature concerned with not only the psychological impacts of wildfire events but also the association within the context of the current COVID-19 pandemic. Our research examines the mental health morbidity in children and adolescents with real-time mental and emotional health response to a wildfire outside of the clinical setting.

Alex O'Neill, Geography, Graduate Student
Faculty Mentor:  Baker Perry, Geography and Planning
Co-Author(s):  Dr. Song Shu, Dr. Maggie Sugg
Title:  ANALYTICAL HIERARCHICAL MODELING OF GLACIAL LAKE OUTBURST FLOOD POTENTIAL IN THE KHUMBU REGION, NEPAL
The Himalayas have seen increasingly devastating glacial lake outburst floods (GLOF), particularly in recent years. These floods are becoming more significant and common as the climate continues to rapidly warm in the region, making accurate and frequent accounting of GLOF hazards a top priority. This study presents a methodology for efficiently modeling GLOF hazards using predominately free, global satellite remote sensing data in conjunction with an analytical hierarchical model (AHP) to inventory GLOF hazards in the Khumbu Region. Findings indicate rapidly retreating and thinning glaciers with a 34% increase in lake area, including a 303% increase in supraglacial water area. Using Imja Tsho to validate the model, 25 potentially-hazardous lakes are identified, with four classified as very high risk and four classified as an extreme risk. Imja Tsho and Lumding Tsho rank as the highest-risk glacial lakes, with Lumding Tsho increasing its growth rate 77% percent between 2013 and 2019 versus 1962-2007. Unlike Imja Tsho, no mitigation work is in place to reduce the risk posed by Lumding Tsho, and few in situ studies have been conducted. Based on these findings,  it is critical to form a mitigation plan to lower the risk associated with Lumding Tsho and assess the potential impact of an outburst event. Projected warming of the region and associated increase in GLOF hazard shows the continued study of GLOF hazards and mitigation is crucial to protecting vulnerable communities.

Charles (Chip) Weir, Geography, Undergraduate Student
Faculty Mentor:  Johnathan Sugg, Geography and Planning
Co-Author(s):  N/A
Title:  SOME GEOGRAPHIC PERSPECTIVES ON THE RELATIONSHIP BETWEEN POLITICAL PARTISANSHIP AND CLIMATE CHANGE BELIEFS IN THE US
Americans are now more ideologically divided over partisan politics than any time in the last two decades. Amid this polarizing gap, the debate over climate change has consistently tracked along partisan lines, with political ideology serving as one of the best predictors of climate change beliefs in the US. Yet, there are growing segments of the public who are concerned, if not alarmed, about climate change, indicating higher levels of awareness, risk perception, and even support for different policies. Do politics remain a reliable indicator of climate change belief? This study examines this question at the US county level and explores the relationship between voting outcome and climate change opinion. Regression models are used to compare the relationship between the percent margin of victory for both parties in the last four general elections and climate change opinion estimates in each county. The results are then evaluated in the context of the prevailing character of county level climate belief. There were consistent positive trends between the Democratic percentage of the vote and climate change acceptance. However, this effect was different for counties with different types of climate change beliefs. Whereas counties with high climate change awareness, risk perception, and policy support exhibited strong relationships in all elections, counties with low awareness, risk

perception, and policy support exhibited a transition from weak to strong relationships. The results reinforce a growing partisanship of climate politics at the national level but highlight regional variability at local levels.

# Geological and Environmental Sciences

Elliot Adler, Exercise Science, Undergraduate Student
Faculty Mentor:  Andrew Heckert, Geological and Environmental Sciences
Co-Author(s):  Zackary Ore
Title:  IDENTIFYING UNPUBLISHED PALEOPATHOLOGIES IN TYRANNOSAURID (DINOSAURIA: THEROPODA) SPECIMENS ON PUBLIC EXHIBIT
Research has explored the effects of aerobic exercise on cognitive abilities such as long-term memory in adults, however there is little research on the effects of aerobic exercise on long-term memory in adolescents. Running is an increasingly popular sport, making it ideal to use in the examination of memory in adolescent runners. Therefore, this study investigated the effects of cross-country training on the long-term memory of high school runners. Researchers used the Rey-Auditory Verbal Learning Test to assess the runners' long-term word-list recall, and the Borg Scale Rating of Perceived Exertion (RPE) to ensure consistent exercise intensity. A total of 17 runners participated in the three visits - a familiarization, and then a rest condition, or exercise condition, randomly alternated. Due to COVID-19, data were collected outdoors and weather was varied for the three collection days. Results indicated no differences in recall by biological sex ($F_{(2,30)} = 1.227$, $p = .632$) and in the study conditons ($F_{(2,32)} = 1.303$, $p = .286$). Results did indicate a difference in RPE based on the day the participants exercised ($t(14) = -2.72$, $p = .017$), possibly due to a difference in weather and temperature. Exercise did not affect long-term memory, this could be attributed to varied weather and the resulting differences in RPE scores. Future research should consider the time of year, collection procedures, and weather conditions.

Shamsuddin Ahmed, Geology, Undergraduate Student
Faculty Mentor:  Andrew Heckert, Geological and Environmental Sciences
Co-Author(s):  Luke Rose, Spencer Randleman, Isaac Pugh, Joel Crothers, James Meyer
Title:  PRELIMINARY TAPHONOMY OF THE VERTEBRATE FOSSIL ASSEMBLAGE FROM THE REVUELTIAN  (UPPER TRIASSIC: NORIAN) AGE GARITA CREEK  SITE OF EAST-CENTRAL NEW MEXICO, USA
A fossil collection from a site near Garita Creek, New Mexico is rich in macro- and micro-vertebrates, including bones, teeth, and coprolites. Sediment and small bags of picked fossils from the site were provided by Larry Martin and the Lauer Foundation for Paleontology, Science, and Education respectively. The sediment consisted of ~20 kg of picked screenwash material, referred to as concentrate hereafter. We used sieves to sort the concentrate into five sizes: ≥4, 2-4, 1-2, 0.5-1, and <0.5 mm. We then picked and identified fossils as bone fragments, tooth fragments, and coprolites. The data presented here are for ≥4 mm and 2-4 mm fossils only.  In our sample of concentrate there are 7,112 fossils, of which 25.8% are bone fragments, 13.9% are tooth fragments, and 60.3% are coprolites. In a small sample of the fossil bags, there are 1,442 fossils, of which 59.2% are bone fragments, 35.2% are tooth fragments, and 5.6% are coprolites.
The concentrate was originally sorted by Larry and Betty Martin, whose picking methods may have been biased as the concentrate is dominated by coprolites, whereas the bags of fossils contain mostly bone and teeth. The Martins likely prioritized more diagnostic fossils for the bags. Since the combined collections contain 51.1% coprolites, 31.4% bone, and 17.5% teeth, we hypothesize that new collections from the site would have proportionately fewer coprolites than in the concentrate, and proportionately fewer bones and teeth than the fossil bags.

Joel Crothers, Art and Visual Culture, Undergraduate Student
Faculty Mentor:  Andrew Heckert, Geological and Environmental Sciences
Co-Author(s):  Zackary Ore
Title:  IDENTIFYING UNPUBLISHED PALEOPATHOLOGIES IN TYRANNOSAURID (DINOSAURIA: THEROPODA) SPECIMENS ON PUBLIC EXHIBIT

Among the most well-known pathological dinosaur specimens are those of the predatory tyrannosaurids. Despite recent studies describing pathological tyrannosaurids, there are numerous exhibited skeletons with obvious healed bones (fractures and/or bites), osteomyelitis, and parasitic infections. Many of these specimens may be absent from the scientific literature, but the presence of pathologies is known by their respective institutions and anecdotally by the scientific community. This poster provides a qualitative analysis of four Late Cretaceous tyrannosaurid specimens from prominent museum displays—Gorgosaurus sp. (TCM 2001.81.1 from the Two Medicine Fm) and two Tyrannosaurus rex skeletons (BHI 6230 Wyrex, and Victoria) and the T. rex skull (UWBM 99000 Tuffs-Love), all from the Hell Creek Fm. TCM 2001.81.1 exhibits lesions on its braincase and right dentary, scapula, and fibula, and at least two fused caudal vertebrae. Wyrex has lesions on its right femur and on at least two caudal vertebrae. Victoria possesses lesions on its right maxilla, at least three cervical vertebrae, and two dorsal vertebrae. Tuffs-Love possesses at least 13 holes throughout its skull. With only 19 documented pathological tyrannosaurid skeletons in the scientific literature, the description of these fossils would significantly increase the known record. By analyzing these museum displays, we hope to push for the publication of these specimens and their dynamic life histories.

Kathleen  Duckett, Geology, Undergraduate Student
Faculty Mentor:  Sarah  Carmichael , Geological and Environmental Sciences
Co-Author(s):  Johnny Waters, Peter Koenigshof, Ariuka Munkhjargal
Title:  LATE DEVONIAN ROCKS FROM A NEW SITE: THE BAYANKHOSHUU  RUINS OF SOUTHWESTERN MONGOLIA

The Late Devonian (383-359 Ma) was characterized by prolonged climate instability and contained several mass extinctions. Our understanding of the Late Devonian extinction event is compromised with paleographic sample bias as nearly all study locations are in North America and Europe (which were paleogeographically adjacent, as Pangea was forming at this time) and in South China. For this reason, we sampled a new section in a paleogeographically unique location: the Bayankhoshuu Ruins section of southwestern Mongolia, which likely represents an isolated volcanic island arc environment. The site spans two adjacent terranes, the Gurvansayhan Terrane and the Mandalovoo Terrane, and samples were collected from the Botuulkhudag Formation's Takhuul and Minjin Members. Optical microscopy, X-ray diffraction, cathodoluminescence, and scanning electron microscopy with energy dispersive X-ray microanalysis thus far indicates that Bayankhoshuu Ruins are characterized by a mixture of sedimentary rocks, volcanic rocks, and volcaniclastic rocks that have experienced low-grade metamorphism, up through prehnite-pumpellyite facies. The metamorphism and mineral assemblages are consistent with the tectonic setting but preclude our ability to detect the primary mineralogy and stable isotope signatures associated with any extinction event horizons. Although the new data collected for this site is not appropriate for determining the cause of these Late Devonian extinction events, it has produced a revised stratigraphic and metamorphic framework for this understudied region.

Nicholas Fiori, Environmental Science, Undergraduate Student
Faculty Mentor:  William Anderson, Geological and Environmental Sciences
Co-Author(s):  N/A
Title:  THE IMPACT OF SEA-LEVEL RISE ON SALTWATER INTRUSION FOR COASTAL AQUIFERS IN NORTH CAROLINA

The coast of North Carolina has been identified as a sea-level rise hotspot because the coastline experiences higher rates of sea-level rise compared to the global mean level. These rising sea-levels will subsequently lead

to increased saltwater intrusion for coastal aquifers in this area. In this study, a head-controlled scenario is used to conduct an analysis of saltwater intrusion for coastal North Carolina under various sea-level rise scenarios. A head-controlled scenario assumes that as sea-level rises, the hydraulic head will remain the same. This is likely to be the case because of groundwater extraction, evapotranspiration, and a possible lack of vertical mobility at these sites. The northern section of the coastline is subsiding, while the southern portion remains stable, or experiences slight uplift, so the rates of sea-level rise vary from north to south. In all locations, the rate of saltwater intrusion increases at an exponential rate as sea-level rises. Under sea-level rise in excess of 1 m, saltwater intrusion exceeding 300 m is expected at certain sites. This increase in saltwater intrusion will lead to an estimated loss in aquifer volume between 20% and 100% by 2100 depending on hydrogeological parameters. Factors such as hydraulic conductivity, thickness of the aquifer, and recharge influence the steepness of this saltwater intrusion curve. Hydraulic conductivity and aquifer width have the greatest influence on the amount of saltwater intrusion, as well as the volume of water that remains in the aquifer as sea-level rises. This study finds that if sea-level rises in excess of 1 m, then some North Carolina barrier islands could lose the entirety of their freshwater lenses.

Isabella  Metts, Geology, Undergraduate Student
Faculty Mentor:  A.B. Heckert, Geological and Environmental Sciences
Co-Author(s):  Shams Ahmed, Joel Crothers
Title:  PHOTOGRAMMETRIC CONSTRUCTION OF A TOOTH WHORL  OF THE GIANT EXTINCT SHARK OTODUS MEGALODON (MEGALODON)
Data visualization aids in scientific research, education, and outreach. Photogrammetry is a form of data visualization that produces a 3D model of a given subject. By using dozens of overlapping images of a specimen taken from all angles, photogrammetry software is able to stitch photos together to create a high fidelity model of the subject. The resulting models can then be shared with a broad spectrum of the population both virtually (via internet publishing), or physically by 3D printing.
Models produced using photogrammetry can also be combined in order to produce a more synthetic representation, an example being a tooth whorl. Tooth whorls are sequences of replacement teeth, found in the jaws of sharks, but almost never preserved as fossils. These whorls form a spiral of teeth, connected near the roots, that extends beneath the gumline. Tooth whorl models are rare in the paleontology community, making this an important project to research.
Using a 3D model of a lower tooth of the extinct Pliocene shark Otodus megalodon previously produced by Mathias Eads, I generated  a complete, albeit hypothetical, tooth whorl. Due to Covid-19, the Visualization Lab of the College of Arts and Sciences was inaccessible for software access. Consequently, I produced the tooth whorl model using the free software Mesh Mixer, where I was able to upload Mathias's model, replicate it, and combine the replications in the proper orientation to produce an educational model of a tooth whorl.

James Meyer, Geology, Undergraduate Student
Faculty Mentor:  Andrew Heckert, Geological and Environmental Sciences
Co-Author(s):  Joel Crothers, Isaac Pugh, Luke Rose, Shamsuddin Ahmed, Spencer Randleman
Title:  AN UPPER TRIASSIC (REVUELTIAN: MID-NORIAN) FOSSIL ASSEMBLAGE FROM THE GARITA CREEK MICROVERTEBRATE LOCALITY  OF EAST-CENTRAL NEW MEXICO
Fossil material from a site near Garita Creek, made available through the Lauer Foundation's generosity, preserves a diverse Upper Triassic assemblage of fish, amphibians, and reptiles. Hybodont chondrichthyans such as Reticulodus and sarcopterygians such as lungfish are both known from their distinctive teeth, while coelacanths are represented by jaw fragments. Numerous scales, skull fragments, and crusher plates represent actinopterygians. Amphibians include fragments of textured skull and girdle bones and temnospondyl vertebrae as well as smaller lissamphibian limb bones and vertebrae. Sphenodonts and other(?) lepidosaurs are known from several tooth-bearing elements. Multiple drepanosaurs are represented by

manual, pes, and tail claws. Most tanystropheid fossils are vertebrae, but one femur is known. A few trilophosaur teeth have been recovered. Among the diverse archosauromorphs, phytosaurs are most common as teeth, ribs, claws, vertebrae, osteoderms, and skull fragments. One large quadrate and some teeth have been assigned to a Postosuchus-like rauisuchian. Shuvosaurids and sphenosuchians are rare. The former is known from a femur and ungual while the latter is represented by one osteoderm. Among the most diagnostic fossils of the larger assemblage are osteoderms of Typothorax. Dinosauromorph fragments are rare but include a distinctive femur and teeth. One jaw fragment with inset, tricuspid teeth is known. A total of 26 taxa have been recovered from the site so far.

Caroline Moore, Environmental Science, Undergraduate Student
Faculty Mentor:  Sarah Evans, Geological and Environmental Sciences
Co-Author(s):  N/A
Title:  HYDROLOGIC BUFFERS ON SOIL TEMPERATURE HETEROGENEITY IN A MOUNTAIN FEN
Fens, groundwater-fed alkaline wetlands, provide many ecosystem services such as improving water quality, reducing flooding, and creating an unique thermal soil habitat for endangered species. However, the long-term suitability of fen soil thermal refugia in a changing climate is uncertain and understudied; shifting environmental factors may serve to either mitigate or compound the impacts of climate change. In this study, we fill this gap by analyzing a novel dataset of fen soil temperatures, air temperature, streamflow, vegetation shading, and snow cover to: (1) establish a baseline understanding of soil temperature heterogeneity, and (2) address which environmental factors have the largest influence on soil temperature. We perform a series of Mann-Kendall statistical tests on hourly field data collected from August 2018 to March 2021 for a mountain fen (elevation: 1,573 m, area: 9,338 m2) in Ashe County, North Carolina. Results suggest that soil temperatures have the largest variation in the summer with a 4.89°C range between eight locations in the fen and the smallest variation in the winter with a 2.09°C range. Soil temperatures in the winter exhibit the largest correlation with distance to the main stream suggesting that streamflow can buffer rising soil temperatures. As climate warming will likely increase soil temperatures in fens, decreasing habitat quality and availability, the results of this work may inform fen management and protection strategies.

Zachary Ore, Geology, Undergraduate Student
Faculty Mentor:  Andrew Heckert, Geological and Environmental Sciences
Co-Author(s):  Joel Crothers
Title:  THE MOST FREQUENTLY INJURED DINOSAURS: WHAT CAN CENTROSAURUS, PACHYRHINOSAURUS, AND TRICERATOPS TELL US ABOUT DINOSAUR  PALEOPATHOLOGY?
The published record of dinosaurs includes at least 272 specimens preserved with fossilized paleopathologies and yields data revealing how dinosaurs interacted with their environment and each other. The clade Marginocephalia (ceratopsians and pachycephalosaurs) has the most instances of paleopathological specimens (102), almost all from ceratopsians. These data include 74 specimens from three genera—Triceratops (27), Pachyrhinosaurus (30), and Centrosaurus (17), preserving a total of 85 paleopathologies. Reporting injuries vs disease vs specimens with both in each shows Triceratops (20/5/2), Pachyrhinosaurus (11/15/4), and Centrosaurus (13/3/1). The injuries preserved are mainly lesions and fractures, while the diseases consist of pseudoarthrosis, exostoses (bone spurs), and other ailments, some of which may be associated with injuries. One null hypothesis for the distribution of pathologies is that they would be evenly distributed across the body. Bonebed data for the centrosaurines Pachyrhinosaurus and Centrosaurus suggest that populations have more vertebral and rib (20) than skull (15) or limb (6) paleopathologies. Past studies on horn use in ceratopsians skew the Centrosaurus data to a majority (10/17) skull pathologies. Similarly, the Triceratops record is dominated by skull paleopathologies (25/27). Our data reinforces previous studies that show that chasmosaurines, like Triceratops, are more prone to skull injuries than centrosaurines are.

Isaac Pugh, Geology, Undergraduate Student
Faculty Mentor: Andrew Heckert, Geological and Environmental Sciences
Co-Author(s): N/A
Title: AN OBSERVATION OF SUPERNUMERARY CARINAE IN REVUELTIAN (TRIASSIC:MID-NORIAN) PHYTOSAUR TEETH FROM THE BULL CANYON FORMATION OF EAST-CENTRAL NEW MEXICO

Supernumerary carinae are extra series of denticles (serrations) known from the teeth of diverse fossil reptiles, including theropod dinosaurs. Current hypotheses regard these as pathologic and genetic in nature. Here I describe supernumerary carinae on two teeth from the upper left jaws of Late Triassic phytosaurs. The first tooth (SD1) contains a resorption pit indicating that the tooth was shed during life and possesses two converging, poorly to moderately developed, mesiolingual supernumerary carinae. Denticle densities of the long (12/5mm) and short (17/5mm) supernumerary carinae vary from the primary carina (15/5mm). The second tooth (SD2) is preserved as two incomplete fragments separated by a small gap. The basal fragment includes much of the root, indicating that the tooth was in use up until the death of the animal. A single mesiolingual supernumerary carina on SD2 begins alongside the mesial carina near the base of the tooth. The supernumerary carina has a slightly higher denticle density (17.5-21/5mm) than the primary carina (15-20/5mm) and does not extend onto the tip fragment, apparently terminating in the gap between fragments. The carinae of these teeth offer a glimpse into the mechanics of tooth formation in archosauromorphs, especially in the formation and relation of dentine and enamel layers naturally crosscut in SD2. As only the second report of Triassic supernumerary carinae, these teeth are critical new data points on pathologic carinae.

