2022
Fall Sidewalk Symposium

Office of Undergraduate Research

NC STATE UNIVERSITY

Evaluating Plasticizer Efficacy in Cellulose Derivatives

Researcher(s): Camille Brule - College of Natural Resources
Mentor(s): Ms. Hannah Dedmon - Wilson College of Textiles

Cellulose acetate (CA) is the most prolific cellulose ester and is utilized for commercial and industrial applications in screens, cosmetics, and textile fibers. Its diverse applications are attributed to sturdy anhydroglucose units that make up the backbone and varying frequencies of acetyl groups on the anhydroglucose chain. CA has a decomposition temperature in close range with its melting temperature, making thermal extrusion of the product impossible when working with pure CA. To aid in its processability, plasticizing molecules, most commonly phthalates, are dissolved into CA to modify its thermal, rheological, and elastic properties. Once in mixture, CA and plasticizer are formed into a product and cooled. As phthalates have been shown to migrate from the polymer matrix, longevity of products are called into question as phthalates are endocrine disruptors. To move away from phthalates and towards non-toxic biomass alternatives, a systematic review of plasticizer efficacy is required. Currently, new formulations for CA plasticization are developed through trial-and-error as no general molecular explanation exists for the mechanism of plasticization to aid in determining optimal structure and concentration of plasticizer. This research completes a theoretical study on the functionality of known plasticizers by studying across the threshold of plasticization in conjunction with a range of percent acetylation of CA. A closer look into the functionality of successful plasticizers currently used in-market can lead to the creation of a rubric for selection of plasticizer for CA to help transition away from phthalate-based plasticizers while maintaining the integrity of the desired product.

Cultural Differences and Difficulties that Asian International College Students Face in the United States

Researcher(s): Thanh Bui - College of Engineering
Mentor(s): Ms. Mary Estrada - College of Humanities and Social Sciences

This study will explore the challenges and difficulties that NC State Asian International Students experience due to cultural differences between the US and their home countries. I will review how students interact with the plethora of activities and events at NC State and reflect on personal experiences. I will then be able to categorize types of challenges that arise in order to understand how NC State could provide support for this population.

What Can NCSU Students do to Deal with Global Warming and its Results

Researcher(s): John Cao - University College
Mentor(s): Ms. Mary Estrada - College of Humanities and Social Sciences

The effects of global warming have reached an alarming level. Powerful impacts of rising greenhouse gas concentrations are predicted to influence climate change more than previous decades. The greatest contributor to global warming is over-balance carbon emission, which is created by human activities. Knowing this, I ask, which methods for combating global warming do individuals use to reduce carbon emission? How do individuals deal with global warming and its impacts? My project will focus on the local level or what students at NCSU can do to reduce carbon emissions. Students will provide answers regarding their chosen habits on a survey, and these results will be analyzed to describe trends, intentions, and feasibility of various methods.

Efficacy of Geminivirus DNA Purification Assessed using Next Generation Sequencing

Researcher(s): Alison Crawford - College of Agriculture and Life Sciences
Mentor(s): Dr. Trino Ascencio-Ibáñez - College of Agriculture and Life Sciences

Geminiviruses are some of the most destructive single-stranded DNA (ssDNA) viruses with the capability to infect crops across tropical, subtropical, and temperate climates. A wide variety of validated methods exist to purify the genomes of geminiviruses from infected plant tissue; however, most methods extract large amounts of non-viral plant DNA in addition to viral DNA of interest. The inability to select against non-viral plant DNA introduces the need for costly purification steps to eliminate extraneous DNA to overcome the complications generated for downstream applications such as next generation sequencing (NGS) in which a significant percentage of sequences produced must be dismissed. With the understanding that highly alkaline buffers will result in denaturation of double-stranded DNA (dsDNA) while keeping circular plasmid dsDNA intact, we developed an adaptation of the current alkaline lysis method and applied it to the purification of bacterial plasmids in an effort to streamline the geminivirus purification process. This new method was compared to traditional DNA extraction methods using Florida Lanai tomato plants inoculated with Tomato yellow leaf curl virus (TYLCV) or cabbage leaf curl virus (CalCuV). Duplicate samples were created for each method tested and DNA presence was evaluated using methods including agarose gel electrophoresis, PCR and Southern blot. Gene libraries of each sample were generated after rolling circle amplification (RCA). We found that while our adapted alkaline lysis method was successful, it was not the most efficient. The 3NO method outperformed each method tested and suggests its use is the most promising for NGS data production.

