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ABSTRACTS FROM THE 2019 ISSUE

Research Articles:

Connecting Rodents to Our Roots: A Journey of Education and Outreach

—Samm Azen (Mentor: Rebecca Rowe)



The natural world often relies on processes that are not immediately apparent to us. Even if such a behind-the-scenes process is well researched, that research might have little effect if the public does not learn about it. This article describes my experience researching the important relationship between small mammals, mycorrhizal fungi, and forest health and then describes the outreach program I conducted on this topic. With a research team from the University of New Hampshire and funded by a Summer Undergraduate Research Fellowship (SURF), I observed the movement and diet patterns of seven rodent species at the Dartmouth College Woodland. Our research showed that rodents carried truffle spores from the established woods into regenerating sections of forest, which needed to establish relationships with the fungi in order to grow and thrive. To extend my summer field research and to apply my studies as an outdoor education major, I created an experiential outreach program to educate the public and show them how they can help to maintain forest health. The engagement of participants, their feedback at the end of the program, and their ability to discuss what they had learned made the outreach program a success.

Investigating the Dark Sector: Attempting to Resolve the Hubble Tension with a Modified Model of the Universe

—Emma Clarke (Mentors: James M. Ryan, Subinoy Das)



The standard model of Big Bang cosmology is the Λ CDM model, which incorporates cold dark matter and dark energy, two mysterious components of what is known as the “dark sector” of the universe, or sector not directly observable with light. Observations of primordial light in the universe allow precision tests of cosmological models, including the expansion rate of the universe, also known as the Hubble constant. Values of the Hubble constant determined using observations of primordial light and the Λ CDM model are in disagreement with the value determined from local observables, such as the recession velocities of galaxies observable with satellites. This tension may indicate a need to move beyond standard Λ CDM. During my International Research Opportunities Program (IROP) research at the Indian Institute of Astrophysics in Bangalore, India, I studied a possible extension of the Λ CDM model in which cold dark matter decays into dark radiation. In this project I investigated the effects of decaying dark matter on cosmological observables such as the Hubble constant. My results show that the decaying dark matter model may help alleviate tension between the indirect and direct determinations of the Hubble constant.

What Influences Seed Selection by Small Mammals?

—Corina Danielson (Mentor: Rebecca Rowe)



Small mammals in New England primarily consume seeds and nuts in the summer. Their selection process while foraging is influenced by many factors, such as seed availability, the density of nearby shrubs, and moon luminescence. This process can, in turn, affect the composition of plant establishment in forests. To examine the primary factors behind small mammal feeding behavior, I recorded the activities of deer mice (*Peromyscus maniculatus*), white-footed mice (*Peromyscus lecopus*), and southern red-backed voles (*Myodes gapperi*) while they were foraging at experimental seed trays containing seeds from American beech, eastern hemlock, and red maple trees that were native to the study site. This study was conducted at the Bartlett Experimental Forest in the White Mountains of New Hampshire, allowing me to capture data from small mammals living in softwood and mixed forest types. The data I've collected has given insight into the variables driving foraging behavior in these rodent species and could have important implications for the relationship between small mammals and forest communities in New England.

Effects of a Typical Fast-Food Meal on Arterial Stiffness in Young Adults

—Erik J. Harrington (Mentor: Timothy J. Quinn)



Fast food is a quick and easy alternative to preparing a meal and is a growing industry that is popular among all demographics and ages. Many younger individuals think that consuming this type of food frequently has no adverse health effects, because their bodies are able to metabolize the food quickly and without noticeable health-related consequences. One way of assessing the stress that this type of food places on the body is through measurement of arterial stiffness. I conducted a study during the summer of 2018 in the Robert Kertzer Exercise Physiology Laboratory at the University of New Hampshire to study the short-term effects on arterial stiffness after consuming a typical fast-food meal high in fat, sodium, and cholesterol. Significant differences were seen in the diastolic blood pressures measured following the consumption of the meal, just one of the measurements taken to assess the health of the cardiovascular system. The drop in diastolic blood pressure was a possible sign of reduced blood flow to the heart, which has more serious implications when this food is consumed habitually. Although other measures neared significance, the small sample size proved to be the greatest obstacle in achieving more significant results.