Ciara Sailar, Geology, Undergraduate Student
Faculty Mentor: Andrew Heckert, Geological and Environmental Sciences
Co-Author(s): N/A
Title: EXPLORING THE ONTOGENY AND PALEOBIOLOGY OF THE LATE CRETACEOUS CHASMOSAURINE DINOSAUR TRICERATOPS THROUGH HISTOLOGY OF FOSSIL BONES

Osteohistology is the study of bone microstructure at the tissue level and, when preserved in fossils, can be rich sources of information on the ontogeny and paleobiology of extinct organisms. While many dinosaur taxa have been histologically sampled, ceratopsian taxa are poorly represented, and sampling therein is phylogenetically uneven, being almost entirely represented by either basal (non-ceratopsid) taxa or much more derived forms. Prior to 2018, there were only two histological studies of chasmosaurines, leaving a nearly nonexistent understanding of their growth patterns. Histological studies on long bones provide the most complete growth record due to modification of bone as the organism grows.

Using a Triceratops specimen collected by an ASU crew, my research focuses on what histologic studies on Triceratops can tell us about its ontogeny. Thin sections of two ribs were prepared using standard thin section methods to analyze bone microstructure to observe ontogenetic changes and growth rates to infer age, physiology and phylogeny in comparison to other ceratopsian dinosaurs. While a long bone would be ideal for histologic analysis, my research focuses on the preserved microstructure in the ribs due to availability. The microstructure of the thin sections preserves secondary osteons, showing secondary remodeling of the bone. It also shows no lines of arrested growth, indicating there are no cyclic growth patterns preserved.

Skye-Anne Tschoepe, Environmental Science, Undergraduate Student
Faculty Mentor: William Anderson, Geological and Environmental Sciences
Co-Author(s): N/A
Title: AN ASSESSMENT OF THE IMPACT OF STORMWATER MANAGEMENT PRACTICES ON STREAM SALT ION CONCENTRATION IN THE SOUTH FORK NEW RIVER WATERSHED

The South Fork New River (SFNR) watershed in Boone, NC includes the SFNR and other streams. These have the potential to contribute to watershed biodiversity; however, salt infiltrates the watershed through stormwater runoff as Boone urbanizes. Some runoff drains to a bioretention system parallel to the SFNR, called Clawson-Burnley Wetland (CBW). There is no significant source of salt in this area outside of the sodium chloride (NaCl) used for road deicing. An explanation for year-round elevated salinity is that reversed-gradient events, occurring during storms, drive saline water into riparian aquifers, or in the case of CBW, move salt from the wetland to the SFNR. Our aim is to use the observed salinity gradient between the CBW and the stream to construct a mass-balance of Clawson-Burnley park to model salt flow through the system.

In initial data collection, I observed a salinity gradient through CBW. Average chloride concentrations recorded by electrical conductivity loggers upstream, where runoff enters, have been 103.9 mg/L and downstream are 29.2 mg/L. The data show a linear gradient between upstream and downstream concentrations when we ignore salt influx and freshwater storms. By this relationship, we predict that salt travels laterally through the aquifer to reach the SFNR or is uptaken by wetland plants. We aim to understand how salt travels through the groundwater at Clawson-Burnley Park, indicating the effectiveness of this system in mitigating salt contamination.

# Interdisciplinary Studies

Kara Haselton, Interdisciplinary Studies, Undergraduate Student
Faculty Mentor:  Ann  Pegelow Kaplan, Interdisciplinary Studies
Co-Author(s):  N/A
Title:  WHERE I'M FROM, A PHOTOGRAPHIC ESSAY ON IMMIGRATION
This verbal and visual presentation will provide viewers with a tour of Where I'm From, a reflexive photographic documentary examining the impacts of immigration on individual identity. In this project, to prevent potential exploitation of people with immigration status while also encouraging self-reflection among viewers who might otherwise overlook how immigration influences their life, I chose to focus on the autobiographical impacts of immigration. Through a series of interviews and socially-distanced portraits featuring individuals with whom I have had a variety of relationships, I collaborated with college students, young professionals, and a physician, all residing in North Carolina. Within the resulting essay, each of their fourteen stories are introduced by the nature of our relationships; intentionally presenting the understanding that their stories contribute to my own. I begin the documentary by detailing my own background to further emphasize the key role immigration plays for this white, non-immigrant American. My text and photographs have a synergetic and poetic relationship throughout, with images of home paired with quotations from oral interviews. The individual stories flow together to create a collective whole. With an intention to begin conversations concerning immigration and identity, Where I'm From encourages all of us to more holistically reflect on the individuals and systems that make up who we are. We are who we are because of others.

Jordan Priest, Interdisciplinary Studies, Undergraduate Student
Faculty Mentor:  Ann Kaplan, Interdisciplinary Studies
Co-Author(s):  N/A
Title:  WEAVING IDENTITIES
WEAVING IDENTITIES is an experimental multimedia documentary series exploring the diverse lives, bodies, and stories of ten non-binary subjects in NC. It features semi-nude photographic portraits printed on life-size fabric tapestries, which are then embroidered with personally identifying symbols and text arising from subject interviews. Alongside imagery are written excerpts detailing both personal introspections and whimsical anecdotes from each individual, painting complex and empathetic portraits of their identities and gender experiences. WEAVING IDENTITIES aims to celebrate the underrepresented non-binary community, and

dispel misconceptions about how one can transcend the Western gender binary. In addition, the content of interviews intersects with issues of race, rural politics, and personal acceptance. The project is ongoing, with plans for expansion to at least twenty-five subjects in the coming months.

Isabel Smith, Global Studies, Undergraduate Student
Faculty Mentor:  Joseph Gonzalez, Interdisciplinary Studies
Co-Author(s):  N/A
Title:  UNDERSTANDING TRENDS IN AUSTRALIAN ASLYUM  SEEKER POLICY: AN ANALYSIS ON THE CONTINUATION OF DETERRENCE THROUGH COVID-19
In this study, I analyze Australia's immigration policy affecting asylum seekers and refugees in the 21st century both before and during COVID. Little literature exists that aims to understand how Australia's inconsistent COVID-19 response fits into the bigger history of Australia's continual, yet ineffective, effort to employ deterrence. I therefore examine the history of Australia's immigration through government documents and news articles to understand how previous policies operated with the intention of deterrence and create a framework for analysis of current COVID practices. I find that Australia's COVID-19 response remains skewed against the asylum seeker/refugee population and follows the same pattern of intended deterrence. Policies provide the same threat of the abuse of human rights utilized pre-COVID, manifested through the threat of increased risk of COVID contraction and economic hardship, making it highly probable that this regime is a continuation of past inhumane policy. On a broader scale, my findings suggest that Australia is continuing down the same racist, exclusionary path that it has since 1788.

# Languages, Literatures and Cultures

Nick Cellini, Languages, Literatures, and Cultures, Undergraduate Student
Faculty Mentor:  Adrienne Erazo, Languages, Literatures and Cultures
Co-Author(s):  N/A
Title:  ANALYSIS OF YURI HERRERA'S SIGNS THAT WILL  PRECEDE THE END OF THE WORLD AND HOW IT METAPHORICALLY REPRESENTS THE LATINX IMMIGRANT EXPERIENCE
Yuri Herrera makes many effective references to the experiences of LatinX immigrants throughout his book, and many of them are more subtle than others. This paper analyzes how Herrera incorporates his linguistic style as a comprehensive metaphor of the different stages, challenges, hopes, and realities of immigrating to the United States as a LatinX individual. There are many elements to the different settings in Herrera's book that are easy to overlook, but analyzing them in the context provided by this paper gives the story a much deeper and more powerful meaning. In this paper I cite academic articles and journals that display real life issues that immigrants face, and connect those to Herrera's description of the setting, characters, and interactions between characters. An example would be how Makina, the main protagonist stumbles through vast expanses of hyperbolically deadly and essentially impassable terrain which seems unbelievably inconvenient. This is done to display the documented strategies of U.S. Border regulations to use natural hazards such as climate and terrain to deter, injure, and often kill immigrants attempting to cross the border. You don't need to look at the story in this context for Herrera's book to resonate with you, but this paper describes and analyzes a number of allusions he makes to real world issues facing LatinX immigrants trying to start a new life in the United States both before and after they cross the border.

# Mathematical Sciences

Connor Briggs, Mathematics, Undergraduate Student
Faculty Mentor:  Eric Marland, Mathematical Sciences
Co-Author(s):  N/A
Title:  REVISIONS IN UNITED NATIONS ENERGY STATISTICS DATA: CAN CHANGES TO THE PAST IMPROVE OUR UNDERSTANDING OF THE PRESENT?
An analysis can only be as meaningful as the data it comes from, but what makes for high quality data? With the rise in interest in global climate change and carbon dioxide ($CO_2$) emissions, this question is important to keep in mind while trying to forecast what is in store for the future of global temperatures. Every year, the United Nations publishes an updated Energy Statistics Database that provides annual statistics on the production, processing, trade, and use of fuels for over 230 countries, going back as far as 1950. Each subsequent publication of the database provides additional entries and updated values to the previous years' data. This opens up questions about these data revisions: what are the changes that are taking place, what countries are adding entries for previous years, and are there recognizable patterns that provide us information to anticipate changes in future database releases? Before data can be analyzed it must be evaluated, and the purpose of this presentation is to learn from the revisions to address questions and concerns surrounding this Energy Statistics Database. This begins with an investigation into the changes occurring in the datasets year to year and ends with an inference into patterns within these changes. The additional insight this presents allows a deeper level of understanding for where in the database revisions are occurring, to better characterize the uncertainty of present $CO_2$ value estimates.

Christian Payne, Mathematics, Undergraduate Student
Faculty Mentor:  Vicky Klima, Mathematical Sciences
Co-Author(s):  Dr. William Cook
Title:  GENERALIZATIONS OF LEIBNIZ AND LIE ALGEBRAS
Generally, Lie algebras are vector spaces equipped with an alternating, bilinear product that obeys the Jacobi identity, a sort of product rule. We will first explore Leibniz algebras, generalizations of Lie algebras in which the bilinear product is no longer required to be alternating. Then, we will extend our discussion to n-ary operations and see what connections we can make to n-Leibniz and n-Lie algebras.

# Physics and Astronomy

Evan Barnes, Engineering Physics, Graduate Student
Faculty Mentor:  Brooke Hester, Physics and Astronomy
Co-Author(s):  N/A
Title:  ENGINEERING AN OPTICAL TWEEZER APPARATUS
An optical tweezers (OT) apparatus utilizes focused laser light to trap micro to nano-sized objects. An OT system can be used to study interdisciplinary subjects such as the elastic modulus of cells or the behavior of tiny gold-coated glass spheres called nanoshells. The objective of this project is to design, engineer, and construct a custom-built OT apparatus. An OT system requires two laser light sources. One laser traps the object, and the other laser is used to monitor the position of the trapped object. These are aligned through telescopes to adjust the diameter of the beams to an optimal size for an objective lens of a microscope to achieve a tight focus onto the sample. After interacting with the trapped particle, the position detection laser

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

Sydney Clark, Environmental Science, Undergraduate Student
Faculty Mentor:  Christopher Thaxton, Physics and Astronomy
Co-Author(s):  Matthew Phillips
Title:  OPTIMIZATION OF MERRA-2 MODEL REGION SIZES FOR ANALYSIS OF AEROSOL-METEOROLOGY INTERACTIONS
Atmospheric aerosols are suspended fine solid particles or liquid droplets in the air. They affect the climate by scattering or absorbing incident sunlight and by modifying cloud reflectivity, lifetimes, and precipitation. According to the Intergovernmental Panel on Climate Change, clouds and aerosols contribute to the largest uncertainty to estimates in the Earth's dynamic energy budget. This is due in part to the high variability of aerosol sources and amounts across different regions of the globe and their complicated interactions with meteorological processes. In this project, we are working to quantify trends in correlations of atmospheric aerosol compositions and meteorological processes by comparing measured aerosol optical products (AOPs) at seven NOAA-FAN/AERONET sites across North America with aerosol and meteorology model outputs from MERRA-2, NASA's first long-term global reanalysis system that assimilates space-based observations of aerosols and provides model products that quantify aerosol interactions with other physical processes in the climate system. Herein, we present results from the initial phase of the project in which we analyze the sensitivity of model-data comparisons on the number of MERRA-2 model grid points chosen that encompass the App State observation site. Results will serve to quantify the degree to which the observation sites represent their surrounding regions and optimize the number of grid points used in generating comparative statistics.

Jacob Greenfield, Engineering Physics, Graduate Student
Faculty Mentor:  Christopher Thaxton, Physics and Astronomy
Co-Author(s):  N/A
Title:  METEOROLOGICAL DATA TRANSMISSION AND ACQUISITION  SYSTEM FOR A DRONE.
The TriSonica Mini (TSM) is a research-grade, integrated atmospheric sensor system that samples temperature, humidity, pressure, tilt, compass, and wind speed and direction. Being compact and lightweight, the TSM is ideal for deployment on a mobile platform such as a drone. However, the TSM does not come with data storage or transmission capability. We present an embedded design for a data logger that allows for data to be stored during flight. The design employs an Raspberry Pi 4 B+, an RS232 shifter, and a SD card. There is a python script written for the RasPi that reads the incoming data, then waits for a rising edge switch toggle to begin saving data onto a CSV file, while also printing a time stamp for each measurement, the program is stopped by toggling the switch into the off position. This datalogging system has the capabilities of collecting data on 12 different parameters at 10 Hz. The mounting bracket used for the drone consists of a three foot long aluminum pole mounted on the drone with a plate on top for the TSM to sit upon. The datalogger circuit is mounted at the bottom of the pole directly on the drone inside a waterproof container. This solution allows student and faculty researchers to acquire high resolution surface and boundary layer data (up to 200 meters) in support of atmospheric chemistry and physics research and modeling.

Jaydan Hush, Physics, Undergraduate Student
Faculty Mentor: Brooke Hester, Physics and Astronomy
Co-Author(s): Lia Phillips, Nathaniel Scott
Title: LASER TWEEZERS MANIPULATION OF A TRAPPED MICROSPHERE IN A RAMAN EXCITATION BEAM
Laser Tweezer Raman Spectroscopy (LTRS) is an effective method used to analyze and characterize materials. The resolution of a Raman spectrum is significantly improved by incorporating optical tweezers. Trapping a particle at the focal point of the laser tweezers greatly increases the intensity of the spectral fingerprint. Optical tweezers can manipulate minute particles, micrometer to nanometer in diameter, and measure pico-Newton forces exerted on a particle. Our apparatus utilizes Laser tweezers to manipulate and hold a particle within the Raman excitation laser as scattered light from the sample is measured by a spectrometer for analysis.

Sara Idris, Engineering Physics, Graduate Student
Faculty Mentor: François Amet, Physics and Astronomy
Co-Author(s): Aeron McConnell, Brian Opatosky
Title: THE JOSEPHSON JUNCTION CIRCUIT: PART II
The electronic properties of superconducting devices called Josephson junctions are strongly affected by temperature and by their ability to dissipate energy.
We developed an electrical circuit whose properties are similar to those of a Josephson junction. Similar to Josephson junctions, the voltage across our circuit is zero even when a current is applied to it, unless that current exceeds a value called the critical current, at which point the circuit behaves like a resistor. We show how the critical current is affected by circuit parameters such as the presence of energy dissipation in the circuit. Additionally, we show that the presence of thermal noise strongly affects the dynamical properties of the circuit. As we increase the temperature the value of the critical current drops, a phenomenon that we quantitatively compare to our theoretical predictions.
This is the second part of three presentations in collaboration with my colleagues Aeron McConnell and Brian Opatosky.

Henry Kolesar, Physics, Undergraduate Student
Faculty Mentor: Brooke Hester, Physics and Astronomy
Co-Author(s): Lucian Murray
Title: FLUORESCENCE ANISOTROPY
Fluorescence anisotropy is a useful method of analyzing interactions between particles on a molecular level. A linearly polarized monochromatic light source is allowed to be incident upon a sample of fluorescent material. The fluorescence emission is directed to a beam splitter which separates the parallel polarized light from the perpendicular polarized light. A comparison of the intensity of the light polarized in the parallel and perpendicular direction can tell us how the molecules are rotating on average. Smaller molecules rotate faster and larger molecules rotate slower, and slower molecules will exhibit larger motion if bound to a larger molecule. We present a custom-built fluorescence anisotropy system implemented with a pulsed picosecond laser and time-correlated anisotropy measurement capabilities.

Clay Langfeldt, Biology, Graduate Student
Faculty Mentor: Brooke Hester, Physics and Astronomy
Co-Author(s): N/A
Title: CALIBRATION OF DUAL OPTICAL LASER FOR STUDY OF SARCOMERES THROUGH AN ACTIN CONSTRUCTED MODEL
Sarcomeres are the smallest subunit of muscle and are composed of actin and myosin. Actin acts as a structural component that the motor protein, myosin can crawl along. This crawling motion is how muscle contracts at the molecular level. To better study this system a model sarcomere is to be created. This model will be composed of microbeads connected by actin filaments. The actin filaments are biotinylated which allows them to readily and strongly attach to microbeads coated in streptavidin. This model will then be held using a dual optical laser trap. This trap will use its dual lasers to hold both beads and then can pull or push the model sarcomere. First the laser must be calibrated, and therefore the model sarcomere is simpler and lacks the myosin motor protein. The model in this experiment will be used to test the dual optical laser and assess what will need to be changed or modified to further and better study the system of interest. After calibration, the next steps will involve introducing myosin in some form to then analyze the interaction between the proteins.

Aeron McConnell, Physics, Undergraduate Student
Faculty Mentor: Francois Amet, Physics and Astronomy
Co-Author(s): Sara Idris and Brian Opatosky
Title: THE JOSEPHSON JUNCTION CIRCUIT
The differential equation describing the behavior of a superconducting device called Josephson junction also exactly describes a few other dynamical systems, such as the motion of a pendulum or the evolution of voltages in a category of electronic circuits including voltage controlled oscillators (VCO). Our project revolves around the study of such a circuit, fabricated from mainstream electronics components, and capable of modelling these equations. We are studying its properties and how they correlate to phenomena observed in Josephson junctions.
In this presentation I will discuss the circuit itself: the motivations that led to its design, its actual fabrication, and the characterization of some of its properties. This is the first part of three presentations in collaboration with my colleagues Sara Idris and Brian Opatosky.

Samuel Moore, Physics, Undergraduate Student
Faculty Mentor: Tonya Coffey, Physics and Astronomy
Co-Author(s): Colin Tyznik, Dr. Oana Jurchescu
Title: CHARACTERIZATION OF LASER PRINTED PEROVSKITE FILMS VIA ADVANCED MICROSCOPIES
Perovskites are part of a class of materials that all have the same crystalline structure. The perovskites in this study are hybrid semiconducting organic-inorganic materials. Compared to conventional silicon-based semiconductors, perovskites are low cost, and their photonic and optoelectronic properties are commercially attractive. These advantages and characteristics of perovskites put them into a unique situation to become prevalent in everyday life, from small electronic applications to next-generation solar cells. Perovskites are usually created using environmentally hazardous methods that would not transfer to industrial processing well. However, Dr. Jurchescu's group at Wake Forest University has developed a method to fabricate perovskite films via laser printing with lower environmental impact and cost. This method is scalable and has minimal material waste. Working with Wake Forest, our group has characterized these films via scanning electron microscopy with x-ray mapping for compositional analysis. We used a Bruker Icon atomic force microscope (AFM) in conductive AFM (C-AFM) mode to create topographical maps that also provide information on the sample's conductivity.

