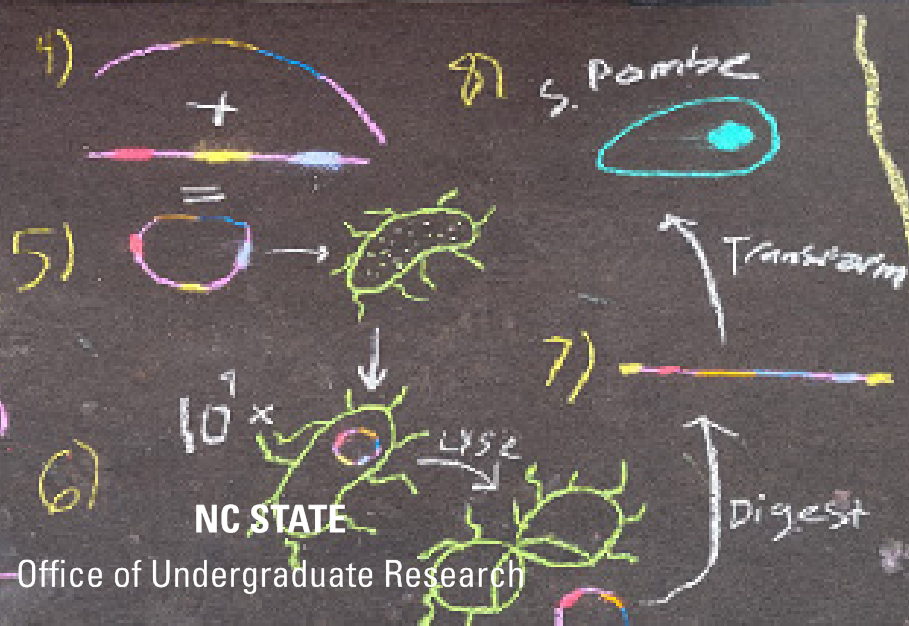


**September 26, 2023**

```
val = 120
```



Thermal Tolerance in an  
Introduced Ant. *B. chinensis*



REFLECTION



POWER IN THE HOME

**NC STATE**

Office of Undergraduate Research

## **Colon Cancer Cell Treatment with Different Phytochemicals**

**Author(s):** Omer Akhtar – College of Agriculture and Life Sciences

**Mentor(s):** Dr. Yoshiaki Tsuji – College of Sciences

Sulphoraphane, or SPH, is a chemical found in broccoli and broccoli sprouts at a high concentration and is linked to having many anticancer effects. The main interaction that leads to this anticancer effect is the fact that the structure of SPH has been shown to bind with an iron metabolism protein called IRP, which binds to the 5' end of a transcription factor called IRE. The IRE transcription factor is shown to be overexpressed in colon cancer and other cancer cells, and the SPH molecule is shown to block the interaction between IRE and IRP. While the interaction between IRE and IRP has been proven to be affected by SPH, there are other similar structures in other phytochemicals, chemicals found in plants, that may also disrupt this interaction. Preliminary data has shown that some of these chemicals are able to disturb this interaction and kill colon cancer cells, the objective of this lab is to find out if any of these other chemicals also cause the interaction to be disturbed at a similar rate as SPH causes. This is done by preparing colon cancer dish cultures and incubating them with different concentrations of these phytochemicals and observing the results under a microscope. While initial tests have potentially shown some effects, the tests need to be repeated to confirm which of these phytochemicals can be effective, and what concentrations they can be used at.