Effect of Hyaluronan on Ozone-Induced Injury of Bronchial Epithelial Cells

Researcher(s): Thusna Gardiyehewa - College of Sciences
Mentor(s): Dr. Stavros Garantziotis, Ms. Vandy Parron - NIEHS Matrix Biology Group

Outdoor air pollution continues to claim the lives of millions around the world each year. One major contributor to air pollution is ground-level ozone. Ozone at the ground level is created due to exhaust products reacting with heat and sunlight. Previous research has shown that ozone-induced hyaluronan breakdown products mediate ozone-induced airway hyperresponsiveness in mice. Hyaluronan plays a key role in regulating inflammation and can activate toll-like receptors (TLR), including TLR5, that are embedded in the cell membrane and can trigger biological effects. The purpose of this study is to explore the use of high molecular weight (HMW) hyaluronan as a therapeutic. It is hypothesized that HMW hyaluronan will protect epithelial cells against ozone-induced injury via TLR5 activation. This will be studied using an air-liquid interface (ALI) model. Normal human bronchial epithelial (NHBE) cells are cultured to test the effects of ozone exposure in the ALI model. Mouse wild type (WT) and TLR5 knockout (KO) cells will be used specifically to show that hyaluronan's effects are mediated by TLR5 activation. Fully grown ALIs will be exposed to ozone, and cytokines and epithelial integrity will be examined post-exposure. Comparing ozone-exposed and naïve cells, with or without hyaluronan treatment, will show whether hyaluronan protects airway epithelia against ozone-induced injury. Comparing TLR5 WT and KO ALIs after ozone exposure will show whether activation of TLR5 has an impact on cellular injury. Moving forward, the ALI model can be used to study hyaluronan as a therapeutic for in vitro lung injury models.

Homesickness in International Students

Researcher(s): Lavan Aditya Kakarla Kirankumar - College of Engineering
Mentor(s): Ms. Mary Estrada - College of Humanities and Social Sciences

This study will address what international students attending NC State do to combat homesickness and how these practices affect the student. We will conduct surveys that will address these issues and then analyze them for common practices and consequences. We expect that international students will occupy their time with activities that engage with the NC State community (e.g., clubs, student organizations, friend groups), thereby leaving little time to reflect on being away from home.

Tagging Tubulin Protein with Photo-Activated Green Fluorescent Protein

Researcher(s): Copeland Lachapelle - College of Agriculture and Life Sciences
Mentor(s): Dr. Mary Elting - College of Sciences

The purpose of my research project is to use Gibson assembly to build a plasmid containing a gene that encodes the protein tubulin and tags the tubulin protein with photo-activated green fluorescent protein (PA-GFP). Tubulin is the protein found in the microtubules of eukaryotic cells. The expression vector used as the backbone of the plasmid is pJK148 which is compatible with our model organism, S. Pombe fission yeast. This plasmid will then be linearized and transformed into S. pombe for expression. After transformation, we will use a leucine selection method to screen for untransformed pombe. We want to use the PA-GFP tubulin during the imaging of S. pombe to control the fluorescence of the tubulin protein. Non-photoactivatable tubulin protein always fluoresces when expressed. So, by using PA-GFP tubulin, we will be able to activate and track precise locations of microtubules during imaging.