Austin Murphy, Physics, Undergraduate Student
Faculty Mentor:  Brooke Hester, Physics and Astronomy
Co-Author(s):  N/A
Title:  CELL CULTURE METHODOLOGY FOR PHYSICAL PROPERTY INVESTIGATION USING AUTOMATED OPTICAL TWEEZER APPARATUS
The physical properties of biological systems can be investigated using an automated optical tweezer apparatus. During investigation it is imperative to carry out proper handling and care of biological substances. The correct procedure for cultivating and maintaining biological systems is referred to as cell culture. To conduct cell culture, cells are transferred from their natural environment to a favorable, artificial environment designed for growth. In cell culture, physico-chemical factors, such as pH, temperature, O2 and CO2 tension, and physiological factors, such as hormone and nutrient concentrations, can be optimized for a specific biological system's needs. Optimizing conditions for the sample being analyzed is crucial to sustain viability of the sample and to acquire accurate data. In addition, the light absorption properties of cells and cell culture materials must be considered, as multiple lasers with varied wavelengths are incident upon the cells and cell culture materials being studied.  Here, I present a detailed methodology, research applications, laboratory setup, and the use of automated optical tweezers with regards to cell culture experimentation.

Brian Opatosky, Physics, Undergraduate Student
Faculty Mentor:  François Amet, Physics and Astronomy
Co-Author(s):  Sara Idris, Aeron McConnell
Title:  JOSEPHSON JUNCTION ELECTRONIC ANALOGUE : PART 3
When a Josephson junction, a superconducting device, is driven by both DC and AC currents, quantum effects arise such as the quantization of the voltage across the device; a phenomenon known as the inverse AC Josephson effect (or phase locking). We present an electrical circuit analogue of the physical Josephson junction, where the inverse AC Josephson effect is observed and compared to theory. In the absence of sufficient energy dissipation, the circuit can exhibit chaotic oscillations. We discuss some of the mechanisms inducing transitions between phase locking and chaotic behavior. We use Fourier techniques to analyze the frequency spectrum of the circuit's oscillations as the system undergoes such transitions. We show that the spectrum exhibits hallmarks of chaotic systems, such as period doubling bifurcations and types of fractal patterns known as the Devil's staircase.
This is the third part of three presentations in collaboration with my colleagues Sara Idris and Aeron McConnell.
Keywords: Josephson junction, Shapiro steps, chaos, nonlinear dynamics, superconductivity, Devil's staircase

Cameron Welsh, Physics, Undergraduate Student
Faculty Mentor:  Sayan Chandra, Physics and Astronomy
Co-Author(s):  Allison Basili, Barret Odom, Tonya S. Coffey
Title:  GROWTH AND CHARACTERIZATION OF THERMOCHROMIC VANADIUM OXIDE FILMS
Vanadium oxide (VOx) is an infrared active optoelectronic material exhibiting tunable optical and thermal properties. This makes it a promising candidate for the development of heat sensors and thermal management systems that find applications in the automotive industry, surveillance, housing, etc. The performance of the sensor critically depends on the quality of the films with respect to chemical composition, color, structural composition and morphology. While multiple growth techniques have been investigated to grow VOx, it still remains a challenge to grow high quality VOx films over large areas.
We have investigated the growth of VOx films by magnetron sputtering. Thin films (~ 100 nm) of metallic vanadium are deposited on glass (SiO2) substrates followed by an annealing process at 673 Kelvin. We discuss the role of various growth factors such as sputtering power, gas pressure, and anneal time on the quality of the VOx films. The optical and electronic properties are studied as a function of temperature (290 K -

400 K) using an optical cryostat and a spectrometer. Our results indicate a large modulation (> 25%) in the spectral reflectance of the films and a two order change in resistance as the temperature of VOx was increased. The impact of the film quality on the thermochromic nature of the films is discussed. This forms the foundational study in identifying the optimal growth conditions of VOx necessary for developing highly sensitive infrared detectors.

# Psychology

Emma Albertino, Psychology, Undergraduate Student
Faculty Mentor:  Denise  Martz, Psychology
Co-Author(s):  Twila Wingrove, Ph.D.
Title:  MENTAL HEALTH OF WOMEN IN EMERGING ADULTHOOD: AN ASSESSMENT OF IN PERSON AND TECHNOLOGICAL SEXUAL ASSAULT
In person sexual assault is well documented. Technological sexual assault, ranging from making online/phone sexual comments to sharing a recorded rape on social media, is not thoroughly researched. This study assessed the relationship between mental health and sexual assault with college women (mean age of 19 & 89.5% Caucasian). The survey contained in person and technological sexual assault questions, a Rape Myth Acceptance scale, and a modified DSM-5 screener with items added for PTSD and eating disorders so that it captured 15 psychological domains. The sexual assault items asked if participants had experienced each form of assault. If any item was positive, she was asked about her relationship to the perpetrator, reporting, frequency, duration of repeated assaults, and if treatment was obtained. Results showed a statistically significant relationship between in person (r = 0.38) and technological assaults (r = 0.35) and worse mental health. Frequency of participants reporting both forms was 76.2%, at least one of in person assault was 81.9%, or at least one of technological assault at 84.8%. A one-way ANOVA showed that participants who experienced both forms (M = 2.23, SD = 0.71) had worse mental health, compared to those reporting one (M = 1.63, SD = 0.41), F(2, 102) = 5.66, p = .005. These results suggest that both in person and technological sexual assault are ubiquitous in the histories of these women and are associated with significantly compromised mental health.

Hannah Castrogiovanni, Psychology, Graduate Student
Faculty Mentor:  Twila  Wingrove , Psychology
Co-Author(s):  Allison Curry, Ashley Tate, & Alissa  Anderson Call
Title:  EFFECTS OF STUDENT AGE ON MOCK JUROR PERCEPTIONS OF A TEACHER-STUDENT SEXUAL ENCOUNTER
Mock jurors often have contradicting views on teachers who are sexual offenders, depending on the gender of the juror themselves, the teacher, and student involved (Fromuth et al., 2010).  The purpose of this study was to examine how mock jurors perceived a sexual encounter between a teacher and a student.  Specifically, we examined the extent that this relationship was defined as an assault, perceptions of teacher responsibility, and perceptions of guilt. We collected data from both undergraduate and mTurk samples.  Overall, we found differences in how mock jurors perceive these encounters, which affected their legal judgements of the case.

Kelsey Charbeneau, Psychology, Undergraduate Student
Faculty Mentor:  Christopher Holden, Psychology
Co-Author(s):  Dr. Amy Page (Sociology) & Dr. Andrew  Smith (Psychology)
Title:  CLARIFYING SADOMASOCHISM IN THE REALM OF SADISTIC NOMENCLATURE
Although recent findings suggest sadism as a facet of antisocial personality associated with malevolent behaviors, sadism in the context of sadomasochism as a sexual practice proposes an ostensible discrepancy.

Trait sadism is broadly defined as the tendency to experience pleasure through the infliction of suffering. However, the consensual nature of a sadomasochistic power exchange implies an element of enjoyment on behalf of the recipient, which suggests a critical distinction from the concept of cruelty that is traditionally associated with sadism. Considering that sadism is typically seen as an aversive trait, distinguishing sadomasochistic variants of sadism from trait sadism would establish a critical disintegration of the BDSM subculture from the stigma of sadistic connotations, as well as guide clinical practice in developing awareness with regard to counseling sadomasochistic practitioners. To explore this, we investigated whether BDSM sadism was significantly different from trait sadism or forensic sadism. We found that scores for each of the measures did not differ significantly between sadomasochistic sadists and non-sadomasochists, although there were significant but small differences between sadomasochistic sadists and non-sadomasochists on only vicarious forms of everyday sadism. Moreover, we found a moderately strong, significant correlation between forensic and everyday forms of sadism. These findings suggest sadistic sexual offense to be closely related to, although separate from, sadistic personality, with sadism in the context of BDSM appearing to be a construct distinct from either of these entities.
Keywords: (sadism, BDSM, dark tetrad, sexual sadism, sadomasochism, S&M, s/m)

Patricia Ferreira, Psychology, Graduate Student
Faculty Mentor:  Twila Wingrove, Psychology
Co-Author(s):  N/A
Title:  THE IMPACT OF SEXUAL ASSAULT NURSE EXAMINER  TRAINING AND EXPERIENCE ON MOCK JURORS' PERCEPTIONS IN A CHILD SEXUAL ABUSE TRIAL
The positive impact of sexual assault nurse examiners (SANEs) in sexual abuse cases and trials is demonstrated throughout the literature. Field and experimental research show that SANEs are perceived as more credible experts than non-specialized registered nurses, and help increase conviction rates (e.g., Golding et al., 2015; Campbell et al., 2014). The primary goal of the current study was to extend these findings by examining factors about SANEs as professionals that may contribute to their positive influence in court. The current study focused on investigating the role of expert training and years of professional experience based on qualitative research illustrating the importance of these variables to jurors' perceptions of expert credibility (Blackwell & Seymour, 2015; Wilcox & NicDaied, 2018). As such, a 2 (Training: SANE, registered nurse) x 2 (Experience: 1 year, 7 years) between-subjects factorial design was used. As predicted, due to their more extensive training, SANEs were perceived as more credible experts than RNs in a child sexual abuse trial. High- versus low-experience experts were also judged as more credible. In addition, high-experience SANEs cumulatively earned the highest credibility ratings relative to all other combinations. In contrast to predictions, conviction rates did not vary by training nor experience. Potential reasons as to why this occurred are discussed, in addition to the legal implications of the findings pertaining to expert credibility.

Sarah Daniel Jackson, School Psychology, Graduate Student
Faculty Mentor:  Dr. Jim Deni, Psychology
Co-Author(s):  Dr. Stephanie Corcoran (The University of Alabama - Birmingham)
Title:  SELF-CARE IN ACTION
Practitioners who utilize self-care strategies can feel a relief of anxiety during times of adversity. This paper presentation will describe a mixed method study that investigated the self-care of practitioners, with the goal of providing recommendations for self-care. We will provide results of a national study on self-care practices of practitioners, including actions taken during the COVID-19 crisis. Practitioners will learn strategies that lead to a healthier workforce.

John Lang, Industrial-Organizational Psychology and Human Resource Management, Graduate Student
Faculty Mentor:  Shawn Bergman, Psychology
Co-Author(s):  Andrea Montoya-Garcia, Jenna Hochstetler, Alexa Sterling, Donovan Mattox, Mulan Lee, Mark Allen, David Ruiz
Title:  LINKING PSYCHOLOGY CURRICULUM WITH CAREER SKILLS: THE FACULTY PERSPECTIVE
There is a perception that students cannot attain adequate employment with an undergraduate psychology degree without pursuing graduate study, consistent with results showing those with only a psychology bachelor's degree are chronically some of the most underemployed employees in the workforce. This high-level of underemployment is relatively surprising given that students who graduate with a bachelor's degree in psychology have many sought-after skills for which employers are looking. Given that a bachelor's degree in Psychology is one of the most popular degree choices in the United States and at Appalachian State University, this misalignment is concerning. Our current research is a part of a multi-pronged initiative to demonstrate the value of an undergraduate psychology degree and help students explore career opportunities that are available to them with a bachelor's degree. The focus is to match the competencies that students develop in the undergraduate psychology curriculum at Appalachian State University to O*NET's knowledge, skills, and abilities (KSAs) framework. By directly mapping the competencies students gain to specific classes, a comprehensive list of occupations and job families for which students would be qualified for can be created and specific vocational guidance can be provided to psychology students. The current study intends to ask professors to rate the extent to which specific competencies are related to the undergraduate psychology courses they have taught in the past three years. We look to publish our research in outlets such as the Teaching of Psychology and generalize our findings to all undergraduate psychology majors.


Connor Linden, Industrial-Organizational Psychology and Human Resource Management, Graduate Student
Faculty Mentor:  Timothy Ludwig, Psychology
Co-Author(s):  Ava Young, Cori Ferguson, Nicholas Granowsky
Title:  APP STATE V. COVID-19
Across the world, the coronavirus (COVID-19) pandemic is changing the landscape of the way in which people live and behave. Practicing infection control behaviors as set forth by the CDC, WHO, and other public health organizations is imperative on college campuses around the country where population density is high and frequent interactions are practiced by students. Behavioral interventions have been documented to work in industry to reduce injury, as well as in health promotion and infection prevention; therefore, behavioral interventions are predicted to be effective in slowing the spread of COVID-19.
While most studies are looking at the outcomes of contracting COVID-19, this study is proactively tackling the health behaviors related to the spread of the virus. Infection control behaviors that students are currently quantifying through on-campus observations are hand sanitizing, mask wearing, and proper social distancing practices. Student observers have been reporting the prevalence of these behaviors through an application created for this study called Habitood, in which observers swipe right or left depending on whether the observed behavior was followed. After six consecutive weeks of student behavior observation, trends are beginning to emerge in key locations on campus that show consistent infection control behaviors that we hope will continue. The ultimate objective of this research is to validate a heat map that is capturing these risky behaviors.


Lauren  Morris, Psychology, Undergraduate Student
Faculty Mentor:  Doris Bazzini, Psychology
Co-Author(s):  N/A
Title:  THE INFLUENCE OF FACE MASKS ON PERCEPTIONS OF BLACK AND WHITE MEN
Due to the recent COVID-19 pandemic, wearing face masks has become a normative behavior in America. However, previous research seems to suggest that face masks may alter how black men (relative to white

men) are perceived by others in society. This study examines whether different types of face masks affect perceptions of the emotions and personality traits of white and black men. Participants (n = 324) completed a survey administered through Amazon's Mechanical Turk (MTurk) in which they rated their pictures of white and black men who were shown wearing a blue surgical mask, a black surgical mask, or no mask. Based on previous research, we predicted that the black man would be perceived as more threatening and untrustworthy across mask conditions. Within race conditions, we expected the black target to be rated in a more negative way when wearing the black surgical mask compared to the light blue surgical mask or no mask at all. A 2 (Race: White vs. Black) X 3 (Mask Type: Blue, Black, None) ANOVA demonstrated significant main effects for both Race and Mask Type, but no interaction emerged. For the race condition, the white male target was rated as more trustworthy than the black male target. This study also found that the blue mask condition increased the perceived trustworthiness of both male targets regardless of race. These findings suggest that the type of face mask worn may not exacerbate racial prejudice towards black men.

Lucy Newsom, Psychology, Undergraduate Student
Faculty Mentor:  Yalcin Achigoz, Psychology
Co-Author(s):  Isabella Lopez, Riggs Matthews, Shawn Bergman, Timothy Ludwig
Title:  GENERATING A PREDICTIVE MODEL FOR INJURY RATES  FOR A CHEMICAL MANUFACTURING COMPANY
Work accidents are costly for both employees and employers. Businesses have typically relied on reactive methods to reduce the number of workplace industries. While these methods have been effective in the past, its ability to reduce workplace injuries has plateaued. To make future strides, safety professionals and scientists will need to modify the way that they approach safety initiatives. Additionally, while workplace injuries occur in all sectors, the manufacturing industry has greater need for safety interventions, as it has higher rates than most.
The next step in reducing injuries centers around a preventative rather than reactive approach. This preventative approach means planning for injuries before they happen. One preventative method that has seen success in the construction industry is predictive modeling. Predictive modeling involves taking diverse sources of data and combining them to predict future outcomes. Despite the manufacturing industry's high injury rates, there is not much focus on using preventative measures for injury reduction. Additionally, previous predictive models have used national-level data. This study plans to advance safety initiatives by using predictive models, and focusing on company level data. The present study intends to add to the predictive analytics field by predicting safety outcomes in a manufacturing facility using company level data.

Kailey Plowman, Psychology, Graduate Student
Faculty Mentor:  Andrew Smith, Psychology
Co-Author(s):  Paul Windschitl
Title:  WISHFUL THINKING IN THE 2020 U.S. PRESIDENTIAL ELECTION: DOES THE PREFERENCE-EXPECTATION LINK CHANGE OVER TIME?
There is a tendency for people's preferences to influence their expectations. For example, numerous studies have shown that people exhibit wishful thinking when making predictions about the outcome of elections. That is, people overwhelmingly expect that their preferred candidate will win. We conducted a study evaluating wishful thinking in the 2020 U.S. presidential election. We were primarily interested in assessing wishful thinking effects over time, and whether the relationship between their preferences and expectations would change during the month leading up to the election. In this study, participants completed surveys at four different time points leading up to the election. Among other things, these surveys assessed participants' preferred winner and their prediction as to the outcome of the election. The results of this study showed robust wishful thinking effects. Approximately 83% of the participants predicted that their preferred candidate would

win the election. Importantly, there was no evidence that wishful thinking changed over time. People exhibited just as much wishful thinking a month before the election as they did a day before the election.

Nicolas Simard, Industrial-Organizational Psychology and Human Resource Management, Graduate Student
Faculty Mentor:  Shawn Bergman, Psychology
Co-Author(s):  Teague Vreeland, Braxton Lee, Andrew Webb, Mackenzie Law, Madison Sexton, Erik Medeiros
Title:  MOVING TOWARD SUSTAINABILITY: AN INVESTIGATION INTO THE RELATIONSHIP BETWEEN ESG SCORES AND ORGANIZATIONAL OUTCOMES IN HRM

The role of Human Resource Management (HRM) professionals in regards to sustainable efforts may not be immediately apparent, but as recent research in the field indicates, HRM professionals are essential to successful company-wide sustainable initiatives. Our current work examines data provided by Mercer LLC and MSCI Inc. in order to investigate potential correlations between sustainable corporate practices and positive HR outcomes. Our intention in investigating this research is to promote the adoption of environmentally friendly policies and to highlight the critical role HRM professionals can play in promoting a sustainable work environment. This approach takes an alternative-profit viewpoint emphasizing both ecological and social progress as essential goals for modern businesses in the form of common good HRM.

Within our dataset of several thousand international corporations, we isolated 128 companies with relevant HR data. Satisfaction, motivation, engagement, and turnover measures were aggregated to create an HR Outcome Score. Using this HR Outcome Score, we have conducted correlational analyses that have yielded compelling results. Moving forward, we will be expanding our examination of this data to industry-level breakdowns of our dataset, examining whether the larger trends of our data hold true across industries and business models.

Ava Young, Psychology, Undergraduate Student
Faculty Mentor:  Timothy Ludwig, Psychology
Co-Author(s):  Cori Ferguson, Nicholas Granowsky
Title:  VALIDATING THE SAFETY MEASUREMENT CULTURE SURVEY: ASSESSING EMPLOYEE SAFETY REPORTING

Organizations are increasingly using data and the outcome of data analysis to make decisions. However, certain organizational practices may taint the data utilized, thereby tainting the decisions made based on analytics. Data must be of good quality to be useful in predicting safety outcomes. The safety measurement culture of an organization, which we define as the culture of an organization around collecting, recording, and using data includes employee participation and management action, arguably plays a large role in determining the quality of data. Accordingly, if organizations can ensure their data is true to life by improving their safety measurement culture, their data will more accurately represent behaviors occurring in their facilities and decisions based on data analytics will become more valuable. To assess employee perceptions that impact data quality a Safety Measurement Culture Survey was developed to assess factors impacting employee participation and management action in safety measurement. This study will examine the tool's criterion-related validity by assessing the relationship between the results of the survey and actual safety outcomes, such as near misses and minor injuries, in an organization. We hypothesize that measurement culture is positively correlated with counts of near-misses and hazards, and there is a negative correlation between safety measurement culture and injuries.