## **Model Averaging Toolbox for Climate Change Projections: Methodology and Implementation**

**Author(s):** Shamik Bhattacharya – College of Natural Resources

**Mentor(s):** Dr. Elias Massoud – Oak Ridge National Laboratory, Dr. Kyo Lee – Jet Propulsion Laboratory, Dr. Adam Terando – College of Natural Resources, Alexander Goodman – Jet Propulsion Laboratory, Adrienne Wootten – Jet Propulsion Laboratory, Dr. Duane Waliser – Jet Propulsion Laboratory

Climate change modeling is a complex endeavor that requires the integration of multiple climate models and observations to enhance the accuracy and reliability of predictions. In this research proposal, we present a novel toolbox designed to facilitate the averaging of climate models, resulting in an ensemble of predictions. Our approach incorporates the Bayesian Model Averaging (BMA) methodology, along with other techniques, to address the challenge of model averaging and improve the precision of climate change projections. The proposed model averaging toolbox encompasses various techniques, including BMA (as utilized in the 5th National Climate Assessment), the Sanderson approach (as employed in the 4th National Climate Assessment), and the AIC (Akaike Information Criterion) methods. These techniques are utilized to estimate model weights, calculate model averages, and compare the predictions generated by the multi-model ensemble against observed data. Furthermore, the toolbox allows for the identification of optimal sets of model weights that can be utilized for post-processing. Notably, the toolbox includes a model independence estimation, an important metric that has gained prominence in recent model averaging methods. By utilizing the obtained model weights, researchers can evaluate the skill and independence of each climate model.

Existing model weighting approaches often rely on predefined criteria to assess model skill and independence, which can limit forecast flexibility and accuracy. In contrast, our suggested toolbox offers users a wide range of alternatives for the model weighting problem, enabling them to effectively address diverse climate change investigations.

## **Analyzing Power Plant Emissions and Environmental Footprint near NC State**

**Author(s):** Shamik Bhattacharya – College of Natural Resources, Emma Mullins – College of Natural Resources, Carter Macklin – College of Natural Resources, Alyssa Paull – College of Natural Resources

**Mentor(s):** Dr. Jennifer Richmond-Bryant – College of Natural Resources

The Yarbrough Drive Central Utility Plant supplies North Carolina State University with a portion of the electricity for the university operations. This plant was built in the 1920s and has undergone a plethora of upgrades and repairs over the past century. The plant is equipped with a Continuous Emissions Monitoring System (CEMS) to monitor concentrations of criteria pollutant emissions from the plant. The objective of this study is to model and analyze the dispersion of pollutants into the campus environment as well as to the surrounding community. Using local climatological data from NOAA and emissions data from a 2019 NC Department of Environmental Quality inspection, a Gaussian dispersion model was created to examine the movement of air pollutants based on wind speed and atmospheric stability. This model aimed to calculate the concentrations of criteria air pollutants at ground level, where most of the campus community comes into contact with the outdoor air. Based on our calculations, it can be concluded that the concentrations of pollution from the Yarbrough Central Utility Plant vary both temporally and spatially. Specifically, pollution concentrations at ground level are highest 1 km away from the plant during the spring and fall seasons. Based on these results, the Yarbrough Central Utility plant does not singlehandedly contribute pollution to the atmosphere in levels that exceed the NAAQS standards. Our findings do not point to any major concerns for ground level air quality near the plant.

## **Assessing Effectiveness of the DSM-5 in Informing Biological Mechanisms**

**Author(s):** Jordan Birkner – College of Sciences

**Mentor(s):** Dr. Joy Little – College of Sciences

This presentation involves the in-progress design and development of a research survey for psychology students to gauge their understanding of medications and biological interventions for mental health disorders in comparison to DSM-5 information. Simply put: does the DSM-5 actually inform the people who will use it in diagnostics anything about a disorder's understood biological mechanisms?

There are correct and incorrect answers regarding classes such as neurodegenerative, neurodevelopmental, and more. Does the DSM-5, as a standard resource, accurately provide access to this information for those who will use this to diagnose and explain to patients what these disorders are? The survey answers can be compared and analyzed through simple statistical means, and trends in commonly missed questions are identified. I hypothesize that there are gaps between the current standard knowledge regarding biological mechanisms in psychological diagnostic categories and the information accessible through the DSM-5. I believe this is an important gap to quantify and understand, especially as those entering the clinical field are expected to interact with patients using the DSM-5's guidance.

While many psychological diagnostic labels may not currently rely on biological assessments, the medications used to treat them do have physiological consequences. The results

gathered from this study can be used to inform local graduate and undergraduate psychology curriculum development, as the students involved in the study may need additional focus on these areas within coursework. The results can also help to formulate potential revision proposals for the DSM-5 itself.