I Cannot Tell a Lie: Emotional Intelligence as a Predictor of Deceptive Behavior

—Jasmine A. Huffman (Mentor: Nicholas Mian)



Research has identified that perceived acceptability and likelihood of lying depend on the type of lie and personality characteristics such as honesty, kindness, assertiveness, and Machiavellianism. However, this research has focused on individuals' experiences of their own emotions and neglected to consider how an individual's understanding of others and their emotions influences deceptive behavior. I expanded upon this research during the summer of 2018 by investigating the relationship between emotional intelligence, personal intelligence, and perceived acceptability and likelihood of telling four types of lies, which are distinguished from one another based on their motivation (altruistic, conflict avoidance, social acceptance, or self-gain). Participants were 80 University of New Hampshire undergraduate students who completed an online survey consisting of both self-report and ability-based measures. Results suggest that scores on ability-based tests of personal intelligence may be useful in predicting an individual's likelihood of telling lies for the purpose of social acceptance. Results also indicate a significant negative correlation between self-reported likelihood of telling social-acceptance lies and levels of personal intelligence, indicating that those with higher personal intelligence are less likely to tell social-acceptance lies.

Scaling Methane Emissions Using Vegetation Cover Type at Sallie's Fen

—Madeline Juffras (Mentor: Ruth K. Varner)



Wetlands are the largest natural source of methane entering the atmosphere, yet there are still uncertainties in the magnitude of these emissions due to the spatial and temporal heterogeneity of methane production and transport processes. One process by which methane can be emitted to the atmosphere from wetlands is through plant-mediated transport—the diffusion of methane through plant tissue. The objective of my project was to determine how methane emissions vary depending on the plant species composition at Sallie's Fen in Barrington, New Hampshire. I used static flux chambers to measure methane emissions at six locations across the fen. I used quadrat sampling to determine species composition. Aerial photography and a geographic information system in combination with transect quadrat sampling were used to create a vegetation map of the entire site. The combination of methane emission data and species composition allowed for scaling of emissions across the entirety of the fen. Overall, this project furthers our understanding of complex wetland ecosystems and their relation to methane, a radiatively important greenhouse gas.

Evaluation of Methods to Monitor Per- and Polyfluoroalkyl Substances (PFAS)

—Alexa Kaminski (Mentor: Kevin H. Gardner)



Per- and polyfluoroalkyl substances (PFAS) are a group of manmade environmental contaminants. They have been used since the 1940s for their desirable properties, including ability to repel both oil and water. For this reason, they have been used for industrial applications as well as in consumer products, such as food wrappers, waterproof clothing, cleaning products, and ski wax. Recent studies have shown adverse health effects following exposure to even low concentrations of these chemicals. PFAS are also mobile in the environment and resistant to degradation, so their widespread use has made them a near-ubiquitous environmental contaminant. The purpose of my project was to evaluate passive sampling techniques for the quantitative monitoring of PFAS in the sediment porewater matrix. This passive sampling technique will make use of a sorbent material to concentrate PFAS inside the sampler, which is important because PFAS is present in the environment in very low concentrations that can be difficult to analytically quantify. Three potential sorbents were tested. Throughout this project, we were able to successfully refine our testing methods in the lab, which will be important for further PFAS studies in the future.

Korean-American Military Brat Lands in NH and Seeks to Improve Mental Health Training for Future Pediatricians

—Claudia R. Maynard (Mentor: Nicholas Mian)



Early recognition of psychiatric disorders is a crucial part of improving a patient's quality of life. Pediatricians are vital in detecting child anxiety, but studies show a lack of training in evaluating, managing, and treating anxiety disorders. Furthermore, there is limited research regarding clinical decision making among early-career medical professionals. I joined the Pediatric Anxiety Training Study (PATS), managed by Dr. Nicholas Mian at the University of New Hampshire at Manchester, which aims to improve pediatric residents' ability to evaluate anxiety disorders. I focused on the possible influence of medical resident characteristics (career focus, interest in child mental health issues, and level of experience) on clinical decision-making factors (diagnosing, referring, and interference ratings). I focused on an assessment in which the resident watched a video showing a patient with anxiety symptoms and then responded to questions. Results show that residents interested in a career in clinical/primary care, as opposed to a career in academic/emergency medicine, reported that the child needed to be referred sooner and that the anxiety was affecting the child to a higher degree. *(continued on next page)*

(Maynard, cont'd)

Also, there was a significant positive correlation between a resident's level of interest in child mental health issues and how urgently the resident would refer the child for treatment. In addition, 78 percent of residents reported receiving "not enough" training on evaluating anxiety disorders. This study has shown the need to use enhanced physician-education tools and an interdisciplinary approach between clinical psychologists and primary care physicians in order to improve patient outcomes.