# Walker College of Business

## Computer Information Systems

Will O'Malley, Marketing, Undergraduate Student
Faculty Mentor:  Jason Xiong, Computer Information Systems
Co-Author(s):  Caleb Wright, Manas Desai
Title:  CRYPTOCURRENCY AND CORONAVIRUS: HOW A GLOBAL  PANDEMIC AFFECTS DECENTRALIZED CURRENCY

Cryptocurrency is a digital, intangible currency that utilizes blockchain technology as an operating system. Blockchain technology acts as an immutable ledger therefore making cryptocurrency significantly more secure than traditional methods. Since the inception of cryptocurrency, there has been a slow growth rate of adoption. However, this has changed within the past two years.

In November of 2019, a SARS-CoV-2 outbreak began to spread around the world. During that time, there was a significant increase in both the value and adoption of cryptocurrencies such as Bitcoin and Ethereum. In contrast to this financial phenomenon, most of the global economy went into a freefall due to the pandemic. Leaving a distrust in central, national currencies, a surge of people turned to cryptocurrency to keep their money safe during this unprecedented time. This alongside other factors led to a higher adoption rate of this intangible technology than ever recorded. Through survey questions utilizing Igbaria's Model and Cognitive Dissonance Theory, the behavior that caused increased adoption and the Coronavirus pandemic has a causal relationship.

Human behavior has been impacted by the Coronavirus pandemic and has caused thousands to reconsider how their money is stored. The purpose of this research it to connect these two concepts. In order to understand how to further push mass adoption of cryptocurrency, it is crucial to understand what caused this rapid increase in value during COVID-19.

## Economics

Connor Lubsen, Economics, Undergraduate Student
Faculty Mentor:  Brock Stoddard, Economics
Co-Author(s):  N/A
Title:  INDIVIDUALISTIC AND COLLECTIVISTIC MINDSETS IMPACT ON COOPERATIVE BEHAVIOR IN SOCIETY

This research program will study the different effects that individualistic and collectivistic mentalities have in economic games. Individualists see events between people as independent; where the collectivists see events between people as ultimately connected. This research will aim to observe those differences in how subjects interact with one another in an experiment. Participants will first complete a triad task that scores them on an individualist/collectivist scale. Next, participants will play a prisoner's dilemma game. In the game, matched participants choose between cooperative and deviant actions. Participants' payoffs vary depending on their own and their matched partners' actions. Participants will play this game for multiple interactions, and for multiple rounds within each interaction. Participants will be matched with a participant for each  dilemma game interaction. To further highlight differences between individualists and collectivists, in some experimental sessions, subjects will participate in a group identity task prior to the prisoner's dilemma interactions. The group identity task will split participants in a session into two separate teams. Participants knowing if their partners are from the in-group or the out-group will create a bias. When matched with an in-group partner, we

predict cooperation rates will be higher for collectivists. However, when matched with an in-group partner, we predict cooperation rates will be higher for individualists.

Carlie Smith, Economics, Undergraduate Student
Faculty Mentor:  Brock Stoddard, Economics
Co-Author(s):  N/A
Title:  FRAMING & INEQUALITY IN PUBLIC GOODS GAMES
We study framing effects in repeated social dilemmas by comparing payoff equivalent Give and Take framed public goods games under varying endowment and productivity inequality. In the Give frame, group members contribute endowed tokens to a public good. In the Take frame, group members can take from an existing public good up to a predetermined limit. Within games that reflect endowment inequality, four group members will be divided,  half each receiving 15 convertible tokens (or a maximum take of 15 tokens) and the other half each receiving 5 convertible tokens (or a maximum take of 5 tokens). Within games that reflect productivity inequality, group members will have different capabilities for producing a public good. Token contributions to (or tokens left in) the public good by half of the group members will have a higher production value for the group than the production value of tokens from the other half of the group members. We will be analyzing decision making across 10 decision rounds, to assess whether framing and  inequality affect subjects' decisions. We will utilize statistical hypothesis tests and regression analysis to perform our behavioral analysis.

# Marketing and Supply Chain Management

Sonoma Dixon, Supply Chain Management, Undergraduate Student
Faculty Mentor:  Steven Leon, Marketing and Supply Chain Management
Co-Author(s):  Hoon Choi
Title:  PERSONALITY AND ITS AFFECT ON CONSUMER SATISFACTION AND LOYALTY IN THE UNITED STATES AIRLINE INDUSTRY
Service quality has been shown to positively influence customer satisfaction and customer satisfaction has been shown to positively influence loyalty. Even though the airline industry invests in customer experience initiatives, United States airlines rank low in satisfaction surveys. Several studies have identified that personality influences consumer and job satisfaction. Thus, the objective of this study is to determine if personality has a significant impact on consumer satisfaction and loyalty in the airline industry. Linear regression was employed to determine such impact. Data were collected through an online survey in 2018 through Amazon Mechanical Turk to ascertain personality, satisfaction, service quality, loyalty, and trust variables. The survey resulted in 624 usable responses. It is expected that the Big 5 Personality types will have a significant impact on both consumer satisfaction and behavioral intention loyalty. The results show that, in part, personality does influence satisfaction, though not necessarily loyalty. This research can be used to increase the understanding of consumer satisfaction in the United States airline industry. Moreover, this research delves into a new impact on the consumer sector of the United States, laying the groundwork for potential future studies about satisfaction and personality.

# Reich College of Education

## Curriculum and Instruction

Rachel Nelson, Educational Leadership, Graduate Student
Faculty Mentor:  Elizabeth Bellows, Curriculum and Instruction
Co-Author(s):  N/A
Title:  LEARNING TO TEACH IN TROUBLING TIMES: AN EXPLORATION OF CULTURALLY RESPONSIVE TEACHING AND EDTPA

Seeking to explore the experiences of students choosing to enter the field of education, this study investigates how the state-mandated teacher performance assessment (edTPA) interacts with individuals' understanding and implementation of Culturally Responsive Teaching (CRT).  As of September 1, 2019, North Carolina adopted edTPA as part of their initial teacher licensure system. EdTPA is completed during the student teaching process because the teacher candidates must have access to a classroom, students to film, and lesson planning opportunities. This study highlights the experiences of student teacher interns inside the classroom. It also provides valuable insight into how edTPA is experienced throughout this journey to full teacher licensure amidst the global pandemic. This mixed-method study utilizes a survey in addition to semi-structured interviews in order to provide readers with a sense of the teacher-candidates' experiences. Findings may have implications for Educator Preparation Programs as these students reflect on their program's utilization of culturally responsive teaching practices, support and enactment of edTPA, along with their general concerns about becoming a teacher during a global pandemic.

## Leadership and Educational Studies

Rachael Moyer, Educational Leadership, Graduate Student
Faculty Mentor:  Alicia Muhammad, Leadership and Educational Studies
Co-Author(s):  N/A
Title:  SERVING MULTIPLE GODS: A NARRATIVE INQUIRY OF THE CULTURE OF DISTRIBUTED INSTRUCTIONAL LEADERSHIP IN AN IB MYP SCHOOL

The purpose of this study was to explore hero's journeys through distributed instructional leadership experiences to highlight a reliance on pedagogical intelligence. The study's conceptual framework incorporated Clandinin and Connelly's (2006) commonplaces of narrative inquiry that consider temporality, sociality, and place to answer this primary research question: how do pedagogical leaders in a North Carolinian public middle school with an IB Middle Years Programme construct and describe the culture of distributed instructional leadership? The objective of this study was to analyze instructional leadership stories in order to understand leaders' pedagogical intelligence in an IB public school context. This qualitative study incorporated the methodology of narrative inquiry through open-ended interviews of three participants from one school setting. Using Joseph Campbell's (2004) phases of the hero's journey, the researcher restoried instructional leadership experiences that follow the archetypal paths of three group-oriented heroes: the traditional hero, the catalyst hero, and the sacrificial hero. This study found that the teacher leader, the IB coordinator, and the principal all experienced the push-pull of IB programming requirements as well as additional state, district, and school level priorities. This push-pull of the power structure within the public IB school setting created conflict for each of the heroes who essentially have been forced to serve different metaphorical gods. As a result of

this conflict, each of the participant-heroes experienced growth and gained pedagogical intelligence so that each can transfer knowledge and skills to future distributed instructional leadership experiences.


# College of Fine and Applied Arts


## Art

Elizabeth Popovic, Art and Visual Culture, Undergraduate Student
Faculty Mentor:  Heather Waldroup, Art
Co-Author(s):  N/A
Title:  CLOUDED VISION: ART AND EXHIBITION DURING WWI
During the First World War, the first efforts to memorialize the conflict were heavily influenced by the propaganda characteristic of the era. The style of modernism found new precedence during the conflict due to its unfiltered portrayal of war. Official British war artists were commissioned by the British War Memorial Committee (BWMC) starting in 1918, and many such as C.R.W. Nevinson and Wyndham Lewis contributed modernist works. These actions are indicative of those that drove the British government to become a propaganda machine. Firstly, the BWMC manipulated the growing popularity of modern artists and adapted their work to fit the government's narrative. Secondly, the subjectivity of the modern works, an element that contributed to their popularity, was distorted as the BWMC saw fit. Lastly, the BWMC was founded by leaders who saw themselves as harbingers of culture, with little concern as to the everyday hardship the conflict brought. After the collapse of the BWMC, these works were acquired by the Imperial War Museum (IWM). The IWM tended to either place these works in their archive or display them in a very traditional manner, at odds with the themes and subject matter of the works. Thus, I argue, these paintings have been remembered for their involvement in memorialization politics rather than the artworks' own interpretations of an unprecedented conflict.


## Sustainable Technology and the Built Environment

Henry Bunn, Technology, Graduate Student
Faculty Mentor:  Chris Tolbert, Sustainable Technology and the Built Environment
Co-Author(s):  N/A
Title:  THE EFFECT OF HIGHLY VARIABLE IRRADIANCE PATTERNS ON PHOTOVOLTAIC CELL PERFORMANCE FOR THE APPLICATION OF SOLAR VEHICLES
In the United States, most of the burden of transportation emissions and energy consumption falls on individuals and how they transport themselves with light duty internal combustion engines. Electric vehicles are increasingly an available option for light-duty vehicles. Incorporating photovoltaics on electric vehicles has the potential to reduce electric vehicle energy consumption from the grid, increase the vehicle's range, and reduce the cost of transportation by offsetting purchased electricity with electricity produced by a photovoltaic array. Incorporating losses due to rapidly changing shading conditions associated with mobile solar applications continues to be a gap in knowledge for modeling electric vehicles with solar inputs. Unlike conventional photovoltaic systems, solar vehicle photovoltaics regularly experience rapidly changing irradiance due to shading.
This study looks at the impact of moving shade in relation to photovoltaics and how these characteristics change with shading speed. With an experimental bench-scale design, this research analyzes the effects of different shading speeds on voltage, current, power, and energy. This research project found the voltage

associated with stagnant shading is less than that of moving shade, while the current associated with stagnant shading is greater than that of moving shade. Photovoltaic cells generated less power under moving shade conditions than they did under equal stagnant shading conditions.

Alex  Christofalos, Sustainable Technology, Graduate Student
Faculty Mentor:  Jeremy  Ferrell , Sustainable Technology and the Built Environment
Co-Author(s):  N/A
Title:  COMPARATIVE ANALYSIS OF AFRICAN BLUE BASIL  UNDER THREE SUPPLEMENTAL LIGHTING SYSTEMS IN A CONTROLLED ENVIRONMENT

Agriculture has changed over the past few decades along with the climate. Today there is estimated to be over 414,127 hectares of greenhouses covered land in the world. Supplemental lighting helps with growing season extension in colder climates, and with growing in completely controlled environments. The purpose of this study was to compare three different supplemental lighting systems: a high pressure sodium lamp (HPS), a plasma lamp, and a LED bar light. In this study, Ocimum kilimandscharicum × basilicum  (African blue basil) was grown under each lamp receiving the same photosynthetic photon flux density (350 PPFD) with the same photoperiod of 16 hours for a total daily light integral (DLI) of 20 moles per square meter. During the study, the height of the basil was measured periodically, and differences between the plants under each system were noted. Environmental parameters being logged during this time were soil moisture content, temperature and relative humidity, $CO_2$ levels, and energy usage for each system. At the end of the study, height, and the wet and dry biomass of African blue basil grown under each lighting system will be measured. Preliminary results show that plant growth under the HPS lamp is 19.6 % taller than LED with more leaves/vegetative growth. The results also show that the plasma lamp uses 53% more energy when compared to the LED system. This study will be concluded mid - April.

Tyree Wilmoth, Sustainable Technology, Graduate Student
Faculty Mentor:  Jeff Ramsdell, Sustainable Technology and the Built Environment
Co-Author(s):  N/A
Title:  CHARACTERIZING THE INFLUENCE OF IMPLEMENTING ORGANIZATIONS ON HOLLOW FIBER MEMBRANE FILTER ADOPTION

At least 2 billion people use drinking water contaminated by fecal matter, which is a major cause of waterborne illness. Household water treatment (HWT) products like hollow fiber membrane (HFM) filters are an interim solution to point-of-use water treatment in low-income communities. A variety of factors affect whether beneficiaries of a HWT product adopt the technology, yet little research focuses on implementing organizations' awareness of these factors. This research characterizes the intervention methods used by 23 organizations that distribute HFM filters. An adoption domain framework is applied to survey responses to quantify the organizations' sensitivity to factors of adoption within five adoption domains: User Preferences, Integration & Collaboration, Government Influence, Resources & Communication, and User Training. Statistical analysis is used to assess the relationship between organizations' sensitivity to domains and what they define as indicators of successful adoption. Results conclude that organizations that have robust monitoring and evaluation are likely to define successful filter adoption through follow up evaluation. Organizations that offer communication channels are likely to define filter adoption through reported satisfaction and increased filter demand. Lastly, organizations that are aware of user preferences are likely to view self-reported evidence of improved health and the filter's presence during follow up as successful adoption indicators.

# Beaver College of Health Sciences

## Communication Sciences and Disorders

Annie Bresko, Communication Sciences and Disorders, Undergraduate Student
Faculty Mentor:  Jordan Hazelwood, Communication Sciences and Disorders
Co-Author(s):  N/A
Title:  SLPS' PERSPECTIVES ON TRAINING IN A STANDARDIZED  APPROACH TO MODIFIED BARIUM SWALLOW STUDY (MBSS): A QUALITATIVE STUDY
The modified barium swallow study (MBSS) is an assessment that allows speech-language pathologists (SLPs) to visualize physiologic function and impairment of the swallowing mechanism. MBSSs are performed by SLPs as a part of regular clinical practice. Standardizing this assessment may help increase accuracy of study results and communication when interpreting patient outcomes. Currently, SLPs at a large medical trauma center in Atlanta, GA are training in one such  standardized approach, the Modified Barium Swallow Impairment Profile (MBSImP). As part of a large mixed-methods study, this qualitative analysis will describe the perspectives and experiences of the SLPs who have completed MBSImP training to better understand the impact of this training on protocol delivery and clinical documentation. Through focus-groups with low-moderator involvement and non-structured interviews, we will collect perspectives of clinicians before and after MBSImP training. Post hoc open coding will define core reported themes until data saturation has been reached. Outcomes of a recent literature review and proposed study methods will be shared.

Leanna  Pollack, Speech-Language Pathology, Graduate Student
Faculty Mentor:  Jordan Hazelwood, Communication Sciences and Disorders
Co-Author(s):  N/A
Title:  ONLINE RESOURCES FREQUENTLY UTILIZED BY SPEECH-LANGUAGE PATHOLOGISTS FOR DYSPHAGIA MANAGEMENT
Speech-language pathologists (SLPs) have access to an infinite number of online resources to help manage patients with swallowing disorders (dysphagia). SLPs' ability to critically review online resources is imperative as the credibility of online resources may directly impact patient health. Survey responses gathered from affiliates of a dysphagia interest group revealed which online resources are frequently utilized by SLPs. Online resources were rated using the DISCERN instrument, a standardized metric used to assess the quality of written consumer health information. Pearson's correlations determined relationships between respondent characteristics, self-reported levels of familiarity and confidence with critically reviewing online resources, and mean total DISCERN scores. Of 88 survey respondents, most were extremely familiar with critically reviewing online resources with moderate levels of confidence. Familiarity and confidence did not correlate significantly with mean total DISCERN scores. Most online resources were of mediocre quality, while mean total DISCERN scores did not vary significantly by any of the respondents' characteristics (age, clinical experience, board certification, practice setting, and region). The results of the study show that no one factor influences SLPs' evaluation of online resources for managing dysphagia. This supports the need for professional training in the critical review of online resources, especially during the COVID-19 pandemic.

# Health and Exercise Science

Marc Augenreich, Exercise Science, Graduate Student
Faculty Mentor:  Jonathon Stickford, Health and Exercise Science
Co-Author(s):  Province V.M., Stute N.L., Stickford A.S.L., Ratchford S.M.
Title:  LONGITUDINAL OBSERVATIONS OF METABOLIC AND VENTILATORY RESPONSES DURING INCREMENTAL EXERCISE IN YOUNG ADULTS FOLLOWING SARS-COV-2 INFECTION

Purpose: To examine metabolic and cardiorespiratory responses during exercise over a 3- month period in young adults following severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection.

Methods: Young adults who tested positive for SARS-CoV-2 in the previous 3-4 weeks completed an incremental exercise test to volitional exhaustion on a cycle ergometer (V1). Exercise tests were repeated monthly for three additional months (V2-V4). Metabolic and ventilatory data at rest; during cycling at 0W, 60W, and 120W; and at peak exercise were compared across visits.

Results: The absolute volume of oxygen ($O_2$) consumed (L·min-1), when collapsed across rest and all exercise intensities, increased from V1 to V2 (V1: 1.16±0.06 ;V2: 1.24±0.08; p=0.02) and tended to remain elevated above V1 for the remainder of the study period (V3: 1.21±0.07; V4; 1.22±0.08; p=0.06). Heart rate and $O_2$ pulse remained similar across visits (p>0.05). Though pulmonary ventilation at rest and each exercise intensity were unaltered, tidal volume (VT) increased to a greater extent as work rate increased from 0W to 60W during V2, V3, and V4 compared with during V1. Additionally, VT at peak exercise increased more during V2 compared with at V1 (p<0.05).

Conclusion: These data suggest that $O_2$ consumption during exercise may be limited early following SARS-CoV-2 infection but it is recovered within two months. VT expansion during submaximal exercise also appears to be limited but is restored within two months.

Emily Benson, Public Health, Undergraduate Student
Faculty Mentor:  Adam Hege, Health and Exercise Science
Co-Author(s):  Aaron Carpenter, Rebecca Hagedorn, Lanae Hood, Julia Waity, Jessica Soldavini, Amelia Huelskamp, Elizabeth Wall-Bassett, Lillian MacNell, Maureen Berner
Title:  HOW DOES FOOD AND HOUSING INSECURITY INFLUENCE THE ACADEMIC PERFORMANCE OF UNIVERSITY AND COLLEGE STUDENTS? EVIDENCE FROM A SAMPLE  OF EIGHT NC UNIVERSITIES AND COLLEGES

Food and housing insecurity, growing public health problems among U.S. university and college students, negatively impact student wellbeing and academic performance. College and university students (N=6,263) at eight universities in North Carolina completed an online, cross-sectional survey. A 10-item Adult Food  Security Survey Module was used to assess food insecurity. Housing security was measured using six adapted questions from the national Survey of Income and Program Participation Adult Well-Being Module. Academic performance was measured by four questions (response selections: 'excellent', 'good', 'fair', 'poor') focused on progress toward graduation, class attendance, class focus, and class concept understanding. Descriptive analyses were performed and Pearson's chi-square tests utilized. Of the sample, 43% were food insecure and 48% were housing insecure. Most students reported good academic performance, with 12.5% reporting 'fair/poor' progress toward graduation, 7.7% 'fair/poor' class attendance, 29.2% 'fair/poor' attention in class, and 15.4% 'fair/poor' understanding of class concepts. The mean GPA was 3.45, with 19% reporting a 3.0 or less. Among those reporting 'good or excellent' on each of the individual academic performance indicators, there were statistically significant lower odds of both food and housing insecurity. College and university administrators and elected officials should implement policies and interventions to improve food and housing security.