## **Mother-Infant Behavior Project**

**Author(s):** Tiffany Brocco – College of Sciences, Rebecca Olson – College of Sciences, Allie Monahan – College of Sciences, Kayla Ruff – College of Sciences, Kaya Rosselle – College of Sciences

**Mentor(s):** Dr. Lisa Paciulli – College of Sciences

Little is known about mother and infant aye-aye lemur (*Daubentonia madagascariensis*) behavior. Aye-aye behavior is rarely documented because it is difficult to observe since aye-ayes are nocturnal and spend the majority of their time in cocoon-shaped nests in trees. In this study, a Duke Lemur Center (DLC) mother aye-aye and her infant's behaviors were observed. With Duke IACUC approval, Pelco IMM12027-1S cameras were hidden in a DLC pre-partum female aye-aye's enclosure and nest boxes and video-footage was recorded for three days. The video-files were manually coded for three hours for each of the three days using 2.5-minute instantaneous focal animal and all occurrences sampling (Altmann 1974). The time, type of behavior, individual who exhibited the behavior, and proximity to the nest were recorded. Data were entered on Google Forms and compiled into a Google Sheets document. The footage revealed behavioral patterns of both the mother and infant aye-aye. Behaviors most frequently exhibited by the mother included vigilance (67%,  $p < 0.05$ ), nest construction (59%,  $p < 0.05$ ), and grooming (51%,  $p < 0.05$ ). Behaviors exhibited most frequently by the infant included sleeping (60%,  $p < 0.05$ ), nursing (7%,  $p < 0.05$ ), and resting (6%,  $p < 0.05$ ). Limitations of this study included difficulty seeing the aye-ayes due to their nocturnal activity, human error in identifying behaviors, and missing synced vocalization data. This study gives insight to patterns of aye-aye behavior and can be used to contribute to future captive care and conservation efforts of this critically endangered primate.

## **Cross-Cultural Considerations in Survey Design: Female Healthcare Fraud Offenders**

**Author(s):** Audrey Bruening – College of Humanities and Social Sciences

**Mentor(s):** Dr. Jim Yocom – College of Humanities and Social Sciences

Research investigating relationships between race/ethnicity and healthcare fraud have been limited by insufficient attention to relevant survey-design factors. Healthcare fraud that victimizes large corporations or offices are not likely or able to note the race of the offender. Therefore, a well-developed survey to measure the race/ethnicity of a possible offender is crucial in gaining new insights into healthcare fraud offenders. This thesis will offer a strong foundation for future surveys on healthcare fraud and provide insights into measuring sensitive topics in relation to race/ethnicity.

Further, the study explores survey methodology relevant to healthcare fraud committed by Latina and White women, utilizing empirical survey-design elements, the total survey error paradigm, cross-cultural considerations, and pertinent criminological literature. A valid and reliable questionnaire-design, examining variations in time frames, targets, frequency, and magnitude of crime across racial and ethnic groups, provides insights to socio-cultural factors influencing fraudulent behaviors in healthcare. Ultimately, this thesis contributes to social science and medical fields, and serves as a valuable resource for designers working in cross-cultural contexts.