Optimal Scaling of 3D-Printed Replicas for Blind and Low Vision Museum Visitors

Researcher(s): Yiting Liu - College of Humanities and Social Sciences
Mentor(s): Dr. Yingchen He - College of Humanities and Social Sciences

Museums are one of the essential ways for a region to inspire and educate people. However, museums have always been a place that relies heavily on vision, which makes blind and low-vision groups face significant challenges and obstacles when visiting museums. Many museums worldwide are exploring new projects to make museums more accessible. However, it is still difficult for the low vision or blind to visit the museum alone since the assistive technology and special events that most museums can offer are limited. This reveals the importance of the current need for more innovative technologies to compensate for the accessibility of museums. With the development of 3D printing technology and the gradual decline in its cost, the technology has become a promising way to provide tactile information to the blind population. Researchers aim to provide touchable 3D-printed replicas in a reasonable size to improve the accessibility of museums. Given the critical impact of scaling in the broader use of 3D-printed replicas in museums, this experiment will explore the optimal scale that can best convey information by comparing 3D-printed replicas of different scales. The initial plan of this experiment is to recruit 20 participants with normal vision and gradually recruit blind and low-vision participants. The experiment is still in the process of recruiting participants, so there is no experimental data yet. But researchers hope to objectively measure the smallest feature size that conveys information to provide a standard and better understanding of the needs of blind and low-vision groups.

A Visual Approach to Virus Symptom Development in Arabidopsis

Researcher(s): Umar Mirza - College of Agriculture and Life Sciences, Muaz Modan - College of Agriculture and Life Sciences
Mentor(s): Dr. Trino Ascencio-Ibáñez - College of Agriculture and Life Sciences

Arabidopsis thaliana is a universally used model plant due to its small genome, fast growth time, and easy seed production. Geminiviruses are single-stranded (ss) DNA viruses that have been known to cause worldwide crop losses. In this project, Arabidopsis will be inoculated with Cabbage leaf curl virus (CLCV) and beet curly top virus (BCTV) to track its phenotypic effect on the plant. The process will also be recorded in the form of a timelapse movie. For the movie, we will be using a Raspberry Pi scripted for a timelapse frame collection, coupled with a high-definition camera. We will produce a visual description of the development of the symptoms for both viruses as compared to a non-infected plant. Based on the virus-host intermolecular interactions, it is suspected that the following phenotypes will be observed: dwarfing, chlorotic mottle, yellow mosaic, and crumpled leaves. Successful infection of the pathogen is dependent on the virus-host intermolecular interactions. The intermolecular interactions of the plant allow them to express their gene products and replicate their genomes so that the virus may move to adjacent cells and through the rest of the plant. Next, DNA is extracted from the host plant and observed using gel electrophoresis, PCR, and qPCR techniques to observe the viral load within the plant. PCR techniques allow us to qualitatively understand the presence or absence of the virus. Further study by qPCR techniques allows us to quantitatively amplify and calculate the degree of viral DNA present within the plant.

Aye-aye Mother-Infant Behavior Project

Researcher(s): Rebecca Olson - College of Sciences, Tiffany Brocco - College of Sciences, Eli Benbeneck - College of Sciences
Mentor(s): Dr. Lisa Paciulli - College of Sciences

In this study, a mother aye-aye (Daubentonia madagascariensis) and her infant's behaviors were examined. The Duke Lemur Center (DLC) approved use of footage taken from Pelco IMM12027-1S cameras set up to observe a mother and infant aye-aye in their enclosure. Aye-ayes create nests in the wild but are rarely documented because they are nocturnal and build their nests off the ground. Video-files were coded for the time, type of behavior, individual who exhibited the behavior, and proximity to the nest. Several days worth of peripartum footage captured in 3-hour intervals revealed behavioral patterns both the mother and the infant are likely to exhibit around one another. Behaviors included grooming, nest construction, observing, and captive carrying. Limitations included inexperienced coders, human error, nocturnal activity, and lack of synced vocalization data. Nonetheless, these results, showing trends in aye-aye behavior, can contribute to the future conservation of this critically endangered primate.