Taylor Berry, Psychology, Undergraduate Student
Faculty Mentor:  Christopher Seitz, Health and Exercise Science
Co-Author(s):  Zach Dumaine, Cody Shina, Katie Bigelow, Grace Ruffin
Title:  AN INCREASE IN ANXIETY AMONG COLLEGE STUDENTS OVER THE PAST TEN YEARS: A SECONDARY ANALYSIS
Background: College students who experience anxiety is a major public health issue and should assessed over time. Therefore, the purpose of this secondary data analysis was to track variables associated with anxiety to determine if there has been an increase during the past ten years.
 Methods: Every semester, the National College Health Assessment (NCHA) is facilitated by the American College Health Association among by a nationally representative sample of college students in the country. From the NCHA reports of 2008 to 2019, this study assessed the percent of students who reported: feeling overwhelming anxiety, being diagnosed with or treated for anxiety, and having their academic performance negatively impacted by anxiety. The study also examined the percent of students who were interested in receiving, and those who actually did receive, information about anxiety from their college.
 Results: From 2008 to 2019, there was an increase in the percent of students who reported: feeling overwhelming anxiety (49%, 65%), being diagnosed with or treated for anxiety (10%, 24%), having academic performance negatively impacted by anxiety (18%, 27%), being interested in receiving information about anxiety from their college (46%, 65%), and receiving that information (51%, 66%).
 Discussion: The drastic increase in anxiety calls for more campus resources to address the issue (e.g., information, awareness, prevention, treatment).

Mckayla Blackwelder, Public Health, Undergraduate Student
Faculty Mentor:  Christopher  Seitz, Health and Exercise Science
Co-Author(s):  N/A
Title:  ONLINE SUICIDE PREVENTION INFORMATION: A SMOG READABILITY ANALYSIS
Background: Given the average reading level of Americans, it is recommended that health education materials be written at a fourth to sixth grade level. Previous research has found that health education materials are often written above the recommended reading level; however, there have not been any studies that has analyzed the reading level of suicide prevention information online.
Methods: The website google.com was searched using the terms: suicide, suicide signs, suicide prevention, suicide help. The websites listed on the first page of results were included in the study. A sample of written text from the websites regarding information to prevent suicide for a loved one were analyzed for readability using the SMOG formula.
Results: The 18 websites included in the study were written above the recommend reading level, ranging from the eighth grade to the first year of college, with an average reading level of the tenth grade.
Discussion: Suicide prevention information is not serving its purpose for the public's health if it is not easy to understand. Organizations focused on suicide prevention should edit their website materials to be at the reading level of the average population, as online information is easily accessible to everyone.

Abbey  Bush, Exercise Science, Undergraduate Student
Faculty Mentor:  Kimberly  Fasczewski, Health and Exercise Science
Co-Author(s):  LaVerene Garner, Sara Powell
Title:  EXPLORING VIRTUAL PHYSICAL THERAPY-BASED PHYSICAL ACTIVITY PROGRAMMING FOR INDIVIDUALS LIVING WITH MULTIPLE SCLEROSIS: A NEEDS ASSESSMENT
Multiple sclerosis (MS) is a chronic neurodegenerative autoimmune disease that affects the central nervous system, resulting in fatigue, coordination difficulties, cognitive impairments, and reduced quality of life. Physical activity (PA) can reduce MS symptoms, and is often part of clinical therapy programs; however, people with MS tend to be physically inactive. During the past year, it has been challenging for immunosuppressed individuals

such as those living with MS to participate in PA programming due to COVID-19 concerns. Therefore, the current study examined the perspectives of physical therapy (PT) professionals to elucidate the feasibility of implementing a virtual PA intervention, gauge their use of PA behavior change theory, and explore interest and willingness to introduce a virtual behavior-change-based PA program. Online survey data were collected from licenced PTs (N = 339). Results indicated 214 respondents (63.1%) currently have access to telehealth technology. Only 63 (18.6%) envision using this technology with individuals diagnosed with MS, with 131 (38.6%) reporting they were unsure about using it. A weak negative correlation between years in practice and use of behavior change theory was found (r = -.123, p<.05), with 165 respondents (48.7%) reporting no use of these theories in their practice. Most PT professionals believe that virtual programming would be a beneficial treatment type. However, additional education on behavior change theory is necessary.

Matthew Canjar, Exercise Science, Undergraduate Student
Faculty Mentor:  Rebecca Kappus, Health and Exercise Science
Co-Author(s):  Dylan Richard
Title:  THE EFFECTS OF COVID-19 ON YOUNG VETERANS' CARDIOVASCULAR HEALTH
INTRODUCTION:  Previous pandemics such as the Spagnola pandemic in 1918, have been followed by a surge of cardiovascular events, with the total deaths from cardiovascular events outweighing the total deaths from all other causes. It is unclear how the current COVID-19 pandemic will affect individuals already suffering a high risk of cardiovascular disease, such as the veteran/military population. Risk factors for cardiovascular disease already displayed in military populations, such as poor sleep quality, inadequate nutrition, elevated stress, and smoking/drinking, may be further amplified during a pandemic, resulting in a surge in cardiovascular events in the veteran population.
PURPOSE:  To determine if traditional risk factors for cardiovascular disease are exacerbated during the COVID-19 pandemic, and if these risk factors affect student veterans more than the general student population.
METHODS:  We are seeking 100 students (50 veterans, 50 civilians) to complete a questionnaire assessing health history, physical activity, diet, and mental health both before and during COVID-19. Data collection is ongoing, with 55 responses to date. The results will be compared to determine the impact of COVID-19 on cardiovascular risk factors. Our hypothesis is that there will be an increase in risk factors for cardiovascular disease during the COVID-19 pandemic and that these risk factors will affect student veterans more so than the general student population.

Katie Childers, Public Health, Undergraduate Student
Faculty Mentor:  Adam Hege, Health and Exercise Science
Co-Author(s):  N/A
Title:  ENVIRONMENTAL CONSERVATION AND ITS RELATION TO PUBLIC HEALTH POLICY
During the modern era, protecting and caring for the natural world has become increasingly more important. Environmental health, conservation, and environmental protection have proven to be economically beneficial while also keeping Americans connected to nature. This paper focuses on how the five primary components of public health policy are incorporated into environmental conservation efforts. These policy components are legal, epidemiological, economic, political, and ethical. Each component of public health policy plays a vital role in the success of our efforts to maintain the beauty and safety of the world in which we all inhabit.

Lillie Cook, Biology, Undergraduate Student
Faculty Mentor: Abigail Stickford, Health and Exercise Science
Co-Author(s): Valesha Province, Marc Augenreich, Jonathon Stickford, Stephen Ratchford
Title: LONGITUDINAL TRACKING OF HEART RATE AND BLOOD PRESSURE IN INDIVIDUALS
RECOVERING FROM SARS-COV-2

BACKGROUND: Individuals with post-acute sequelae of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) report autonomic impairments such as orthostatic tachycardia. However, the impact of SARS-CoV-2 on autonomic and cardiovascular function in otherwise healthy individuals remains largely unclear.
METHODS: Young adults (n=9, 5F) who tested positive for SARS-CoV-2 came to the laboratory 3-4 weeks post-diagnosis (V1), one month (V2), 2 months (V3), and 3 months later (V4). Beat by beat systolic (SBP) and diastolic (DBP) arterial blood pressure, and heart rate (HR) were continuously measured at rest and during a 60°head-up-tilt (HUT) test.
RESULTS: Resting SBP (V1: 132±13, V2: 131±14, V3: 130±11, and V4: 129±10 mmHg), DBP (78±6, V2: 78±5, V3: 76±9, and V4: 75±6 mmHg), and HR (V1: 63±10, 64±9, V3: 63±8, and V4: 64±6 bpm) did not change between visits 1-4 (p>0.05).  Similarly, the SBP, DBP, and HR responses to HUT did not change over time (p>0.05).
CONCLUSION: Infection with SARS-CoV-2 does not appear to impact supine resting or upright BP and HR over four months of recovery in otherwise healthy young adults who experience no-to-mild COVID-19 symptoms.


Makenzie Corgan, Exercise Science, Undergraduate Student
Faculty Mentor: Scott Collier, Health and Exercise Science
Co-Author(s): Sarah Brown, Paige Bramblett, Ben Lloyd
Title: DETRIMENTAL SLEEP SCHEDULES IN FIREFIGHTERS AND POLICE OFFICERS

Firefighters (FF) and police officers' (PO) occupations lead to poor sleep quality and quantity. Disturbed sleep in these occupations can lead to poor life or death decision-making. The purpose of this study was first to quantify the sleep of these two professions; and second, to compare it to age-matched normative data. Methods: 13 male and female PO and 10 male FF completed all 3 nights of polysomnography recordings (Sleep ProfilerTM).  A rmAnova was used to determine differences in sleep values with significance set at p<0.05. Results: Three important variables; deep sleep (PO: 1.6 +/- 0.1 vs. 0.8 +/- 0.3 hrs; FF: 2.7 +/-1.4 vs. 3.0 +/- 1.0 hrs), rapid eye movement (PO: 1.4 +/- 0.1 hrs vs. 0.8 +/- 0.3 hrs; FF: 1.1 +/- 0.7 vs 1.1 +/- 0.5 hrs), and spindle duration (PO: 2.9 +/- 0.4 Hz. vs 14.7 +/-5.4 Hz.; FF: 6.0 +/- 10.3 vs. 7.6 +/- 7.8 Hz.) for PO and FF were statistically and/or clinically significant between sleep at home or in the barracks and between night and day shifts. All sleep results were significantly more deleterious when compared to normative data.
Conclusions: These data demonstrate that both police officers and firefighters show poor sleep architecture. However, police officers' poor sleep may be due to circadian disruption while the firefighters' poor sleep may be due to sleeping in the barracks versus sleeping at home.  These results, when compared to age-matched normative data shows clinical manifestations of disturbed sleep in PO and FF populations.


Andrew Davis, Biology, Undergraduate Student
Faculty Mentor: Jonathon Stickford, Health and Exercise Science
Co-Author(s): Province, V.M., Augenreich, M.A., Stute, N.L., Stickford, A.S.L., Ratchford, S.M.
Title: EVALUATION OF PULMONARY FUNCTION DURING RECOVERY FROM SARS-COV-2 INFECTION
IN YOUNG ADULTS

PURPOSE: The purpose of this study was to examine pulmonary function of otherwise healthy, young adults over a period of 4 months after testing positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

METHODS: Otherwise healthy, young adults completed pulmonary function testing using a volume displacement plethysmograph 3-4 weeks after a positive SARS-CoV-2 test result (M1), as well as at 1, 2, and 3 months following baseline testing (M2, M3, and M4 respectively). Subjects completed a forced expiratory maneuver in triplicate to assess spirometry, as well as maneuvers to assess lung volumes and maximal voluntary ventilation (MVV).

RESULTS: Peak expiratory flow (PEF; L·s-1) was greater at M3 and M4 compared with M1 (M1: 8.5±1.3; M2: 8.9±1.6; M3: 9.3±1.5; M4: 9.2±1.7; p=0.04). MVV (L·min-1) was greater at M4 compared with M1 and M2 (M1: 147.9±37.5; M2: 146.4±40.2; M3: 160.6±39.6; M4: 166.1±38.7; p=0.005). The change from M1 to M4 in PEF significantly correlated with the change in mid-maximal forced expiratory flow (p=0.049). Lung volumes were maintained over the 3-month study period.

CONCLUSION: High flow rates are reduced in the initial 2 months following SARS-CoV-2 infection and that ability is returned at M3 following infection (e.g., improved large airway function). Most spirometry and lung volume measurements are near predicted and do not change over the 4-month study period in a group of young adults who experienced mild symptoms.


Lauren Elliott, Public Health, Undergraduate Student
Faculty Mentor:   Christopher Seitz, Health and Exercise Science
Co-Author(s):  Julianna Rodriguez-Cruz, Margaret Lloyd, Cody Shina, Grace Ruffin
Title:  A DESCRIPTIVE ANALYSIS OF COMPLAINTS ON YELP.COM  ABOUT RESTAURANT STAFF NOT WEARING FACE MASKS  DURING COVID-19
Background: The CDC recommends the use of face masks to prevent the spread of COVID-19. The guideline to wear face masks are especially important for those who prepare and deliver food; however, not everyone adheres to wearing masks. As such, the purpose of this study was to analyze the website Yelp.com for complaints about restaurant staff who do not wear masks. Methods: During February of 2021, a Google advanced search of Yelp.com was performed using the terms: not wearing a mask and not wearing masks with each of the following search terms: host, hosts, hostess, hostesses, server, servers, waiter, waiters, waitress, waitresses, bartender, bartenders, cook, cooks, drive thru, and drive through. The number of complaints estimated by Google for each search was analyzed using descriptive statistics. Results: There was a total of 221,235 complaints on Yelp.com about not wearing masks regarding the following types of staff: servers (47%), drive through (17%), cooks (14%), hosts (11%), and bartenders (11%). Discussion: There was a shocking number of complaints on Yelp.com about restaurant staff who were not wearing masks during a pandemic. In addition, the study's findings are a conservative estimate, due to the limited number of registered Yelp.com users and search term parameters. Finally, the number of complaints varied by type of staff, which may be due to the amount of interaction that customers typically have with each type of restaurant worker.


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Faculty Mentor:  Adam Hege, Health and Exercise Science
Co-Author(s):  Grace Ruffin (Non-ASU Researchers - Rebecca Hagedorn, Lanae Hood, Julia Waity, Jessica Soldavini, Amelia Huelskamp, Elizabeth Wall-Bassett, Lillian MacNell, Maureen Berner)
Title:  FOOD INSECURITY AND THE IMPACTS ON MENTAL AND PHYSICAL HEALTH OUTCOMES AND PERCEIVED HEALTH STATUS AMONG A SAMPLE OF STUDENTS  AT EIGHT NC UNIVERSITIES AND COLLEGES
Food insecurity is a growing public health problem among U.S. university and college students and can have broad negative impacts on physical and mental health outcomes. College and university students (N=6,263) at eight higher education institutions in North Carolina completed an online, cross-sectional survey. This survey included the USDA's 10-item Adult Food Security Survey Module, the CDC's Healthy Days Core Module (HDCM), and self reported body mass index (BMI) and health status measurements. Descriptive analyses were performed and Pearson's chi-square tests were utilized for comparisons. Of the sample, 43% were

considered food insecure (22.4% very low food security). Nearly half (46.2%) of respondents had at least one bad physical health day, nearly three-fourths (71.7%) reported at least one bad mental health day, and 51.7% reported these outcomes keeping them from doing normal daily activities at least one day in the past month. Approximately one-fourth reported their health status as 'fair or poor' and 36% were overweight or obese. Food insecurity was associated with increased odds of poor physical health (OR=1.54) and mental health (OR=1.94), being kept from normal daily activities (OR=2.40), reporting a 'fair or poor' health status (OR=3.04) and being overweight or obese (OR=1.55). Colleges and university administrators and elected officials should strive to implement policies and interventions aimed at improving the food security status of students.

Laurel Koontz, Exercise Science, Graduate Student
Faculty Mentor:  Stephen Ratchford, Health and Exercise Science
Co-Author(s):   Valesha M Province, Nina L Stute, Marc A Augenreich, Jonathon L Stickford, Abigail S Stickford, Stephen M Ratchford
Title:  LONGITUDINAL TRACKING OF VASCULAR FUNCTION AMONG YOUNG ADULTS WITH SARS-COV-2

Background: The SARS-CoV-2 virus may be inflicting detriments to the cardiovascular system, both directly through angiotensin converting enzyme 2 receptor as well as initiating systemic inflammation. In particular, recent evidence has suggested a decrease in vascular function in the arms and legs which may persist for some time following recovery from SARS-CoV-2.

Methods: We have assessed vascular function in 7 young healthy adults (4M/3F, 20±1y, 174±12cm, 72±8kg) who tested positive for SARS-CoV-2. Using Doppler ultrasound, brachial artery flow-mediated dilation (FMD) in the arm and single passive limb movement (sPLM) in the leg were assessed as markers of vascular function at baseline (3-4 weeks after testing positive for SARS-CoV-2) and at 1-month and 2-month follow up testing visits. Data are mean±SD.

Results: The sum of shear at peak brachial artery vasodilation decreased from baseline (81,369±35,101AU) to the 2-month follow up visit (50,584±36,606AU) (p<0.05). FMD tended to increase from baseline (2.30±1.32%) to the 1-month follow up (3.85±1.47%, p=0.07) and 2-month follow up (3.57±1.34%, p=0.08) visits. The 30-second area under the curve for the single passive limb movement improved from baseline (31±6ml) to the 2-month follow up visit (77±41ml) (p<0.05).

Conclusion: These results suggest positive alterations to vascular function in the arms and legs following several months of recovery from contracting SARS-CoV-2 in young adults. However, complete vascular recovery may be prolonged beyond the first few months.

Alyssa Lefler, Exercise Science, Undergraduate Student
Faculty Mentor:  Christopher Seitz, Health and Exercise Science
Co-Author(s):  Aidan Estes, Nick Little, Gracyn Travitz
Title:  COVID-19 SAFETY VIOLATIONS AMONG GREEK ORGANIZATIONS AND UNIVERSITY RESPONSE: AN ANALYSIS OF NEWS REPORTS

Background: Due to COVID-19, universities have limited social events, especially among Greek organizations. Violations of COVID-19 guidelines by Greek organizations have been reported in the media. The purpose of this study was to analyze these media reports in order to characterize universities' responses. Methods: In February 2021, newspaper articles were located from ProQuest Central and Google News using a combination of the search terms: fraternity, sorority, COVID, and party. Articles were included in the study if they described parties (not gatherings) that were hosted by Greek organizations during the COVID-19 pandemic. The types of university responses to parties were categorized and positive cases of COVID-19 was analyzed using descriptive statistics. Results: A total of 38 newspaper articles were included in the study. The responses of university administration to the parties included: suspensions (71%), investigations (32%), cease and desist orders (13%), probations (5%), warnings (5%), no response (5%), and fines (3%). The length of suspensions

ranged from one semester to indefinite. Reported fines ranged from $1,500 to $4,470. Six articles reported 313 positive COVID-19 cases that contract tracing led to the parties. Discussion: The findings from the study suggest a pattern in university response to COVID-19 violations tend to be lenient. This could be due in part to internal university investigations, which could be a conflict of interest.

Molly Fox, Public Health, Undergraduate Student
Faculty Mentor:  Jennifer Tyson, Health and Exercise Science
Co-Author(s):  Emily Benson, Laura Brady
Title:  PUBLIC HEALTH PREPAREDNESS: SUPPORTING THE GLOBAL PANDEMIC THROUGH A TRAINEESHIP
The global pandemic spurred by COVID-19 sent the world on a path of response and now we are shifting into a recovery march. Public health academic programs are now working on integrating public health preparedness curriculum and principles into the learner's experience to adapt and assure that the rising public health workforce is equipped. In response to a multitude of inquiries from students and professionals on how to adapt and learn from the global pandemic, a public health preparedness traineeship was developed. As part of this traineeship, we are being trained in public health preparedness skills including mitigation, planning, response, and recovery competencies like case investigation, contact tracing, and vaccination distribution. The traineeship is a sustainable professional development practice to support implementation science techniques in training the public health workforce to respond to the pandemic in the long term. In this oral presentation, we will reflect on our experience as scholars and walk though an interactive website.