## **Interpolating QCD Between Instant and Front Forms Using Temporal Gauge**

**Author(s):** Hunter Duggin – College of Sciences

**Mentor(s):** Dr. Chueng Ji – College of Sciences

The 1+1D model of quantum chromodynamics (QCD) in the infinite number of colors, or 't Hooft model, is interpolated between the instant form dynamics (IFD) and the light-front dynamics (LFD) using an interpolation parameter  $\delta$  in the interpolating Coulomb gauge which links the Coulomb gauge ( $A^0 = 0$ ) in IFD and the light-front gauge ( $A^+ = 0$ ). There are a number of benefits to the Coulomb gauge that cannot be ignored. All degrees of freedom are physical, making this an ideal choice for finding the bound-state equations and for renormalizability. Using this parameter  $\delta$ , we find the mass gap equation using both hamiltonian formalism and feynman diagram analysis, noting that it reproduces both the results for IFD and LFD in the Coulomb gauge and the light-front gauge, respectively. We then derive the quark-antiquark bound-state equation in the interpolating dynamics using the dressed fermion propagator. We also obtain the bound-state wave functions and compare the results between the interpolating coulomb gauge and the interpolating axial gauge. Since QCD respects the gauge symmetry, these results should all be independent of the gauge choice. These wavefunctions are particularly useful in the calculation of quasi-parton distribution functions (quasi-PDFs), in which we can produce an alternative approach to the quasi-PDFs not only with the frame dependence but also with the  $\delta$  dependence. The interpolation may lead to an alternative quasi-PDF that can be implemented in the lattice QCD without suffering from the large momentum boost.

## **Exploring Mites on Lemurs**

**Author(s):** Adam Ehmke – College of Sciences

**Mentor(s):** Dr. Lisa Paciulli – College of Sciences

Mites (class arachnida) are arthropod ectoparasites living on hosts. Mites have been investigated in mammals regarding their possible role in disease development, and few studies have examined mites on lemurs. Therefore, to study mite presence on lemurs, Duke Lemur Center (DLC) lemur hair samples taken from six facial and eight limb regions were examined under light microscopes. Potential mites were photographed and identified based on their morphology. 30 potential mites were found including some that look like they belong to *Demodex*, a mite genus commonly found on dogs. In the future, genetic analysis would be needed to identify the specific mite species found. Studying the presence of mites on lemurs will provide insight into the largely unstudied relationship between ectoparasites, mites in particular, and lemurs, and if / how mite proliferation causes illness in lemurs.

## **Characteristics of Aye-Ayes' (*Daubentonia madagascariensis*) Huff Vocalizations**

**Author(s):** Adam Ehmke – College of Sciences

**Mentor(s):** Dr. Lisa Paciulli – College of Sciences

Vocalizations give important information about what an individual is feeling such as fear, hunger, excitement, etc. Little is known about aye-aye lemur (*Daubentonia madagascariensis*) communication. Aye-ayes have four main vocalizations: aack, eep, drum, and huff. Thus, to learn more about one aye-aye vocalization - the huff - data were used from a previous study (Watts & Paciulli 2020). In that study, vocalizations were recorded with microphones placed in five Duke Lemur Center (DLC) aye-aye enclosures with Duke IACUC approval. To elicit vocal responses of the five aye-ayes, a novel object (a steel wrench) was placed in their enclosures for five minutes. Watts and Paciulli (2020) found that significantly more "huffs" (n=57) were emitted than any other vocalization. The huffs were interpreted as a sign of the aye-ayes feeling distressed when the novel object was present. In this study, the physical characteristics of those 57 huffs were examined. Adobe Audition was used to create spectrograms of the huffs, and the peak amplitude, frequency, and loudness were noted. The results showed that the average peak amplitude of the huffs was -25 Hz, the frequency ranged between 121 Hz and 126 Hz, and the average loudness was -32 dB. Most importantly, it sounds like huffs do not seem to originate from the vocal cords. Rather, huffs may be the sound made when aye-ayes breathe-out and clear their nasal passages to then breathe in more air/scent, such as dogs do when investigating their environment. So, although the physical characteristics of huffs are within the range of other primates' calls, huffs may not even technically be a vocalization. Future research should explore the anatomy involved when aye-ayes generate huffs in order to help elucidate their nature and function.

## **Exploitation on the Field - Human Trafficking in Sports**

**Author(s):** Drake Gomez – College of Humanities and Social Sciences

**Mentor(s):** Dr. Maura Nsonwu – College of Humanities and Social Sciences

The global sports industry is expected to grow from \$388.28 billion in 2020 to \$440.77 billion in 2021 (Kumar & Bhalla, 2021). Projected to outpace global GDP, the sports industry is a lavishly oiled, complex machine that is entirely dependent on exceptionally talented individuals with the skills, drive, and discipline to chase their dreams (Kearney, 2011). Oftentimes young, socially, and financially vulnerable, athletes are targets for traffickers who hold the deceptive promise of wealth, fame, and opportunity. Traffickers, regularly going by the alias “recruiter” – exploit young athletes through force, fraud, and coercion for social and economic power (Busch-Armendariz et al., 2018; TVPA, section 103[8]).