School Racial Climate's Effects on Belonging and Academic Coping

Researcher(s): Fiona Prestemon - College of Humanities and Social Sciences
Mentor(s): Dr. Kelly Lynn Mulvey - College of Humanities and Social Sciences

School racial climate (SRC) plays a role in students' school performance (Byrd, 2015; Byrd, 2019; Byrd & Chavous, 2011) yet no prior research explores its relation to academic coping (AC), a tool that can support school success (Skinner et al., in press; Skinner & Saxton, 2019). The present study investigates how SRC shapes a student's AC strategies, and if belonging mediates the relationship. 686 students in 9th and 10th grade (Mage= 15.13, SD = 0.86) of diverse racial makeup were recruited from five low-to-middle income public schools in the southeastern United States to complete a survey with likert scales for SRC (Byrd, 2015), an adapted Institutional Belonging Scale (London et al., 2011), and an AC (Skinner & Saxton, 2019) likert scale. After data collection, a mediation analysis was run with Hayes' SPSS process macro with the Sobel test (Z) and 95% confidence intervals. From these processes, we found interaction between SRC and AC, as well as a relationship between SRC, a sense of belonging, and academic coping. These results suggest a student's sense of belonging could behave as a mediator between SRC and AC. Belonging also a) has the potential to help or harm a student's AC and success, and b) has different levels of influence based on the student's level of belonging within academic work. Based on these findings, schools and researchers can acknowledge the need for a positive SRC, and work to foster belonging and explore early interventions that promote a positive racial climate in the school setting.

Perception of Warm-Up and Stretching Protocols of NCSU Gym Goers

Researcher(s): Gianna Vega - College of Engineering
Mentor(s): Ms. Mary Estrada - College of Humanities and Social Sciences

Stretching before running is a highly divisive topic in the running community because studies do not provide consistent results regarding its impacts. My in-progress paper explores the opinions of NCSU patrons and gym-goers regarding stretching before running. A survey will be disseminated in Carmichael Gym and it will serve as the data collection tool for my research. I expect to find that NCSU gym goers think that static stretching benefits them before a long run. I concluded this because most people have been conditioned to consider that stretching is a prerequisite to engaging in any type of physical activity, particularly running. However, I am also interested in evaluating the different perceptions gym-goers might have based on previous athletic backgrounds.

What do NCSU American Students Think About Study Abroad Opportunities?

Researcher(s): Diego Renau Robert - College of Design
Mentor(s): Ms. Mary Estrada - College of Humanities and Social Sciences

As an international student, I know it can be both exciting and intimidating to study outside of one's native country. Adapting to a culture, making friends, and other factors can be a source of concern. It is known that studying abroad can impact academic achievement (Nwosu, 2022), has personal and professional benefits (Milian et al., 2015), and affects second language acquisition (Freed, 1995). The purpose of this project is to determine what NCSU students think about studying abroad and identify what factors influence their answer. I will survey domestic NCSU students and ask them about their opinion on studying abroad and collect demographic information to help shape a profile that may provide insight to opinions on studying abroad. It is expected that most students will have a positive view of studying abroad. Those who have already experienced travel away from home to study for university are likely to view studying abroad more positively (e.g., due to a level of independence gained from moving away from home) than those who have not traveled. Factors such as "sense of adventure" or family background may have an important role in what students think about going to a foreign country. It is expected that most students will make their decision about studying abroad between the 2nd and 3rd year in college depending on area of study, scheduling, and availability/knowledge of opportunities.

CHARGE: Camouflaging beHavior in Autistic Adults by Race, Gender, and Ethnicity

Researcher(s): Marguerite Ross - College of Sciences
Mentor(s): Dr. Jamie Pearson - College of Education

Camouflaging entails 'masking' or 'passing' in social situations. We hypothesize that racially and gender-marginalized individuals will have significantly more pressure to mask and will do so at a higher rate. The purpose of this study is to illuminate the racial and gender differences in autistic adults' camouflaging by using an oversampling of marginalized groups. This study accomplishes this by surveying 300 autistic adults with the CAT-Q, DASS-21, and RAADS-14, all methods used in Cage and Troxell-Whitman's 2019 study, *Understanding the Reasons, Contexts, and Costs of Camouflaging in Autistics*. This study is in its early stages and therefore does not have data or conclusion.