Arianna Moore, Public Health, Undergraduate Student
Faculty Mentor:  Adam Hege, Health and Exercise Science
Co-Author(s):  Sydney Davis
Title:  FOOD AND HOUSING INSECURITY AND THE DIFFERENCES  BETWEEN LIVING ON-CAMPUS AND OFF-CAMPUS AMONG A SAMPLE OF STUDENTS AT EIGHT DIFFERENT  NC UNIVERSITIES AND COLLEGES
Background: Food and housing insecurity are growing public health problems among U.S. university and college students. Methods: College and university students (N=6,263) at eight higher education institutions in North Carolina completed an online, cross-sectional survey. The 10-item Adult Food Security Survey Module was used to assess food insecurity status. Housing Security was measured by using six adapted questions from the national Survey of Income and Program Participation (SIPP) Adult Well-Being Module (if answering yes to any of the questions, the student was housing insecure). Students were also asked about their awareness of and use of campus resources. Descriptive analyses were performed and Pearson's chi-square tests were utilized for comparisons. Results: Of the sample, 43% were food insecure and nearly half (48%) were housing insecure. The odds of being food insecure (OR=1.32) and housing insecure (OR=8.10) were increased among students living off campus. Only about a half (50.3%) of students were aware of campus resources available and only 12.2% were actually making use of available campus resources. The odds of housing insecurity (OR=0.68; OR=0.63) were lower among those aware of campus resources and making use of resources; interestingly, there were no significant differences in terms of food insecurity status. Conclusions: Colleges and university administrators and elected officials should implement policies and interventions aimed at improving the food and housing security status of students and consider the different needs between students living on-campus and off-campus. Learning Outcomes: 1. Understand the differences in food insecurity and housing insecurity among college and university students living on-campus and off-campus. 2. Discuss strategies for interventions aimed at addressing food insecurity and housing insecurity among both on-campus and off-campus college and university students.

Sophie Osada, Exercise Science, Undergraduate Student
Faculty Mentor:  Steve Ratchford, Health and Exercise Science
Co-Author(s):  Rachel Szeghy, Valesha Province, Laurel Koontz, Landry Bobo, Nina Stute, Marc Augenreich, Jonathon Stickford, Abigail Stickford
Title:  CARDIAC ABNORMALITIES AMONG YOUNG ADULTS WITH  SARS-COV-2

Background: The novel virus SARS-CoV-2 inflicts far-reaching health decrements, both directly and through secondary inflammatory stimulation. To date, there is little information regarding the effects of COVID-19 on the heart after infection, especially among young, healthy adults. Purpose: We sought to determine whether contracting SARS-CoV-2 affects cardiac function in young, otherwise healthy adults, weeks after testing positive for SARS-CoV-2. Methods: Transthoracic echocardiography of the parasternal long-axis view and four-chamber apical view was performed on 17 subjects (8F/9M, 20±1y, 24±3 kg·m-1) with SARS-CoV-2 who tested positive 3-4 weeks prior to study test date. Z-tests were performed to determine if these values are significantly different from normative values with significance set at $P<0.05$ (mean±SD). Results: Interventricular septal wall was enlarged in male and female subjects with SARS-CoV-2 compared with normative values ($P<0.05$). Left ventricular mass index was enlarged in subjects with SARS-CoV-2 compared with normative values ($P<0.05$). Mitral valve deceleration time was prolonged in subjects with SARS-CoV-2 compared with normative values ($P<0.05$). Septal wall e' was elevated in male and female subjects, and lateral wall s' was high in female subjects with SARS-CoV-2 ($P<0.05$). Conclusions: These results suggest evidence of myocardial inflammation as well as systolic and diastolic abnormalities, which may persist in young adults for weeks after contracting SARS-CoV-2.

Valesha Province, Exercise Science, Graduate Student
Faculty Mentor:  Jonathon Stickford, Health and Exercise Science
Co-Author(s):  Marc Augenreich, Nina Stute, Dr. Abigail Stickford, Dr. Stephen Ratchford, Dr. Jonathon Stickford
Title:  EVALUATION OF EXERTIONAL DYSPNEA DURING RECOVERY FROM SARS-COV-2 INFECTION IN YOUNG ADULTS

PURPOSE: The purpose of this study was to examine the sensory and affective dimensions of exertional dyspnea (i.e., shortness of breath during exercise) in otherwise healthy, young adults who had previously tested positive for SARS-CoV-2 over a period of 4 months. METHODS: Otherwise healthy, young adults (4M/5F, age: 20±1y, BMI: 24.1±2.7kg·m-2) who tested positive for SARS-CoV-2 completed an incremental exercise test to voluntary exhaustion on a cycle ergometer 3-4 weeks after a positive SARS-CoV-2 test result (BL), as well as 1, 2 and 3 months following baseline testing (1M, 2M, and 3M respectively). Subjective ratings of perceived breathlessness (RPB) and unpleasantness of breathing (RPU) were collected at rest and during each stage of exercise. Following exercise, subjects rated the unpleasantness and accompanying negative emotions (depression, anxiety, frustration, anger, and fear) associated with their peak exertional dyspnea using a visual analog scale (VAS). RESULTS: RPB and RPU at rest, during cycling at 60W, 120W, and at peak exercise were similar across all visits ($p>0.05$). Furthermore, no VAS ratings differed between visits ($p>0.05$). CONCLUSION: These data suggest that the sensory dimension of exertional dyspnea is unaltered during recovery from SARS-CoV-2 infection. Likewise, the affective dimension of exertional dyspnea appears to be maintained throughout recovery, as no emotions related to exertional dyspnea fluctuated over the 4-month time period.

Caroline Pruitt, Public Health, Undergraduate Student
Faculty Mentor:  Adam Hege, Health and Exercise Science
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Title:  FROM SUBSTANCE USE TO MENTAL HEALTH: HOW COVID-19 DISPROPORTIONATELY AFFECTED LGBTQ+ COLLEGE STUDENTS
Background: Research has established a positive correlation between LGBTQ+ individuals and increased rates of chronic stress, mental health disorders, and substance use. A similar pattern has been observed among college students, suggesting that LGBTQ+ college students are uniquely vulnerable to the effects of the COVID-19 pandemic.
Methods: College students at a medium-sized, rural, public university completed an online, cross-sectional survey. Demographics included: sex/gender, race/ethnicity, sexual identity, and year in school. The Patient Health Questionnaire-9 and General Anxiety Disorder-7 were used to assess the frequency of depression and anxiety symptoms, respectively. An average depressive score and average anxiety score were calculated for each participant (n=269) based on their responses with a higher score indicating a higher frequency of symptoms. Mann-Whitney U tests were used to analyze ordinal depressive and anxiety scores between cisgender and non-cisgender groups as well as heterosexual and non-heterosexual groups.
Results: Both non-heterosexual students and non-cisgender students were found to have significantly higher depressive and anxiety scores than their heterosexual and cisgender peers, respectively.
Conclusions: Findings support the hypothesis that LGBTQ+ students experience anxiety and depressive symptoms at a higher rate than their cisgender, heterosexual peers, with uniques areas of concern such as political climate and living with family.

Brianna Richardson, Public Health, Undergraduate Student
Faculty Mentor:  Erin Bouldin, Health and Exercise Science
Co-Author(s):  Bryan Belcher, Amber Chapman, Kimberly McCullough, Gary McCullough
Title:  EVALUATION OF A CAREGIVER EDUCATION PROGRAM  IN APPALACHIA
Informal caregiving involves providing aid for a loved one in need of assistance. About 20% of US adults provide informal care. The Aging and Adult Health  interdisciplinary research group in the Institute for Health and Human Services developed a free and public program to assist current caregivers in identifying resources in Watauga County, NC. During fall 2020, six weekly sessions were offered via Zoom by an interdisciplinary team of practitioners and faculty members, covering Medicare and Medicaid, dementia and normal aging, self-care, and more. Attendance ranged from 1-9 caregivers per session. All respondents reported being extremely satisfied with the content each week and 65% of the time gave the highest rating for recommending it to a friend or colleague. Participants reported that they appreciated the information provided, the practical ideas, the personalization, and the discussions. One participant reported not liking the virtual format. The caregiver training enabled participants to learn more about tools to ease caregiver burden and local organizations that assist caregivers and their care recipients. Feedback from this pilot session will be used to modify the program for the next cycle. In the post-pandemic period we hope to offer both in-person and virtual options for caregivers.

Grace Ruffin, Public Health, Undergraduate Student
Faculty Mentor:  Christopher Seitz, Health and Exercise Science
Co-Author(s):  Bryce Clark, Kate Mulligan, Ann Mosely Whitsett, Meg Hanff
Title:  A READABILITY ANALYSIS OF THE CDC'S WEBPAGES  THAT PROMOTE EARLY CHILDHOOD VACCINATIONS
Background: Previous studies have analyzed the readability of the CDC's print-based vaccination information (e.g., brochures, pamphlets). Similar vaccination information provided through the internet has yet to be studied. As such, the objective of this study was to analyze the reading level of webpages from the CDC that

promote early childhood vaccinations. Methods: Six webpages from the CDC's vaccines for your children website were analyzed for readability. The readability formulas used in the analysis included SMOG, FOG, FRY, and Flesh-Kincaid. Results: Each readability formula showed that all of the webpages were written above the recommended reading level of fourth to sixth grade. The webpages ranged in reading levels from seventh grade to the fourth year of college. Conclusions: Given that 43% of Americans have a basic or below basic literacy level, there could be a noteworthy number of people who may be unable to read the CDC's current state of vaccine information online. There are a variety of resources that the CDC, or any other public health agency, should use to revise health education materials that have been written at a high reading level. These sources are provided by the US Department of Health and Human Services and are practical to use when editing or developing materials.

Dasari Sai Nivedita, Biology, Undergraduate Student
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Co-Author(s):  Sophie Osada, Rachel Szeghy, Valesha Province, Laurel Koontz, Landry Bobo, Nina Stute, Marc Augenreich, Andrew Putnam, Jonathon Stickford,  Abigail Stickford, Stephen Ratchford
Title:  LONGITUDINAL TRACKING OF CARDIAC ALTERATIONS  AMONG YOUNG ADULTS WITH SARS-COV-2
Background: The novel SARS-CoV-2 virus inflicts far-reaching health decrements, both directly and through secondary inflammatory stimulation. To date, there is little information regarding the effects of COVID-19 on the heart after infection, especially among young healthy adults. Purpose: We sought to determine whether contracting SARS-CoV-2 affects cardiac function in young, otherwise healthy adults and whether these alterations recede after testing positive for SARS-CoV-2. Methods: Transthoracic echocardiography of the parasternal-long axis view and four-chamber apical view was performed on 9 subjects with SARS-CoV-2 (5F/4M, 21±1y, 23±3kg·m-2) who tested positive 3-4 weeks prior to baseline testing, followed by 1-month, 2-month, and 3-month follow-up testing. Data are mean±SD. Results: Left ventricular diastolic mass was unaltered over time, but values are elevated when compared to normative values. Mitral valve A velocity was lower at 2 and 3-month follow-up ($p<0.05$). Mitral valve E/A ratio was increased at 3- month follow-up ($p<0.05$). Tricuspid valve E/A ratio was increased at 3-month follow-up ($p<0.05$). Conclusions: The data suggests acute alterations to the myocardium following SARS- CoV-2infection, with little improvement after 4 months. Further analysis of the longitudinal data may be indicative of subclinical improvements in diastolic function, although additional studies are necessary to determine if more significant cardiac recovery is achieved with more time.

Amy Sheldon, Exercise Science, Undergraduate Student
Faculty Mentor:  Jonathon Stickford, Health and Exercise Science
Co-Author(s):  Augenreich, M.A., McMichael, 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 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 end-expiratory and end-inspiratory lung volumes, expressed as absolute lung volumes and as percentages of total lung capacity, were significantly different between techniques ($p<0.05$). Yet, 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 (TYP: 39±17%, MEAN: 38±17%; p=0.66).

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.


Nick Stevens Jr., Exercise Science, Graduate Student
Faculty Mentor:  Kimberly Fasczewski, Health and Exercise Science
Co-Author(s):  Paige Bramblett, Jennifer Thornton-Brooks
Title:  UNDERSTANDING MULTIPLE SCLEROSIS CHARITY EVENT PARTICIPATION: IS BEHAVIORAL ECONOMICS THE MISSING LINK TO INCREASING PHYSICAL ACTIVITY?

Background: The positive physiological and psychological health benefits of regular physical activity (PA) are widely known. However, PA levels remain low among the general population as well as those with neurological conditions like Multiple Sclerosis (MS). Increasing self-efficacy and intrinsic motivation through PA programming can increase PA behaviors; however, this alone produces marginal long-term success. The theory of behavioral economics posits that social norms, biases, and habits influence health decision making, including PA behaviors. Therefore, the present study applied the lens of behavioral economics to explore PA motivation to elucidate the relationship between motivation and these constructs of behavioral economics. Methods: Mixed-methods survey data were collected from individuals, both with (n = 47) and without MS (n = 67), participating in a PA-based MS charity fundraiser event. Results: Open-ended data themes revealed intrinsic (i.e. enjoyment, sense of satisfaction for doing good) and extrinsic (i.e. social support) factors for event participation. Conclusion: Habit formation for PA behaviors may emerge due to personal biases (importance of fundraising and control over MS) and a sense of relatedness. Involvement in MS charity events  may alter social norms, frame events as enjoyable, and foster a sense of community thereby increasing the likelihood of future event participation.


Nina Stute, Exercise Science, Graduate Student
Faculty Mentor:  Abigail Stickford, Health and Exercise Science
Co-Author(s):  Valesha Province, Marc Augenreich, Jonathon Stickford, Stephen Ratchford
Title:  SYMPATHETIC NEURAL ACTIVITY AND HEMODYNAMICS  IN YOUNG ADULTS RECOVERING FROM SARS-COV-2

Individuals infected with SARS-CoV-2 exhibit a wide variety of symptoms, indicating potential systemic effects of the virus. The impact of SARS-CoV-2 on autonomic and cardiovascular function remains unclear.

METHODS: Young adults who had tested positive for SARS-CoV-2 (COV+; n=16, 8F) visited the laboratory within 8 weeks following their diagnosis. Muscle sympathetic nerve activity (MSNA; n=11) via microneurography, systolic (SBP) and diastolic (DBP) blood pressure, and heart rate (HR) were measured in subjects during resting conditions and during a 2-min cold pressor test (CPT); indices of heart rate variability (HRV) were assessed during 5 min each at 30° and 60° head-up tilt (HUT). Data were compared with a healthy young adult control group (CON; n=14, 9F).

RESULTS: COV+ participants (18.2 ± 6.6 bursts·min-1) had higher resting MSNA burst frequency compared with CON (12.7 ± 3.4 bursts·min-1) (p=0.02), as well as higher MSNA burst incidence and total activity. Resting HR, SBP, and DBP were not different between groups.

During the CPT, MSNA burst incidence differed between groups (COV+: 35.4 ± 3.2 bursts·100 heart beats-1, CON: 24.7 ± 3.1 bursts·100 heart beats-1, p=0.03), but not burst frequency or total MSNA. Total MSNA response to CPT was suppressed in COV+ compared with CON. HR, SBP, or DBP or the responses of these variables between groups during the CPT did not differ. COV+ subjects reported lower ratings of pain during the CPT compared with CON (5.7 ± 1.8 vs. 7.1 ± 1.9 a.u., p=0.045).

Quantification of sympathovagal balance was similar between groups during HUT, but COV+ had higher indices of HRV compared with CON.

CONCLUSION: Resting sympathetic neural activity, but not HR or blood pressure, may be elevated following SARS-CoV-2 infection. During acute recovery from the virus, cardiovascular and perceptual responses to physiological stress may also be altered..

Rachel Szeghy, Exercise Science, Undergraduate Student
Faculty Mentor:  Stephen Ratchford, Health and Exercise Science
Co-Author(s):  Valesha M. Province, Laurel K. Koontz, Nina L. Stute, Marc A. Augenreich, Abigail S. Stickford, Jonathon L. Stickford
Title:  LONGITUDINAL TRACKING OF ARTERIAL STIFFNESS AMONG YOUNG ADULTS WITH SARS-COV-2

Introduction: The long-term implications of contracting SARSCoV-2 on arterial stiffness and vascular architecture in subsequent months is unknown. Purpose: We sought to determine the prolonged implications of SARSCoV-2 on carotid stiffness, carotid-femoral pulse wave velocity (cfPWV), and pulse wave analysis (PWA) 3 months after infection. We hypothesized these measures of arterial stiffness would improve 3 months after contracting SARSCoV2. Methods: We assessed 9 young adults (4M/5F) at 1-4 months (1-4M) following SARSCoV-2 infection. Doppler ultrasound was used to assess carotid distensibility, stiffness, carotid intima media thickness, and cfPWV. SphygmoCor was utilized to determine carotid distensibility and aortic augmentation (AIx), as well as brachial and aortic arterial pressures. Results: Mean arterial pressure (MAP) decreased following infection (1M: 98.7±4.8 mmHg; 2M: 92.7±10.4mmHg; 3M: 88.6±5.0mmHg; $p<0.05$). There was a tendency for aortic systolic pressure (1M: 123.9±7.3mmHg; 2M: 119.7±11.9mmHg; 3M: 114.1±7.1mmHg ; p=0.089) and aortic diastolic pressure (1M: 74.00±6.6mmHg; 2M: 73.4±10.7mmHg; 3M: 67.3±9.4mmHg; p=0.068) to decrease ($p<0.1$). Carotid stiffness, cfPWV, PWA measures were unaltered months following SARSCoV-2 infection. Conclusion: Preliminary results indicate a lack of improvement in arterial stiffness in young adults 3 months following contraction of SARSCoV-2.

Kimberly Todd, Biology, Graduate Student
Faculty Mentor:  Zachary Farris, Health and Exercise Science
Co-Author(s):  N/A
Title:  PATTERNS OF SPATIAL CO-OCCURRENCE AMONG NATIVE AND EXOTIC CARNIVORES IN NORTHEASTERN MADAGASCAR

Mounting human encroachment is eliciting greater numbers and larger ranges of exotic carnivores (e.g., cats and dogs), and thus heightened interactions with native wildlife. In Madagascar, knowledge is limited regarding the effects of free-roaming cats and dogs on native carnivore populations. We combined camera trapping across seven sites with two-species occupancy modeling to provide the first assessment of the spatial co-occurrence of native and exotic carnivores in Madagascar, and how habitat variables explain these relationships. Our surveys from 2008 to 2013 accumulated 2991 photo-captures of native and exotic carnivores in 8854 trap nights. We found that native carnivores select habitat with fewer exotics and that exotic carnivores may be replacing native carnivores, especially in forested areas nearest villages. Six of the native carnivores in this study showed higher site use in the absence of exotic carnivores and their species interaction factors (SIF) revealed an avoidance relationship (SIF < 1.0). We demonstrate the efficacy of combining camera trapping with co-occurrence modeling as a means of exploring the impacts of exotic species on native wildlife communities. Our study highlights the strong negative effect of exotic carnivores which can span competitive exclusion to complete replacement of native carnivores. It is exigent that targeted educational programs be coupled with exotic carnivore removal to attenuate the influx of exotic carnivores.