There is a dearth of publications, information, and vocabulary surrounding the human trafficking of athletes, despite its growing threat to human rights. Though the presenters have identified specific domestic and global legal cases surrounding the topic, they also recognize that the void of information continues to perpetuate this growing and time-sensitive issue and seek to address this.

Exploitation on the Field: Human Trafficking in Sports is a much-needed examination and discourse of this emerging social and public health problem. The presenters will seek to define trafficking within the global sports industry as a human rights violation and center this call-to-action as an international human rights issue by utilizing systems thinking maps (causal loop and flow diagram).

## **Photothermal Heating of Polymers Using Embedded Nano-Tubes**

**Author(s):** Nora Hicks – College of Sciences

**Mentor(s):** Dr. Laura Clarke – College of Sciences, Erin Crites – College of Sciences

Polymer materials are increasingly used in technology and engineering because they are cheap, relatively easy to manufacture, and can be modified by adding fillers such as multi-walled carbon nanotubes (MWCNTs). Carbon nanotubes are strong and highly conductive nano-scale tubes made from carbon atoms. Polymer/MWCNT composites turn a normally insulating material (polymers) into a conductive one, which opens up applications in sensors and wearable technology. However, carbon nanotubes are expensive and currently not economical to use in large-scale applications. In this work, we are maximizing the conductivity of the composite while using the fewest number of MWCNTs as possible by focusing on increasing the dispersion and contacts of the MWCNTs within the composite. To improve dispersion, the surfactant Triton X-100 is used during sample production. We then use photothermal heating (lasers) to heat the junctions of the MWCNTs in the sample, thus increasing the contact between the nanotubes and increasing the conductivity. We monitor the bulk temperature throughout the photothermal heating along with the conductivity of the sample before and after treatment. We look at surface features in optical microscopy and optical properties using UV-Vis spectroscopy before and after photothermal treatment. Through microscopy, we have seen changes in the surface features of composites that have gone through treatment. UV-Vis measurements also display changes in optical properties. Additionally, we explored the relationship between laser intensity, laser duration, and increase in conductivity. We confirm this by seeing an increase in the conductivity of treated samples.

## **Utilizing and Manipulating Agronomical Data to Enhance Sweet Potato Profitability**

**Author(s):** Carmella Holloway – College of Agriculture and Life Sciences

**Mentor(s):** Dr. Daniela Jones – College of Engineering

Sweet potato growers aim to yield the most desirable products to maximize profits. To achieve this, the grower seeks a harvest that externally adheres to the USDA's US No 1. root standard, which outlines the most desirable sweet potato shape and size in the eye of the consumer. Sweet potatoes that do not match this standard are significantly less profitable and risk being left to waste. This project aims to identify factors that will improve the growth of sweet potatoes and reduce the chance of inconsistencies upon harvest. Data such as agronomic field, climate, machinery-based harvest, and packout data will be used to develop algorithms to enhance harvest decisions and improve field selection upon planting time. These results are estimated to positively influence the product's value, reduce produce waste, and increase consumer satisfaction.

## **Splitting Hairs: Bend Testing Gray Whale (*Eschrichtius robustus*) Baleen**

**Author(s):** Ferris Lee – College of Natural Resources

**Mentor(s):** Dr. Cassandra M. Donatelli – Chapman University, Dr. Shirel Kahane-Rapport – California State University Fullerton