The Effects of Chronic Alcohol Exposure on Alzheimer's-Related Pathologies

Researcher(s): Sashank Sabbineni - College of Agriculture and Life Sciences
Mentor(s): Dr. Shannon Macauley - Wake Forest School of Medicine

Alzheimer's disease (AD) is the 7th leading cause of death in the US with over 6 million people affected (NIA). One of the major components of AD is the accumulation of amyloid beta (Aβ) plaques which can lead to neurofibrillary tangle formation and neurodegeneration. Determining how risk factors that facilitate earlier cognitive impairment and increase Alzheimer's pathology is vital to determine novel targets to slow the rate of AD progression. Studies show that long term alcohol consumption can lead to an increased rate of AD progression and Aβ plaque deposition. To further assess the role of alcohol consumption in AD, our lab identified whether chronic alcohol consumption would produce similar effects in a mouse model of AD. To do this, we exposed APP/PS1 mice to a modified two bottle choice paradigm for 10 or 20 weeks. Following 10 weeks of ethanol exposure, APP/PS1 mice exhibited a deficit in brain mass, but no overall change in Aβ plaque deposition. Since chronic alcohol use is associated with an earlier development of AD pathologies, we increased the duration of ethanol exposure to 20 weeks in a new cohort of APP/PS1 mice. Following 20 weeks of ethanol exposure, APP/PS1 mice presented similar deficits in brain mass, robust increases in Aβ plaque deposition, and alterations in plaque localizations, specifically from the brain parenchyma to the vasculature. Having identified these changes, we sought to determine how gene expression for glia and vasculature were altered as a result of genotype and ethanol exposure.

Production of Rep from a Viral Protein for Binding Assays

Researcher(s): Courtney Walton - College of Agricultural and Life Sciences
Mentor(s): Dr. Trino Ascencio-Ibáñez - College of Agricultural and Life Sciences

Geminiviruses are destructive diseases to plants worldwide, and a method of broad-based resistance has not been found for these viruses. Geminiviruses are small circular single stranded DNA viruses that are transmitted by insects. Their small genomes encode for 5-7 proteins, among them one (called Rep or AL1) that is responsible for their replication, although it is not a DNA polymerase. The Rep protein is common to all geminiviruses and is absolutely necessary for replication of the virus. Therefore, targeting the Rep protein is a possible way to stop viral replication of these viruses and potentially allow for resistance against multiple geminiviruses. Production of the Rep protein in large quantities will allow for further studies on the binding of peptide aptamers and small molecules to the Rep protein in the future. Additionally, testing can be done to determine if the potential binding of these molecules actually inhibits viral replication. Thus, in this experiment, we developed a protocol for how to produce the Rep protein in our laboratory. We selected two strains of E. coli, pLYSE and BL21 for production of

the protein based on prior research showing success using these strains. Using the protocol outlined in this report, the Rep protein was successfully produced on a small scale from the BL21 strand of E. coli bacteria.

The Preferences of NCSU International Students for Making Friends

Researcher(s): Zhangyixin Zheng - College of Humanities and Social Sciences
Mentor(s): Ms. Mary Estrada - College of Humanities and Social Sciences

In this study, I will explore the preferences that Chinese students at NC State have when making friends. From previous literature, we know that the majority of students' networks are comprised of co-nationals. However, one previous study reveals that some international students tend to revert to segregation after negative interactions with the domestic population (Hendrickson, 2011). In my study, Chinese students at NC State will complete a questionnaire about their social ranges and preferences; to be more specific, I will ask, "Do Chinese international students have different views about American students and compatriots? Do you have or have ever come across any stereotypes in the US that affect how you make friends? How would you respond to these stereotypes; do you fight against or stay away from similar-background socializing?" It is hypothesized that Chinese students will not base their choice of American friends on assumed stereotypes held about Americans. It is also hypothesized that Chinese students, aware of stereotypes held against them, may choose to befriend other Chinese students over Americans. Despite stereotypes from and against both Chinese and American students, Chinese students will still seek to make American friends.