Gracyn Travitz , Public Health, Undergraduate Student
Faculty Mentor:  Adam Hege, Health and Exercise Science
Co-Author(s):  N/A
Title:  THE IMPACTS OF FOOD INSECURITY ON SCHOOL-AGED CHINESE CHILDREN
Purpose: This research aims to explore the influence of food insecurity on school-aged children in China and to offer unique perspectives on the present issues, make future suggestions, inform intervention/policy solutions, and discuss the impact and significance of disparities due to the global COVID-19 pandemic. Methods:  A systematic literature review of peer-reviewed articles is being conducted. Key search terms have targeted specific aspects of the topic, including primary locations of food insecurity in China, impact of food insecurity on growth/development, prevalence of food insecurity in China, and specific vulnerable groups of school-aged children. Results: Final results are pending the literature review and will be available for the Celebration of Student Research and Creative Endeavors. Discussion: Preliminary results show the impact of food insecurity is significant on Chinese children and the country as a whole. Specifically, mental health and elementary students' academic performance are negatively impacted by malnutrition and left-behind-children (LBC) are an emerging group. To prevent complete environmental degradation, China is relying on self-sufficiency efforts, increased imports, and policy solutions. Without focused intervention and research efforts, China will continue in a downward spiral where children go hungry, mental health worsens, disparity is widened, trust will falter, and the environment is degraded.

Mary Ann Watkins, Public Health, Undergraduate Student
Faculty Mentor:  Christopher Seitz, Health and Exercise Science
Co-Author(s):  N/A
Title:  US COLLEGE STUDENTS' USE AND PERCEPTIONS OF CIGARETTES AND E-CIGARETTES FROM 2000 TO 2019
Background: College students' use (and perceptions of others' use) of cigarettes and e-cigarettes is a major public health issue and should be tracked over time. As such, the purpose of this study was to summarize these behavioral trends over the past two decades among students. Methods: The American College Health Association conducts the National College Health Assessment (NCHA) every semester. The NCHA survey is completed by a representative sample of college students in the US. For this project, the NCHA findings on the percent of students who were current use of cigarettes and e-cigarettes (any use in the past 30 days) and perceptions of how many other students' currently used were collected from 2000 to 2019. Results: Students who were current users of cigarettes decreased from 2000 (25%) to 2019 (6%). Perceptions of other college students' use of cigarettes also decreased from 2000 (90%) to 2019 (70%). Students who were current users of e-cigarettes increased from 2015 (4%) to 2019 (12%). Perceptions of other college students' use of e-cigarettes increased from 2015 (73%) to 2019 (83%). Discussion: Although the percent of students who smoked cigarettes decreased drastically in the past 20 years, there has been a recent sharp increase in the use of e-cigarettes. Misperceptions of use regarding both substances remain high. There is a need for efforts in cessation and normative education on college campuses.

Trenten Winebarger, Exercise Science, Undergraduate Student
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Co-Author(s):   Augenreich, M.A., Szeghy, R.E., Province, V.M., Stute, N.L., Stickford, A.S.L., Ratchford, S.M.
Title:  CHANGES TO BODY COMPOSITION IN YOUNG ADULTS FOLLOWING SARS-COV-2 INFECTION
Background: Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection is known to disturb respiratory and cardiovascular health, which may hinder physical activity and, subsequently, alter body composition.
Purpose: To examine potential changes in body composition over the initial 4 months of recovery following SARS-CoV-2 infection in young adults.

Methods: A dual-energy x-ray absorptiometry (DEXA) scan and the International Physical Activity Questionnaire (IPAQ) were completed by young adults 3-4 weeks after testing positive for SARS-CoV-2 (V1). DEXA and IPAQ measurements were repeated monthly during the subsequent 3 months (V2-V4) to examine potential changes in body composition and physical activity over time.

Results: Total body mass tended to increase over the 3-month investigation period (p=0.06). Fat mass (p=0.04), but not body fat percentage, increased from V1 to V3 before returning at V4 to levels similar with V1. Lean body mass was maintained from V1 to V4 (p>0.05). No differences were observed in physical activity as assessed by the IPAQ (p>0.05).

Conclusion: These data suggest that body mass increases during the period of recovery from SARS-CoV-2 infection, and that the increased body mass is largely driven by accumulation of fat mass. The observed changes in body composition may be due to dietary factors rather than changes in physical activity.

Alex Zepka, Exercise Science, Undergraduate Student
Faculty Mentor:  Steve  Ratchford , Health and Exercise Science
Co-Author(s):  Valesha Province , Laurel Koontz  , Nina Stute  , Marc Augenreich ,
Jonathon Stickford, and Abigail Stickford

Title:  LONGITUDINAL TRACKING OF HEMODYNAMICS AND METABOLISM DURING HANDGRIP EXERCISE AMONG YOUNG ADULTS WITH SARS-COV-2

Background: Recent evidence suggests vascular dysfunction may occur in young adults following SARS-CoV-2 infection, yet less is known regarding if these impairments translate to functional impairments during exercise.

Purpose: We sought to determine if contracting SARS-CoV-2 affects exercising hemodynamics and metabolism in young adults during the first 3 months of recovery from the virus.

Methods: Static intermittent handgrip exercise was performed among 8 subjects with SARS- CoV-2 (4F/4M, 20±1y, 24±3 kg·m $^{-1}$ ) who tested positive 3-4 weeks prior to baseline testing followed by 1-month and 2-month follow-up testing. Subjects performed 3 minutes of static intermittent (1 Hz) in the supine position at 30% and 45% of their maximal voluntary contraction (MVC) while central hemodynamics (Finapres) brachial artery blood flow (Doppler ultrasound), and muscle oxygenation (Oxiplex ISS NIRS) were measured. Data are mean±SD.

Results: Mean arterial pressure was unaltered over time at rest (Baseline:97±8mmHg, 1-month:98±7mmHg, 2-month:100±14mmHg, p>0.05), 30%MVC (Baseline:106±10mmHg, 1-month:106±9mmHg, 2-month:113±14mmHg, p>0.05), or 45%MVC (Baseline:125±11mmHg, 1-month:117±11mmHg, 2-month:125±23mmHg, p>0.05).

Brachial artery blood flow was unaltered over time at rest (Baseline:146±67ml/min, 1-month:156±42ml/min, 2-month:154±38ml/min, p>0.05), 30%MVC (Baseline:467±107ml/min, 1-month:470±154ml/min, 2-month:441±173ml/min, p>0.05), or 45%MVC (Baseline:609±107ml/min, 1-month:605±270ml/min, 2-month:605±214ml/min, p>0.05).

The change from rest to exercising muscle oxygen saturation decreased over time at 30%MVC (Baseline:-4.9±3%, 1-month:-3.5±7%, 2-month:-0.4±2%, p<0.05) and 45%MVC (Baseline:-7.7±4%, 1-month:-3.7±8%, 2-month:-2.4±2%, p<0.05) as subjects recovered from SARS-CoV-2.

Conclusions: Central and peripheral hemodynamics are unaltered, while oxygen saturation during exercise may be improving during the 3-month recovery in adults with SARS-CoV-2.

Abigail MacFarlane, Public Health, Undergraduate Student
Faculty Mentor: Adam Hege, Health and Exercise Science
Co-Author(s): Marina Rogers, Aidan Estes, Sydney Ayers, Eliza Hancock,
Elizabeth Dull
Title: FOOD AND HOUSING INSECURITY AND THE RELATIONSHIP WITH SLEEP HEALTH OUTCOMES AMONG A SAMPLE OF STUDENTS FROM EIGHT NORTH CAROLINA UNIVERSITIES AND COLLEGES

Background: Food and housing insecurity are growing public health concerns at U.S. university and college students.

Methods: Eight colleges and universities had students(N=6,263) do an online, cross-sectional survey. The 10-item Adult Food Security Survey Module assessed food insecurity status. Housing Security was measured by using six adapted questions from the national Survey of Income and Program Participation Adult Well-Being Module. The Pittsburgh Sleep Quality Index (PSQI) assessed sleep quality and sleep related outcomes. Descriptive analyses and Pearson's chi-square tests were used for comparisons.

Results: 43% of the sample was food insecure and 48% were housing insecure. 30% reported a 'fairly or very bad' sleep quality in the past month. 43.6% were getting less than seven hours of sleep nightly. The mean PSQI score was 7.34 (SD=3.56) and 65.5% had a score of six or greater. Food insecurity (OR=1.80; OR=2.69) and housing insecurity (OR=1.28; OR=1.51) were linked with higher odds of a shorter sleep duration (&lt;7 hours) and PSQI scores of six or greater.

Conclusions: School administrators and elected officials should enforce policies and interventions aimed at improving student food and housing security.

Learning Outcomes:
1. Understand the effects of food and housing insecurity on sleep health among university and college students.
2. Examine the disparity in impacts of food and housing insecurity on the sleep health among university and college students.


# Nursing

R.E Hengsterman, Nutrition, Graduate Student
Faculty Mentor: Jean Bernard, Nursing
Co-Author(s): Dr. Gregory S. Marler
Title: THE MECHANISMS OF MYOCARDIAL INJURY IN COVID-19: AN INTEGRATIVE REVIEW

Introduction: The emergence of the novel zoonotic betacaronovirus (SARS-CoV-2), as a dynamic killer and global health threat cannot be understated. SARS-CoV-2 is an RNA virus within a larger family of viruses and the current pandemic raises the need for knowledge about the mechanisms that cause myocardial injury.

Aims: To synthesize and present the available scientific evidence surrounding the mechanisms for myocardial injury in patients infected with the novel zoonotic betacaronovirus (SARS-CoV-2).

Methods: Using Templier and Paré's framework for guiding and evaluating literature reviews, we conducted a systematic search of peer-reviewed literature published between December 2019 and December 2020 using the PubMed and EMBASE databases.

Conclusions: As our understanding of the underlying pathological mechanisms of COVID-19 continue to evolve, preliminary findings suggest that demand ischemia, endothelial compromise, viral toxicity, mechanical dysfunction, and systemic inflammation all play critical roles in evoking functional cardiac abnormalities.

Descriptors: SARS-CoV-2; COVID-19; Coronavirus; myocardial injury, mechanisms of injury.

Haley Love, Nursing, Graduate Student
Faculty Mentor: Becki Turpin, Nursing

Co-Author(s):  N/A

Title:  INCREASING TRIAGE NURSE CONFIDENCE DURING VETERAN SUICIDE CALLS: EVALUATION OF AN EDUCATIONAL INTERVENTION

Telephone triage nurses are often the first point of contact for those struggling with mental illness.  The literature demonstrates that there is an increasing number of veteran suicides each year (Department of Veterans Affairs, 2019).  To decrease stress on the job, triage nurses must develop an understanding of their role which in turn will lead to increased confidence in their role (Visser & Montejano, 2019).  The utilization of a virtual training session consisting of a literature-based education module may be beneficial in increasing triage nurse self-confidence in adequately responding to a suicidal veteran phone call.  Using Adult Learning Theory, a virtual training session was developed and will be provided and evaluated using elements of The Kirkpatrick Model and Anita Smith's (2011) Triage Decision Making Inventory (TDMI). These combined components will assess the effectiveness of the education provided, and allow triage nurses the opportunity to self-report their confidence to make triage decisions.  This educational intervention project aims to determine if job-specific virtual training is useful in increasing triage nurse confidence during a telephonic encounter with a suicidal veteran.  In the future, this training is intended for use in new-hire triage nurse orientation and annual competency training.

Keywords: veteran, triage nurse, veteran suicide, Adult Learning Theory

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Lauren Pineda, Nursing, Graduate Student
Faculty Mentor:  Dana Brackney, Nursing
Co-Author(s):  N/A

Title:  VERBAL DE-ESCALATION TRAINING TO INCREASE NURSING STUDENT CONFIDENCE FOR HANDLING PATIENT AGGRESSION

Background: Workplace violence has been on the rise within the healthcare field for many years. Many nurses view this as part of their job description, which causes violence to be underreported. Workplace violence has many physical and emotional effects on the nurse. Aim: This project aims to describe if education on use of verbal de-escalation increases nursing student's confidence in their ability to de-escalate a confrontational situation involving a patient or family member.  Method: Guided by the Constructivist Learning Theory, this educational module applies Fink's domains for Significant Learning in an online module that includes reflection and video simulations. The education's effectiveness will be evaluated using a pretest and posttest survey, including the Clinician Confidence in Coping with Patient Aggression Instrument. Additionally, the module will provide time for student reflection. Nursing students at Appalachian State University and Carolinas College of Health Sciences will be asked to voluntarily participate in the online module. Results: Demographic and pre/posttest data will describe the change in student knowledge and confidence in use of de-escalation for violence prevention. The project findings will be discussed in the context of learning theory.

# Nutrition and Health Care Management

Erica Blackburn, Nutrition, Graduate Student
Faculty Mentor:  Alisha Farris PhD, RDN, Nutrition and Health Care Management
Co-Author(s):  Marco Meucci PhD, John Arrowood MS, RDN
Title:  EVALUATION OF A SUMMER CAMP ON FOOD AND DRINK  BEHAVIORS

Introduction: In the US, 1 in 4 children are overweight or obese. Research suggests that interventions to change dietary and physical activity behaviors are more effective in early ages, and food preferences track into adulthood. Cooking, peer modeling, and food exposure has been shown to increase food acceptance. Interventions are needed which meld these strategies. The aim of this study was to evaluate changes in preferences, diet, and self-efficacy for children participating in EartH, a 6-week camp on physical activity, art, and healthy eating.

Materials and Methods: Children aged 8-11 were recruited. Nutrition education was provided 1 day/week for 3 hours with healthy lunch served daily. Participants' food preferences, diet and  self-efficacy were evaluated using a pre/posttest design and evaluated with descriptive statistics.

Results and Discussion: 7 participants completed the surveys. Participants had improved views towards and developed more self-efficacy to eat fruits/vegetables and swap unhealthy snacks for healthy ones. Participants improved water intake, while milk and juice intake decreased. Sweetened beverage intake was low pre/post.

Conclusion: Nutrition education can impact the behaviors, food preferences, and self-efficacy of young children. This research should be expanded with a larger sample size, and the effectiveness of nutrition education long-term should be evaluated.

Alison Collins, Nutrition, Graduate Student
Faculty Mentor:  Melissa Gutschall, Nutrition and Health Care Management
Co-Author(s):  Dr. Alisha Farris, Dr. Adam Hege
Title:  PERCEPTIONS OF FOOD ACCESS AND NUTRITION EDUCATION NEEDS AMONG FOOD PANTRY CLIENTS IN WATAUGA COUNTY, NORTH CAROLINA

Objective: Watauga County has the 3rd highest poverty rate in North Carolina. About 68 families utilize the Hunger and Health Coalition food pantry daily. Addressing food access and nutrition education needs to develop targeted interventions will better meet community health needs. The purpose of this study was to investigate those needs among the low-income community in Watauga County, NC.

Methods:  Twenty-five community participants were recruited to participate in three focus groups. Focus group questions included topics like food preferences, barriers to food access, food box items, and nutrition education needs. At the completion of each focus group, participants were given a 30 pound box of produce.

Results: Twenty-one participants completed all focus groups. Participants preferred fresh produce over canned and frozen, and desired nutrition education and counselling; seasonal challenges were identified as the main barrier to healthy food access.

Conclusions: Focus groups identified several potential areas for intervention to meet the nutritional needs of this community including access to increased fresh fruits and vegetables, nutrition counselling, and nutrition education to improve self- efficacy for accessing and preparing healthier foods. Findings have guided the development of programming and policies surrounding nutrition services and offerings. Future research should continue to evaluate the outcomes of implementing nutrition services within food pantries.

Hannah Coyner, Nutrition, Graduate Student
Faculty Mentor:  Paul Moore, Nutrition and Health Care Management
Co-Author(s):  Marie Mahon Carpenter, RD, LD; Kyle Thompson DCN, RDN, LDN, CNSC; M. Margaret Barth, PhD, MPH
Title:  ANALYSIS OF GOAL ATTAINMENT FOR ACUTE CARE  HOSPITAL PATIENTS BY A CLINICAL NUTRITION TEAM IN A REGIONAL MEDICAL CENTER

P (Plan): At a regional medical center in western, North Carolina, a Quality Improvement (QI) project assessed the nutrition goal attainment for acute care hospital patients by the clinical nutrition team. This project was conducted in an effort to address any lapses in intervention provision and to provide insight on better practices for the clinical team to consider when intervening and formulating a plan for Medical Nutrition Therapy.

D (Do): Data were collected on 59 patients in the acute care setting who were admitted between the dates of August 3, 2020 - October 23, 2020. This data was collected randomly throughout that timeframe. The data included each patient's admission date, date of first nutrition diagnosis, nutrition diagnoses, interventions, goals, how many days to meet goal (if applicable), number of follow-ups, any intervention changes, and if the goals were measurable following the SMART (Specific, Measurable, Attainable, Realistic, Timely) goal framework.

S (Study): This study aimed to answer two questions: 1) Whether an earlier nutrition diagnosis increases the likelihood for patients to meet their goals, and 2) Of the goals set, how often were they measurable goals? It was discovered that a faster nutrition diagnosis from admission does not make a patient more likely to meet their goals than a patient with a nutrition diagnosis >5 days from admission. 87.1% of the goals created were measurable and 12.9% were not measurable in the context of the reference criteria provided on the data collection tool.

A (Act): This study indicates needs for improvement in the areas of forming interventions that allow the patient to meet their goals more often than they currently are, and to ensure that goals are measurable so they may be met with intervention changes.


Stacey Deng, Nutrition, Graduate Student
Faculty Mentor:  Laura McArthur, Nutrition and Health Care Management
Co-Author(s):  Melissa Gutschall, PhD, RD, LDN, Alisha Farris, PhD, RDN, Dr. Kimberly Fasczewski, PhD
Title:  DESIGN AND EVALUATION OF A SKILL-BUILDING  FOOD SECURITY COURSE FOR COLLEGE STUDENTS: A PILOT STUDY

Introduction: This research pilot tested a skill-building course to decrease food insecurity risk among students at Appalachian State University.

Materials and methods: This course included skills requested by food insecure students from previous research, i.e., budgeting, meal planning, purchasing healthy foods, cooking, container gardening, finding food assistance programs, and advocacy. Participating instructors were from the Honors College and departments of Nutrition and Health Care Management, Health and Exercise Science, Social Work, Physics and Astronomy, and Sustainable Development. Classes provided lectures, readings, videos, activities, and discussion questions. Data were collected through pretests, posttests, pre and post USDA Adult Food Security Survey (AFSS), reflection papers, and the SNAP challenge.

Results: The AFSS identified two marginally food secure and one low food secure student (n=8). The latter student had a 2-point decrease in their post AFSS score, suggesting an improvement in food security status. Self-efficacy scores for planning healthy meals increased significantly (m=2.83 to m=3.83, p=0.041), out of five points. The SNAP challenge revealed an understanding of the limits of the current SNAP budget, and the reflection papers were positive about the usefulness of the course for decreasing food insecurity risk.

Discussion and conclusions: Although not statistically significant, pre/post-test scores indicated overall knowledge gain. Students stated that they would be able to apply the skills learned to their own lives and to

help and encourage others who face similar difficulties. More research is needed to confirm the efficacy of skill-building courses for reducing student food insecurity.

Rachel Gallardo, Nutrition, Graduate Student
Faculty Mentor: Laurel Wentz, Nutrition and Health Care Management
Co-Author(s): N/A
Title: NUTRITION ASSESSMENT AND BODY COMPOSITION CHANGES ACROSS A COMPETITIVE SEASON IN COLLEGIATE WRESTLERS

Weight management is key in wrestling. Previous research on weight loss and management in college wrestlers has been conducted; however, dietary weight loss methods have not been well-studied. This study conducted dietary analysis of 3-day food records for college wrestlers, analyze body composition changes (pre-season to in-season), and analyze weight cutting practices.