Mysticetes, a group of Cetaceans, use an apparatus of baleen to filter-feed their prey. Baleen is a keratinous material that hangs from the palate of a whale's mouth. As baleen varies, so do the feeding methods. Balaenids, which includes bowhead whales and right whales, perform a feeding method that we understand the filtration of. Rorquals, which includes all other mysticete whales, perform a feeding method with a filtration that is not as well understood. Most rorquals utilize intermittent lunge feeding– however, gray whales (*Eschrichtius robustus*) instead use suction filter feeding. Gray whales fluidize mud and sand containing their prey by scraping their heads and baleen along the substrate. In order to better understand how the baleen of gray whales is used in this cryptic process, we measured the morphometrics and material properties of baleen plates from 18 gray whales varying in age and sex. Load capacity corresponded strongly with size and age of the animal, although capacity consistently decreased towards the fringe of the baleen across all groups. Load capacity was found to be higher in males than in females. Scaling of baleen stiffness varied at each section– with the middle and ends of baleen scaling hyperallometrically and portions nearer to the gum scaling hypoallometrically. Variation between age groups in baleen properties is primarily driven by rack spacing and major plate lingual thickness.

## **Comparative Effects of WiFi Transmissions on the Development of Gallus Domesticus**

**Author(s):** Caroline Leanard – College of Humanities and Social Sciences

**Mentor(s):** Shelley Armour – DH Conley High School

This project explored the effects that Internet signals (WiFi) have on the development of *Gallus domesticus* eggs while being incubated and after the chicks hatched. The project commenced on Day 1 when we received the eggs and concluded on Day 28 when the last of the eggs hatched. We acquired the eggs from Perdue Farms in Kenly, North Carolina. This



allowed for uniformity in the breed of the birds and the use of commercial grade eggs. This project was an extension on another chapter member's work on *G. domesticus* and WiFi impact (Nies, 2019). That member explored the impact of WiFi on incubation by exposing one clutch to WiFi and another not. Reflecting upon his work, a larger clutch size was used for a total of 164 eggs, 82 for each treatment. The growth of the eggs was measured in two groups; two incubators in a room with a large amount of WiFi (Group A), and two incubators in a classroom (Group B).

The incubation period began on April 7th, 2023 and ended on May 5th, 2023. It was observed that in Group B, the egg shells were thinner than those in Group A. This could have been due to the lack of ventilation in the server room where Group A was held. There was a 67% hatch rate for the entire clutch. One of the eggs had rolled off the scale, resulting in a crack. That particular egg was a part of the group that did not end up hatching. It was noted that in Group A there was a 64.6% hatching rate, while in Group B there was a 69.5% hatching rate. Since a student from my chapter had previously done this experiment, I expected our results to be similar. However, that was inaccurate. When reviewing the data from the current project, it was concluded that as the egg grew, the total weight of the *G. domesticus* decreased. It was also noted that each incubation group grew at a similar rate. While there were more outliers in Group A (server room), it was noted that there was a higher hatching rate for this group than there was for Group B (classroom).

## **Biochar Anode for Wastewater Microbial Fuel Cell System**

**Author(s):** Khing Masaya-anon – College of Engineering

**Mentor(s):** Dr. Praveen Kolar – College of Engineering

Microbial Fuel Cell (MFC) is a bioelectrochemical system that can treat wastewater and generate electricity by harnessing the oxidation of organic substrate by electrogenic microbes (Patil et al., 2010). The spontaneous redox reaction occurs as electroactive microorganisms oxidize the substrates in the anoxic anodic chamber, releasing electrons and protons that get transferred to the cathodic chamber where oxygen gas is reduced to water. Therefore, MFC is potentially more effective in both energy production and waste remediation because the microbial oxidation of substrate reduces the chemical concentration (indicated by COD) in wastewater while simultaneously producing bioelectricity and clean byproduct. Nonetheless, the system still needs continuous efforts to significantly improve the power density (Pd) and decrease the cost of fabrication which challenge large-scale practicality (Gude, 2016).

Biochar (BC) electrode is one of the potential solutions to a more robust and sustainable MFC system for bioelectricity and wastewater treatment. While biochar has competitive conductivity and durability compared to traditional carbon-based electrodes, it can be synthesized from various biomass and agricultural byproducts with lower cost, biocompatibility, and higher renewability (Chakraborty et al., 2020). Its large surface area and porosity can also benefit the microbial communities and enhance power generation. With the high availability of pine bark biomass and swine lagoons in North Carolina, this study aims at developing an efficient MFC system with pine bark biochar anodes to remediate lagoon wastewater and generate electricity. The %COD reduction and Pd of the wastewater-MFC system will be used to evaluate effects of different material and chemical modification of BC anode compared to traditional graphite granules (GG) anode. Other methods e.g. SEM and hydrophobicity test will be used to evaluate the physiochemical property of each anode and the corresponding biofilm formation, with the hypothesis that BC anode will result in better performance and higher economic benefit relative to commercial GG anode.