Continuous Field Monitoring and Evaluation to Assess Water Quality

Researcher(s): Chase McCrary - College of Natural Resources, Emma Mullins - College of Natural Resources, Mindy Dunn - College of Natural Resources, Jada West - College of Natural Resources
Mentor(s): Dr. Angela Allen - College of Natural Resources

Water samples were tested from two locations in Raleigh: the Richland Creek at Schenck Forest and the Walnut Creek in the Wetland Center vicinity. These samples were analyzed in an effort to begin a long-term water quality monitoring system to evaluate and determine sources of alteration as the surrounding environment changes with time. Continuous monitoring allows us to observe the physical, chemical, and biological parameters of the water as urban development expands and local sewage pipeline reconstruction occurs.

Claire's Choice: A Case Study of Political Lesbianism

Researcher(s): Leslie Vespermann - College of Humanities and Social Sciences
Mentor(s): Dr. Paige Averett - College of Humanities and Social Sciences

Through a series of interviews, Claire describes her journey of choosing her identity as a political lesbian, thus asserting the idea that sexuality can be a choice. Claire identified as a heterosexual woman until about the age of 45, until she experienced a midlife transition in which she chose to become, what she labels herself as, a political lesbian. Using queer theory as a framework, this case study of Claire's midlife transition examines sexual fluidity and the implications of choosing one's sexual identity. This research began by conducting a series of four interviews with Claire and one with her current partner that lasted roughly two hours. These interviews were then transcribed and analyzed between the two research team members using a narrative analysis lens. This research provides themes of 2nd wave of feminism, political activism, woman identified, rebellion, and mutual respect and power in the home. This research is important in understanding the implications of choosing the origins of one's sexuality and the plasticity of identity. However, this research challenges certain political and religious perceptions of sexuality and whether or not it can be acknowledged as something one can choose.

Time Resolved Fluorescence to Identify Plant Lanthanide Binding Peptides

Researcher(s): Alex Harris - College of Agriculture and Life Sciences
Mentor(s): Dr. Colleen Doherty - College of Agriculture and Life Sciences

Rare Earth Elements (REEs) are increasingly becoming critical resources for new technologies. Despite a relatively high abundance, concentrated deposits of REEs are rare and isolation and purification of REEs is economically and environmentally costly. US production is limited and China has come to dominate the worldwide REE supply. Biomining using plant-based peptides from REE hyperaccumulating plants may allow for expanded US production and separation of REEs. In order to identify potentially useful peptides, we are developing high throughput screening methods using time-resolved fluorescence of long lived f-f electronic transitions found in most REEs to identify and quantify REE binding. These long lived transitions enable the detection of REEs in living cells by allowing interfering biologically produced fluorescent signals to decay before an emission spectrum is taken, leaving only the fluorescence of the REEs. I have optimized the detection parameters to detect Europium and Terbium in both plant and yeast tissues. I am now screening for REE sensitizing compounds and beginning to assay REE binding of different isolated proteins.

Designing and Testing 3D-Printed Hyperuniform Networks

Researcher(s): Caitlyn Obrero - College of Engineering
Mentor(s): Dr. Christopher Rock - College of Engineering, Dr. Karen Daniels - College of Sciences