The Heart of a Horse: 3-D Echocardiographic Analysis of the Equine Aortic Valve

—Amber McElhinney (Mentors: Andrew Conroy, John A. Keen)



Aortic regurgitation (AR) can be a normal function of aging or a disease in younger horses. Symptoms range from no outward signs to decreased performance to sudden cardiac arrest. My study used 3-D echocardiography, ultrasound of the heart, to look at the equine aortic valve and assess it for AR severity. Three-dimensional echocardiography records a pyramid of tissue rather than a 2-D plane, showing cardiac structures difficult to visualize in standard 2-D methods. In normal valves, only the edges of the cusps were visible, as the tissue is very thin when images were taken from the right, which is standard positioning for imaging the aortic valve. I observed the cusps of the aortic valve to be thickened in horses with AR, with degree of thickening corresponding to AR severity. Left-sided images were generally worse quality than right-sided, but in some cases there was better visualization of some aspects of the aortic valve in left-sided images. 3-D echocardiography potentially could be used as a standard for diagnosis of AR, specifically by looking at cusp thicknesses, and could more specifically diagnose which part of the valve is affected by disease.

Digging in the Dirt and Keeping Research Clean: Bridging Two Majors with Hands-on Work

—Rebecca M. Philibert (Mentors: Eleanor Harrison-Buck, Julie Bryce)



With a double major in anthropology and Earth science, my research experiences include both archaeological field school in Belize and work in a clean lab. In field school I experienced what participating in a Maya dig is like: early mornings, long days in the tropical heat, the rewarding feeling of finding artifacts and making maps of the site, and finally, validating that archaeology is what I want to do. My more recent work in the clean lab has branched off from that field school experience. Throughout the summer of 2018 and the academic year that followed, I have been working to expand our knowledge of neodymium as a useful new method in archaeology. Specifically, I am aiming to improve the methods in which the provenance of ceramic artifacts can be attained. During my research I worked with clay samples taken from the Belize River Valley during the 2013–2014 field seasons by a previous University of New Hampshire student. I analyzed both the strontium isotopes, a method that is already used in archaeological research, and the neodymium isotopes, a method new to the archaeological field. My results will go toward a push to make neodymium isotopic analysis more common in the field and a database of known neodymium concentrations available for future archaeologists. Funded by a Summer Undergraduate Research Fellowship, this project has allowed me to combine both of my majors for my senior thesis and has set me up for a great beginning to my graduate career.

Commentaries:

Looking into the Eye with REAP

—Ryann Boudreau (Mentor: Kyung Jae Jeong)



Keratoprosthesis is an artificial cornea that is surgically implanted in the eye to replace damaged cornea, correcting corneal blindness. Keratoprosthesis offers a unique solution that eliminates the possible rejection of donor cornea, a common problem with keratoplasty. The design used currently for this procedure is Boston Keratoprosthesis (KPro), but it has some flaws. Boston KPro needs donor cornea for its design, which is in high demand and short supply. The design is also open to the environment, creating a pathway for bacteria to enter the eye and cause permanent damage. My research through the Research Experience and Apprenticeship Program (REAP) at the University of New Hampshire involved creating a new artificial cornea

that fixes both of these issues. I started fabricating a cornea out of silk fibroin and gelatin, called a hydrogel, to replace the need for donor cornea. These hydrogels were tested using a rheometer and a scanning electron microscope for the stiffness, mechanical strength, and porousness of the structure, as these qualities have to be similar to a real cornea. It was a success. We created hydrogels that replicated the characteristics of a human cornea and fixed the issues Boston KPro has. REAP was a great opportunity to explore my interests in bioengineering while potentially changing peoples' lives.

From Farm to Fork: A Firsthand Investigation into New Hampshire's Food System

—Alexandra Papadakis (Mentor: Joanne Burke)



Inspired by my first year studying sustainable agriculture and food systems at the University of New Hampshire (UNH), I sought to get a better handle on the food system by diving into a research project with my mentor, Dr. Joanne Burke, a professor in the Department of Agriculture, Nutrition, and Food Systems. Together, we planned a full summer investigating various aspects of New Hampshire's food system, allowing me to better understand what goes on from farm to fork and to think through potential opportunities that exist to improve food system viability in our state. Using the food system framework of the New Hampshire Food Alliance to structure the research, we looked at opportunities to improve food system education, increase market

development for local producers, and increase food access for New Hampshire residents. To do so, I worked with a middle school farm-to-school education program, surveyed farmers and consumers, and volunteered with an organization called NH Gleans. By the end of the summer, I witnessed how education can influence students' knowledge about food, explored the feasibility of establishing a food hub in the seacoast area, and learned how gleaning can assist food assistance providers in supplying fresh produce to those in need.