## **Aye-aye Mother-Infant Vocalization Project**

**Author(s):** Allie Monahan – College of Sciences, Chloe Glynn – College of Sciences

**Mentor(s):** Dr. Lisa Paciulli – College of Sciences

Like humans, other primate mothers use vocalizations to communicate with their offspring. Not much is known about the vocalizations of aye-ayes (*Daubentonia madagascariensis*) as they are nocturnal, tree-dwelling, and cocoon-nest living animals that are difficult to see and hear. In this study, the vocalizations between a captive aye-aye mother and her infant were examined. Microphones were placed in a mother-infant aye-aye (Medusa and Agatha, respectively) enclosure at the Duke Lemur Center. Using Adobe Audition, the audio-recordings were listened to and the mother's vocalizations were identified as either an eep, aack, drum, and/or huff. Similarly, the infant's vocalizations were identified as a scream, plea, grunt, rasp, plea-like-grunt, and scream-like plea. The time, stimulus, duration, frequency, and amplitude of each vocalization was also noted. The results showed that the mother's most common vocalization was the huff at 93 instances, while the infant's most common vocalization was the scream at 34 instances. These vocalizations yield insight into the little known aye-aye mother and infant communication and relationship.

## **Lemur Mother Anxiety and Infant Sex Differences Project**

**Author(s):** Allie Monahan – College of Natural Resources, Maddie Greenway – College of Sciences, Rebecca Olsen – College of Sciences

**Mentor(s):** Dr. Lisa Paciulli – College of Sciences

One of the main female reproductive strategies is to invest in offspring. To this end, mothers have close affiliative relationships with their infants (Broad et al. 2006). In some lemur species, mothers show sex biased behavior, displaying more affiliative behaviors with female offspring (Schaik & Kappeler, 1993). Maternal anxiety can also impact sex-differentiated behaviors (Coleman & Pierre, 2014; Olson et al., 2022). In this study, the behavior of lemur mothers toward their offspring was examined at the Duke Lemur Center. We hypothesized that mothers would behave more negatively toward male offspring, and that anxiety would impact the interactions. Data were collected using 3-minute instantaneous focal animal sampling as well as all occurrences sampling of all affiliative (e.g., grooming), agonistic (e.g. biting), and anxiety (shivering and pacing) behaviors toward infants. Preliminary analysis suggests that mothers showed higher levels of agonism toward male infants. Future research should further examine mother-infant interactions in order to better understand sex differentiated behaviors between mothers and their offspring, as well as how maternal anxiety affects interactions with offspring.

## **Order Effects of Exposure to Distraction on Frustration**

**Author(s):** Trevor Patten – College of Humanities and Social Sciences

**Mentor(s):** Dr. Anne McLaughlin – College of Humanities and Social Sciences, Frank Lodge – College of Humanities and Social Sciences

Extended Reality (XR) technologies have applications for aiding complex attention tasks. XR can simulate reality, add information, or remove information. We used virtual reality (VR) to simulate a room on the ISS with many ongoing distractions to understand the effects of diminished reality (DR) on complex attention tasks. The conditions were a control with no

diminishment, a universal diminishment that reduced all stimuli, and a context-aware diminishment that reduced only irrelevant stimuli. I believe that changing the conditions influenced the participants' frustration, potentially increasing their workload. We measured participants' subjective cognitive workload using the NASA-TLX after each scene to assess the impact of the DR condition on the cognitive workload required to complete the task. By analyzing the difference in frustration scores from each TLX between diminishment conditions, we can identify if changing to different conditions influenced participants' frustration scores, and what sequence of conditions influenced frustration the most. An understanding of when and what kind of diminishment to use can inform future design decisions on the situational use of DR.