Hyperuniformity refers to a characteristic of networks that fall between ordered and disordered. While ordered networks have a consistent edge length and disordered networks have a variety of edge lengths, hyperuniform networks have characteristics of both. We aim to find which properties of a hyperuniform or nearly-hyperuniform network have practical applications such as transport properties or mechanical response. To make a network from a randomly-generated point cloud become iteratively more hyperuniform, we used Lloyd's Algorithm. The algorithm works by calculating the centroid of each cell in a Voronoi diagram based on the initial point cloud and moving the point to the centroid's position. It generates a new diagram, and the process repeats for N iterations, where each one is more hyperuniform than the previous. For each iteration, we then connect every point to its nearest neighbor using a method called Delaunay's triangulation. We have created MATLAB scripts that bring each dataset from its initial point cloud to an STL file ready for 3D printing. For our printed samples, we selected a copper-filled PLA to provide good thermal and electrical conductivity for transport properties testing. In our initial thermal conductivity tests, we noticed that in more disordered, nearly-hyperuniform structures, heat centralized in areas where the edges were more tightly-packed, matching the predictions from calculating a network property known as betweenness centrality. From these initial results, we are now motivated to quantify these results and extend our studies to include electrical and photoelastic measurements.

Characteristics of Aye-ayes' (Daubentonia Madagascariensis) Huff Vocalizations

Researcher(s): Cooper Lamb - College of Agriculture and Life Sciences, Allie Monohan - College of Sciences
Mentor(s): Dr. Lisa Paciulli - College of Sciences

Vocalizations give information about what an individual is feeling such as fear, hunger, excitement, etc. Aye-ayes (Daubentonia madagascariensis) have four main vocalizations: aack, eeep, drum, and huff. However, little is known about aye-aye communication. In 2020, with Duke IACUC approval, a study was conducted at the Duke Lemur Center (DLC) that examined the vocal responses of five captive aye-ayes in response to a novel object in their enclosures for five minutes. It was found that significantly more "huffs" (n=57) were emitted than any other vocalization (Watts & Paciulli 2020.). The huffs were interpreted as a sign of distress in the aye-ayes when the novel object was present. In this study, the physical characteristics of those

huffs were examined. Spectrograms of the vocalizations were shown in Adobe Audition, and the peak amplitude, frequency, and loudness were noted. Thus far, the results showed that the average peak amplitude of the huffs was -24.56 Hz, the frequency ranged between 121.42 Hz and 126.48 Hz, and the average loudness was -32.23 dB. These characteristics are within the range of other primates' calls. Previously, huffs were viewed as a sign of distress, however, because huffs do not seem to originate from the vocal cords, they may not be a vocalization. Rather, huffs may be a sound made when aye-ayes clear their nasal passage to then breathe in more air/scent, such as dogs do when investigating their environment. Future research should explore the anatomy involved when aye-ayes generate huffs in order to help elucidate their nature and function.

Thermal Tolerance in an Introduced Ant Species

Researcher(s): Lucie Ciccone - College of Sciences
Mentor(s): Dr. Elsa Youngsteadt - College of Agriculture and Life Sciences, Ms. Michelle Kirchner - College of Agriculture and Life Sciences

Brachyponera chinensis, the Asian needle ant, is an imported ant species with an expanding range in the Southeast US. The presence of B. chinensis has been associated with the displacement of several ecologically important seed-dispersing native ant species, making the prospect of the species continuing to spread a cause for concern. Despite their expansion success, it is not clear what has enabled needle ants' spread. Additionally, B. chinensis's utilization of canopy habitat is only starting to be understood. Previously thought to only nest on the ground, nests of B. chinensis have now been found in temperate tree canopies, which are known to experience both more variable and more extreme temperatures than corresponding ground habitat. Due in part to these characteristics, temperate canopies harbor distinct ant communities, and it is unknown how the introduction of needle ants will affect these relationships. We seek to understand the role that thermal tolerance plays in facilitating the spread of B. chinensis by 1) comparing the thermal tolerance of canopy and ground-nesting B. chinensis and 2) comparing the thermal limits of B. chinensis to established current and predicted future air temperature ranges.