Twenty-eight wrestlers from Appalachian State University's Wrestling Team participated in two Dual-energy X-ray Absorptiometry measurements and completed a survey to provide information on weight loss practices. Nutrition assessment data were collected as picture food records over a three-day period. Data were analyzed via SPSS statistical software.

Wrestlers showed significant changes between the pre-season and in-season scans in body mass ($p<0.001$), fat free mass ($p< 0.001$), body fat ($p<0.003$), and fat mass ($p<0.001$). The most common weight cutting methods used the week before competition were energy and salt restriction (60.7%, 35.7%); the most common weight cutting methods used the day of competition were active sweating (75.0%) and energy restriction (50.0%). Food records analyzed (n=7) showed energy, carbohydrate, and fat intakes lower than recommendations for weight loss, while protein intake was greater leading up to competition.

Other literature has shown that macronutrient intake decreases before competition, leading to body composition changes and increases the day of competition for refueling.

Sarah Helmick, Nutrition, Graduate Student
Faculty Mentor: Martin Root, Nutrition and Health Care Management
Co-Author(s): Kyle Thompson, Alisha Farris
Title: THE ASSOCIATION OF DIETARY FIBER INTAKE WITH METABOLIC SYNDROME

Metabolic syndrome (Met-S) is a rapidly increasing diagnosis, characterized by having 3 of the 5 factors: large waist circumference, high blood pressure, high fasting triglycerides, high fasting glucose, or low HDL cholesterol. High calorie fast food, low activity, and unhealthy lifestyle can lead to this disease. Fiber is known to decrease cholesterol, and is part of a healthy diet. This study's goal was to evaluate the relationship between dietary fiber intake and its effect on Met-S score among 12,132 participants.

The Atherosclerosis Risk In Communities (ARIC) data set was used for this study. Individuals with a diabetes diagnosis and alcohol intake greater than 15% of daily energy intake were excluded. Fiber and other nutrients were measured through a food frequency questionnaire. Relevant model covariates included age, BMI, education level, smoking status, race, sex, energy intake, and carbohydrate intake. Met-S score was calculated by summing the characteristics (0-5). Linear regression was used to determine the association of dietary fiber intake, as well as subsets of dietary fibers, with Met-S score.

In the multivariate model, dietary fiber intake (per 10 grams/day) was significantly associated with a lowered Met-S score (p=0.031, beta= -0.055 Met-S units per serving/day) and cereal dietary fiber was significantly associated with a lowered Met-S score (p=<0.001, beta= -0.031)

Dietary fiber may be an important nutrient in preventing the prevalence of Met-S

Priscilla Holmes, Nutrition and Foods, Graduate Student
Faculty Mentor:  Laura McArthur, Nutrition and Health Care Management
Co-Author(s):  Melissa Gutschall,  Alisha Farris, Kimberly Fasczewski
Title:  DESIGN AND EVALUATION OF A FOOD SECURITY COURSE  FOR COLLEGE STUDENTS: A PILOT STUDY

Introduction: In 2018, the rate of food insecurity (FI), defined as the disruption of food intake or eating patterns because of lack of money and other resources, was 46.2% among students at Appalachian State University. This research pilot tested and evaluated an interdisciplinary course with topics intended to decrease student FI.

Materials and Methods: Instructors were from the Honors College, Nutrition and Health Care Management, Health and Exercise Science, Social Work, Physics and Astronomy, and Sustainable Development. Classes included lectures, readings, videos, activities, and discussions, i.e., basic nutrition, FI at the local, national, and global levels, vulnerable populations, coping mechanisms, and health and academic outcomes. Data collection methods included the USDA Adult Food Security Survey (AFSS), demographic questions, pretests:posttests, and reflection papers. Data were analyzed using descriptive statistics and statistical significance was $p <= 0.05$.

Results: Among participants (n=8), one student reported a two-point decrease in their AFSS score, three students reported more favorable ratings of physical health, and two students reported more favorable ratings for mental health at course completion. Although not statistically significant, post-test results showed a decrease in knowledge retention. Reflection papers suggested that students found the course helpful, thought it should be repeated, and indicated they would communicate knowledge gained to peers.

Discussion and conclusions: Although student feedback was favorable, findings from larger, more diverse samples are needed to test the efficacy of this course for decreasing student FI at the University.

Conflict of interest / funding disclosure: None declared.

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Faculty Mentor:  Melissa Gutschall, Nutrition and Health Care Management
Co-Author(s):  Karalee Cole MA CCC-SLP and Alisha  R Farris PhD RDN
Title:  INCORPORATING NUTRITION EDUCATION INTO A SUMMER  LITERACY PROGRAM: AN INTERPROFESSIONAL PILOT PROGRAM

Introduction: Summer learning loss or summer slide has affected children who live in rural communities. The Summer Literacy Program is a summer program that integrates nutrition exposures within the program to simultaneously promote healthy snack consumption and improved reading skills.

Materials and methods: Twenty-four rising first graders who are reading below-grade level, ages 6-7, participated in an observational pilot program. The interdisciplinary team in this program collaborated together to facilitate with reading and writing to enhance language, and incorporate snack into speech lessons to promote food acceptance. The promotion of healthy snacking was based on themes set and was aligned with the enrichment activities.

Results: Facilitating independent snack assembly by the children was a key strength as it increased exposure to new food items that they are not familiar with and allowed the participants to build their vocabulary by naming the fruit or vegetable if they wanted more. The recipes incorporated into this program kept the participants excited and engaged during snack time.

Discussion and conclusions: Limited to a small amount of resources, there is not much literature on food acceptance and the improvement of language literacy. Interdisciplinary teams such as Speech Language Pathologist and Dietitians are common in clinical settings. The benefits that came along with this collaboration was being able to work together in a community-based program. The program enabled teaching the participants about new vocabulary words and at the same time receiving a nutritious snack. Future collaborations should develop evaluative measures in both nutrition and literacy areas, including changes to

participant food acceptance. There were no data collected initially since this was a developmental pilot program focused on creation, implementation, and feasibility of nutrition education within a literacy program. Funding disclosure: Funded by Duke Endowment.

Ashlyn Minton, Nutrition, Graduate Student
Faculty Mentor:  Melissa Gutschall, Nutrition and Health Care Management
Co-Author(s):  Alisha Farris, Kyle Thompson
Title:  NUTRITIONAL NEEDS OF LOW-INCOME FAMILIES WITH CHILDREN SERVED BY A LOCAL FOOD PANTRY
Background: Food insecurity is highly prevalent among low-income families. As of 2018, 7.1% of households with children under the age of 18 in America were foodinsecure.1 North Carolina reported food insecurity in 14% (1,456,200) of households, and 19.2% (443,040) of children experienced food insecurity in 2018.
Objectives: This study aimed to assess nutrition education and support needs for low-income families in Boone, North Carolina through survey methods in order to develop effective future interventions.
Methods: A needs assessment survey was given to participants of an elective focus
group at Hunger and Health Coalition, a nonprofit organization that provides food assistance boxes and pharmaceutical prescriptions to people in need. The 21-item survey was administered to 15 focus group participants with children which assessed food frequency and meal patterns, parent satisfaction with HHC services, and overall nutritional needs. Study methods were approved by the Institutional Review Board at Appalachian State University.
Results: The findings gathered from the survey included the following: on average, children ate vegetables, drank sugar-sweetened beverages, and ate non-nutrient dense snacks such as chips, cookies, etc., a few times per week. Parent satisfaction with snack bags ranged between neutral and somewhat satisfied. Mothers reported they would like to see more fruits and vegetables, yogurt, and juice in snack bags.
Conclusion: Nutritional assistance is needed for participants of Hunger and Health Coalition (HHC) in increasing daily vegetable intake for their children, decreasing intake of sugar-sweetened beverages and unhealthy snacks, and increasing satisfaction with foods participants receive in food boxes and snack bags. This can be achieved by continued nutrition education regarding proper nutrition for children, as well as by expanding nutrient-dense offerings through partnerships with the local food system.

Tyler Roof, Nutrition, Graduate Student
Faculty Mentor:  Laurel Wentz, Nutrition and Health Care Management
Co-Author(s):  Danielle Nunnery, Marco Meucci
Title:  EFFECT OF NUTRITION INTAKE AND CHANGES IN BODY COMPOSITION ON INCIDENCE OF INJURY IN COLLEGIATE WRESTLERS
The purpose was to investigate acute and longitudinal nutrition practices, changes in body composition, and incidence of injuries in Division I male collegiate wrestlers across the competitive season. Data were collected from 28 student-athletes of the Appalachian State University Wrestling team via survey questionnaires, a 3-day food record, and a Dual-energy X-ray absorptiometry (DXA) whole body scan for body mass (BM), fat-free mass (FFM), and body fat (BF) percentage. In-season competition and practice injury data were collected from the team's athletic trainer. Student's t-tests were used to compare differences in continuous data, and Chi-square tests were used to compare differences in categorical variables. Wrestlers significantly changed their BM from pre- to mid-season (80.2+/-14.9 vs 77.9+/-14.9, p<0.001) decreased FFM (63.5+/-10.7 vs 62.0+/-10.6, p<0.001) and decreased BF (16.5+/-2.6 vs 15.9+/-2.8, p=0.020). Of the 28 participants, 9 wrestlers experienced at least one injury during the season. Changes in BM, FFM, and BF were not significantly different between those who experienced a season injury and those who did not; nor were methods of weight loss or mass lost immediately prior to competition. The most popular method of weight loss practices, energy restriction, was congruent with current literature; as was the most popular type of injury,

sprains, at 53% of total injuries. Future research should focus on dietary interventions to manipulate body composition.

Jana Sherrill, Nutrition, Graduate Student
Faculty Mentor:  Sandi Lane, Nutrition and Health Care Management
Co-Author(s):  N/A
Title:  EVALUATION OF STAFFING DURING HURRICANES FLORENCE AND MICHAEL
Hurricanes Florence and Michael made destructive landfalls in the late summer of 2018, negatively impacting normal operations in nursing homes across the southeastern US. In disaster events, the decision to shelter-in-place (SIP) or evacuate is one of the most important decisions made by nursing home leaders, as it impacts residents, staff and families. Administrators from fifteen nursing homes affected by Michael and Florence were individually interviewed by phone to explore their experiences of disaster preparation. The present study focuses on interview responses related to managing staff. Effective decision-making played a key role in preventing harm to residents and mortality among administrators interviewed, but further study is needed to optimize staffing procedures during hurricane events.
Objective: The objective of this study was to examine effective preparation plans and challenges related to staffing in post-acute care facilities during two hurricane events that affected the southeastern United States in the fall of 2018.

# Recreation Management and Physical Education

Christopher Cardwell, Social Work, Graduate Student
Faculty Mentor:  Dr. Jill Juris Naar, Recreation Management and Physical Education
Co-Author(s):  Katherine Uva, Dr. Anastasia Schulhoff, Dr. Erin Bouldin
Title:  COMBATING SOCIAL ISOLATION, LONELINESS, AGEISM,  AND THE DIGITAL DIVIDE USING AN INTERGENERATIONAL REVERSE-MENTORING MODEL.
Social isolation, loneliness, ageism, and the digital divide create negative health outcomes for older adults. Our goal was to reduce these social problems and attract students to work in gerontology-related fields using an intergenerational reverse-mentoring program called AppState Cyber-Seniors. During fall 2020, we developed and implemented a program that encouraged student volunteers to provide digital literacy, technology mentoring, and virtual recreation sessions to their grandparents and local older adults of the High Country seven-county area. We recruited students through a sociology class focusing on gerontology as part of an optional assignment. We recruited local older adults through partnerships with the High Country Area Agency on Aging and Project on Aging. We collected data from  students and older adults through pre-and post-tests that included validated measures and open-ended questions about the program. Isolation and loneliness improved among older adults but not among students. Both groups reported enjoying the time with one another. Attitudes about aging did not change in either group. Students indicated that they are more likely to volunteer to assist older adults after experiencing the program. Challenges included the communication medium (telephone, video chat) and scheduling older adult and student pairs. Post-COVID, in-person one-on-one sessions will likely yield better outcomes for both populations.

Katherine Uva, Business Administration, Graduate Student
Faculty Mentor:  Jill Juris Naar, Recreation Management and Physical Education
Co-Author(s):  Cardwell, Chris (B.S.) and Shanely, Shannon (Ph.D.)
Title:  EQUIPPING STUDENTS TO MEET THE CHANGING VIRTUAL RECREATION NEEDS OF OLDER ADULTS

Accessing recreation opportunities online can be difficult for older-adults due to a digital divide between generations. Older adults constitute a growing population increasing demand for new and modified programs including virtual programming. During the COVID-19 pandemic, community and university partners in the High Country of North Carolina are working together to bring older adults to virtual platforms to engage in play. Appalachian State University students are providing resources to older adults through 1) reverse-mentoring older-adults with technology and 2) creating virtual recreation activities for older-adults. Utilizing the Canadian program Cyber-Seniors, students learn basic technology and interaction skills to assist an older-adult in how to use their smart device or computer to be able to participate in recreation online. Students are paired with an older adult that has been recruited through community agencies such as the local Area Agency on Aging, AARP, and AppFaithHealth.  Recreation management students enrolled in the Program Planning course are responsible for creating a sense of connection among the intergenerational participants while online. This program will be evaluated this semester through a mixed-method approach with qualitative data from interviews and quantitative data from an online survey of community partners and students who planned programs for local older adults.


# Social Work

Asaf Zemah, Social Work, Graduate Student
Faculty Mentor:  Maureen MacNamara, Social Work
Co-Author(s):  N/A
Title:  ATTITUDES TOWARDS HUMAN AND NONHUMAN ANIMALS

The idea that violence toward nonhuman animals is related to violence against humans is not a new proposition. A robust body of literature explores correlations between cruelty to animals and human-directed violence. Indeed, many have argued for the importance of family professionals recognizing the impact that violence toward animals has on all aspects of society. Acts of intimate partner violence (IPV) and abuse of nonhuman animals are common, harmful, and co-occurring phenomena. Amid growing societal pressures on reducing violence, it is crucial to locate animal cruelty within the spectrum of intimate partner violence (IPV). Recently, several studies have focused on individual variation in attitudes toward the treatment of animals and findings have suggested correlations between attitudes toward animal cruelty and attitudes towards IPV. This study expands on this recent work to specifically explore attitudes toward IPV and attitudes toward the treatment of animals. The field of violence prevention continues to struggle with accuracy in predicting violence, thus an understanding of the link between attitudes toward violence can be an important step in understanding the development of violent behaviors. The current study examines the relationships between attitudes toward the treatment of animals and attitudes toward the treatment of dating partners in a sample of college students. Using a self-report methodology, scores on standardized scales explore potential correlations between attitudes towards treatment of partners' animals and treatment of dating partners. This poster session reports study findings and provides recommendations for practice and future research.

# Hayes School of Music

## Music

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Faculty Mentor:  Christine Leist, Music
Co-Author(s):  N/A
Title:  HEARTBEAT RECORDINGS IN MUSIC THERAPY: A SEQUENTIAL-EXPLANATORY  MIXED
METHODS STUDY
The use of an audio recording of a patient's heartbeat superimposed with a music recording is a recent addition to music therapy practice but is growing in use in the profession. Heartbeat recording projects in music therapy can provide a meaningful representation of the patient's identity, especially in the context of a legacy project when a patient is nearing death. Despite the appeal of heartbeat recordings, there is minimal research about how they are being used in clinical practice. This study will utilize a sequential-explanatory mixed methods design to better understand the current practice, clinical use, potential barriers, and ethical implications involved in the use of heartbeat recording projects in music therapy. An online survey was distributed to 8,962 board-certified music therapists. The survey data will be collected and analyzed through Qualtrics and will inform the questions for the semi-structured interview. Survey respondents with at least one year of experience using heartbeat recordings in music therapy will be invited to participate in this interview. The follow-up interview will provide respondents opportunity to elaborate on the topics addressed by the initial survey based on their personal experience with heartbeat recordings in music therapy. The final transcripts of the interviews will be analyzed with a thematic analysis, and findings from the survey and interview data will be applied to the initial research questions. It is hoped that the results of this study will provide important information for board-certified music therapists interested in incorporating heartbeat recordings in music therapy into their clinical practice.

# Research Institute for Environment, Energy, and Economics

Andrew Bagwell, Geography, Graduate Student
Faculty Mentor:  Dennis Gilfillan, Appalachian Energy Center
Co-Author(s):  Caity Duncan and Caroline Fehlman
Title:  THE GEOGRAPHIC DISTRIBUTION OF CLIMATE CHANGE RESPONSIBILITIES AND BURDENS IN THE UNITED STATES
Sustainable Development Goal (SDG) 9.4.1 measures the ratio of carbon dioxide ($CO_2$) emissions to gross domestic product (GDP). This metric can be useful in understanding the degree to which economic growth can be decoupled from fossil fuels. Our work seeks to understand the spatial distribution of SDG 9.4.1, and how it relates to community resilience and predictions of change in local climate. Using the new high-resolution emissions dataset Vulcan 3.0, we explore these relationships at the state and county level in the US between the years 2010-2015. While SDG 9.4.1 has been decreasing for the United States as a whole, our research finds massive local variation. In total, eight trends between $CO_2$ and GDP are found at the county level. We examined spatial variations in the sources of emissions through time in order to identify specific ways in which the carbon economy is changing, as well as how this relates to shifts in population. We then compared SDG 9.4.1 to the Baseline Resilience Indicators for Communities (BRIC), which resulted in only weak correlations when grouped at the state level. Finally, we compared current emissions data to predicted changes in county-level climate under the IPCC's worst-case scenario, allowing us to observe the geographic relationship

between the responsibilities and burdens of climate change. We found strong latitudinal and continental effects in rising temperature, as well as stark geographic divides in precipitation levels.

# Office of Student Research
## APPALACHIAN STATE UNIVERSITY

## Celebration of Student Research and Creative Endeavors
## By the Numbers

| Undergraduate and Graduate Student Presentations | |
|---|---|
| Undergraduate Students | 74 |
| Graduate Students | 53 |

| College of Faculty Mentor | Students |
|---|---|
| Arts and Sciences | 62 |
| Health Sciences | 52 |
| Business | 4 |
| Fine and Applied Arts | 5 |
| Education | 2 |
| Music | 1 |
| Research Institute for Environment, Energy, and Economics | 1 |
| Grand Total | 127 |

| Major | |
|---|---|
| Art and Visual Culture | 2 |
| Biology | 18 |
| Business Administration | 1 |
| Communication Sciences and Disorders | 1 |
| Computer Science | 4 |
| Economics | 2 |
| Educational Leadership | 2 |
| Engineering Physics | 3 |
| Environmental Science | 5 |
| Exercise Science | 15 |
| Geography | 5 |
| Geology | 7 |
| Global Studies | 1 |
| Industrial-Organizational Psychology and Human Resource Management | 3 |
| Interdisciplinary Studies | 2 |
| Languages, Literatures, and Cultures | 1 |
| Marketing | 1 |
| Mathematics | 2 |
| Music Therapy | 1 |
| Nursing | 2 |
| Nutrition | 11 |
| Nutrition and Foods | 1 |
| Physics | 7 |
| Psychology | 9 |
| Public Health | 13 |
| School Psychology | 1 |
| Social Work | 2 |
| Speech-Language Pathology | 1 |
| Supply Chain Management | 1 |
| Sustainable Technology | 2 |
| Technology | 1 |