## **What Kinds of Proteins Are You Really Eating?**

**Author(s):** Nicole Rideout – College of Sciences

**Mentor(s):** Dr. Manuel Kleiner – College of Agriculture and Life Sciences, Ayesha Awan – College of Agriculture and Life Sciences

One of the knowledge gaps within the field of proteomics is understanding the impact of microbial proteins in traditional fermented foods and beverages (TFFB) on their nutritional quality. Currently, we do not know if or how microbial proteins in TFFB are digested by the host or processed by the gut microbiota. Little research has been done on the nutritional relevance of microbial proteins present in the dietary proteins of fermented foods. The goal of this project was to address this knowledge gap and explore the microbial protein content of fermented foods using metaproteomics. I did this by extracting proteins from different fermented foods (plant-based and dairy-based yogurt, sourdough bread, plain yeast bread, dairy and non-dairy sour creams, miso, and tempeh) and then analyzing the extracted peptides using mass spectrometry. I am currently working on creating databases of known proteomes taken from UniProt that I expect to find in each of the fermented diets based on literature, and then using the databases to identify the proteins in our samples. We expect to find that the fermented foods will have a high abundance of microbial proteins because the industrial processes used to manufacture the fermented foods utilize a variety of microbial species.

## **Who's Responsible for Implementing Sexual Health Programming for Youth in Foster Care?**

**Author(s):** Karina Seebaluck – College of Humanities and Social Sciences

**Mentor(s):** Dr. Laura Widman – College of Humanities and Social Sciences; Julia Brasileiro – College of Humanities and Social Sciences

Youth in foster care have increased risk for STIs and pregnancy compared to their same age peers. Providing youth in foster care more access to education regarding sexual and relationship health may help improve these poor outcomes; however, there's limited research about who should be offering this information. This study aims to better understand who's responsible for offering sexual health programming to youth from the perspective of adults working with youth in foster care.

Our sample included 14 adults in the southeastern U.S. affiliated with the foster care system (M age = 40; 100% female; 64% white; 2-21 years of experience). Recruitment occurred via community partners and a listserv of foster caregivers. With some holding multiple roles, this sample represented 9 foster caregivers, 3 employees of private foster care agencies, and 4

Department of Health and Human Services (DHHS) social workers. Semi-structured interviews were conducted over Zoom, transcribed, and coded by two authors.

Data are currently being analyzed, but overall suggest that adults affiliated with the foster care system believe the responsibility of offering sexual health education to youth is a team effort of foster care social workers and foster caregivers. Few placed the responsibility onto foster care social work agencies, or through social-worker led group meetings with youth. Others deemed foster caregivers responsible because of they live with youth. Future research should elaborate on caregivers and social workers best coordinating an approach to offering sexual and relationship health programming to youth in foster care.

## **Evaluating Liver Disease Disparities: Epigenetic Insights from Marginalized Communities**

**Author(s):** Abdullah Zaben – College of Agriculture and Life Sciences

**Mentor(s):** Dr. David Skaar – College of Sciences

In our ongoing research project, we aim to investigate the disparities in liver disease prevalence among marginalized communities compared to their counterparts. Our primary objective is to understand how environmental exposure and lifestyle choices contribute to disproportionately higher rates of liver disease in these communities.

To answer this question, we are employing an epigenetic approach. Specifically, we are exploring the role of methylation-sensitive regions in the genome, known as Imprinting Control Regions (ICR), in regulating gene expression. Our research hypothesis centers on the presence of liver-related ICR regions that may play a crucial role in developing chronic liver disease.

Our study design comprises a blind investigation, with a control group consisting of DNA samples from individuals without liver disease and a case group comprising individuals diagnosed with chronic liver disease. We have conducted bisulfite DNA conversion to facilitate methylation percentage analysis during sequencing. Subsequently, we have designed primers specific to the identified ICR regions and utilized PCR to amplify them. We have completed the experimental procedures, including DNA sequencing and methylation percentage determination for both the control and case groups. However, we have yet to analyze the results.