Exploring Mites on Lemurs

Researcher(s): Allie Monahan - College of Sciences, Jonah Peckham - College of Sciences, Taeim Kwon - College of Sciences, Trey Kaufman - College of Sciences, Francis Vial - College of Agriculture and Life Sciences, Catherine Edbrooke - College of Sciences, Rebecca Olson - College of Sciences
Mentor(s): Dr. Lisa Paciulli - College of Sciences

Mites (class arachnida) are arthropods living on hosts. Mites have been investigated in mammals regarding their possible role in disease development, but few studies examined proliferation of mites on lemurs. To study mite presence on lemurs, hair samples from the Duke Lemur Center (DLC) were examined by undergraduate research assistants under light microscopes. Potential mites were photographed across six facial and eight limb regions, and subsequently identified based on their morphologies. We have previously found potential mites including Demodex, one of the genera of mites commonly found in domestic animals, on captive lemurs differing in genus and species. Studying the presence of mites on lemurs will provide insight into the largely unstudied relationship between mites and lemurs, identifying if future steps should be taken to prevent mites from inhabiting the hair microbiome of captive nonhuman primates.

Female Lemur Catta Howl, too

Researcher(s): Carmen Cromer - College of Sciences, Diego Garza Guajardo - College of Sciences
Mentor(s): Dr. Lisa Paciulli - College of Sciences

Animals communicate in many ways, including vocally. Ring-tailed lemurs (Lemur catta) are one of the most studied lemur species and have 22 vocalizations (Macedonia, 1993). While investigating ring-tailed lemurs at the Duke Lemur Center (DLC), and their responses to novel objects, a student opportunistically captured video and audio recordings of a female howling. However, howling was previously thought to be a vocalization exhibited only by males. Consequently, this study sought to determine whether what was interpreted by human ears as a female ring-tailed lemur howling was truly a howl or another vocalization. The hypothesis was that female ring-tailed lemurs do howl. Spectrograms of the female's two calls were made using Audacity software (2019), and the start, end, and peak frequencies, and duration and structure of the calls were then compared to spectrograms of five male howls; two published, and three from the DLC. The start (892 Hs, 797 Hz), end (935 Hz, 965 Hz), and peak (928 Hz, 965 Hz) frequencies, durations (1.208 secs, 0.639 secs), and structures of the female ring-tailed lemur's howls fell within the range of male howls. Although Jolly (1966) and Sauther (1991) reported observing a female ring-tailed lemur howl, this is the first recording and analysis of female

howling vocalizations. Male ring-tailed lemurs howl to advertise their location and/or indicate the number of males in the group. It appears that female lemurs howl for different reasons, possibly because they are nervous. Future research should explore female howling in the wild and its function.

Aye-aye Mother-Infant Vocalization Project

Researcher(s): Allie Monahan - College of Sciences, Eli Benbenek - College of Sciences, Cooper Lamb - College of Agriculture and Life Sciences, Ian Lewis - College of Sciences, Rebecca Olson - College of Sciences, Jeni Smithson - College of Sciences, Destiny Clayton - College of Humanities and Social Sciences, Nishani Jacobs - College of Sciences, Hannah Widdowson - University College, Andrea Mims - College of Humanities and Social Sciences, Jarica Edwards - College of Agriculture and Life Sciences, Beatrice Eddy - College of Agriculture and Life Sciences
Mentor(s): Dr. Lisa Paciulli - College of Sciences

In this study the vocalizations between aye-ayes (Daubentonia madagascariensis) and their infants have been examined. Audio files were collected from the Duke Lemur Center's aye-aye enclosure in 2017 when aye-aye Medusa had her infant, Agatha. Adult aye-ayes have four main vocalizations: eep, aack, drum, and huff. Infants have six main vocalizations: scream, plea, grunt, rasp, plea-like-grunt, and scream-like plea. Our coders analyze these audio files and code the time, stimuli, duration, frequency, and amplitude of each vocalization using Adobe Audition. Not much is currently known about the vocalizations between aye-ayes and their offspring and we hope to learn more through our audio files. The results of our analysis may help us to better understand the meaning behind the infant vocalizations and the relationship between aye-ayes and their infants.

Study Abroad

Researcher(s): Khadija Balata - College of Humanities and Social Sciences
Mentor(s): Ms. Mary Estrada - College of Humanities and Social Sciences

Why do college students choose to study abroad?