**Green Sea Urchins Need Friends: Decision Making and Risk in *Strongylocentrotus droebachiensis* in Competitive and Non-Competitive Foraging Environments**

Larry G. Harris, Jenna N O'del[2], Sierra Rose Mae Walsh[1]
[1]Biological Science, UNH Durham
[2]Biological Sciences, UNH Durham

Green sea urchins (*Strongylocentrotus droebachiensis*) have unique foraging behaviors not currently understood. Pilot studies have examined these behaviors with captive urchins and have noted that competition may change urchin foraging behaviors. We ran experimental trials to investigate behavior of solitary and groups of urchins when offered a high value food source (shrimp). Urchins were placed in one of two environments: competitive (five urchins) or non-competitive (alone), three replicates each, three types of experimental trials. These trials involved timing the urchins' movement across a tank from a uniform starting point to an animal protein food source, rewarding the urchins with some of the animal protein once the food was reached within the trial duration; we also recorded a lack of results within each trial. The three trial types saw the urchins able to use kelp as cover and food during the trial, have no cover, or use mussel shells for cover only. Tradeoffs among attraction of the food source, competition, and refuge from potential predation were observed. Solitary urchins more frequently favored any type of refuge than urchins in competitive environments despite the high value food source, which were more likely to access the food within the allotted time, and to access the food quicker, suggesting a competitive effect. These results indicate that urchins make riskier decisions when in groups.

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| Presenter: | Jenna N O'del |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Senior |
| Research Interest: | Marine Biology |
| Presenter: | Sierra Rose Mae Walsh |
| Presenter's Major(s): | Zoology |
| Year at UNH: | Freshman |
| Research Interest: | Marine Biology |
| Adviser: | Larry G. Harris |

**A Population Genetics Assessment of Northeast Northern Long-eared Bats (*Myotis septentrionalis)* Before and After the Onset and Spread of White-nose Syndrome**

Jeanne M Cassidy, Matthew D MacManes, Meghan Stark
MCBS, UNH Durham

White-nose syndrome (WNS) emerged in North America during the 2005/2006 winter season (Blehert et al., 2009; Lorch et al., 2011; Warnecke et al., 2012). It is caused by the fungal pathogen Pseudogymnoascus destructans (Pd) and, since its initial discovery, has caused a high mortality rate among several Myotis species. While mortality rates from WNS vary among bat species (Langwig et al. 2012, 2016), the northern long-eared bat (Myotis septentrionalis) is one of the species most impacted by the disease, resulting in its current listing as "threatened" under the Endangered Species Act. For this reason, M. septentrionalis was chosen for this population genetics study. In order to answer questions related to the genetic structure of M. septentrionalis throughout the Northeast region before WNS, tissue samples taken from bats before the spread of Pd were prepped and sequenced using a double-digest RAD-seq approach. These results were then compared to samples collected after the onset of the disease. Preliminary results indicate panmixia throughout the Northeast region; meaning they had genetic homogeneity prior to the onset of WNS. Post-WNS individuals show little to no change in genetic variation since the onset of the disease.

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| Presenter: | Jeanne M Cassidy |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | Population Genetics |
| Adviser: | Matthew D MacManes |
| Adviser: | Meghan Stark |

**Assessing Salt Marsh Resilience at Moody Point, Great Bay Estuary, NH**

Natalie A White, Gregg E Moore
MEFB, UNH Durham

Salt marshes are incurring stress from several anthropogenic causes: sea level rise, invasive species, eutrophication, and increased intensity and frequency of storms. These stressors are causing the marsh edge to erode and the vegetation to retreat landward. The residential community of Moody Point located along the shores of Great Bay in Newmarket, New Hampshire is particularly susceptible to these changes, and is already experiencing erosion of walking paths which will soon threaten infrastructure. To determine if Moody Point is a viable location for a coastal restoration project, the Landowner Technical Assistance Program, operated by NH DES and UNH Cooperative Extension, has assessed the property and decided to begin a long-term study at this site. For this study, erosion pins (iron rebar rods) were installed horizontally into the marsh edge at 25 locations and were monitored over a four-month period to determine erosion rates. Other environmental parameters were monitored including vegetation (species composition, percent cover) and porewater (salinity, pH, sulfides, redox potential). Preliminary data shows vegetated percent cover decreases from low marsh to high marsh, and species richness is greatest in the high marsh. Salinity, pH, and sulfide concentrations are highest in the low marsh, while the redox potential is the most negative. Comparing salinity, pH, sulfides, and redox potential to plot distance away from the vegetated edge produces a stronger relationship than comparison to plot elevation. Changes in porewater chemistry and vegetation communities may indicate more frequent flooding and higher risk of erosion.

Presenter: Natalie A White

Presenter's Major(s): Environmental Sciences

Year at UNH: Sophomore

Adviser: Gregg E Moore

**Changes in Bone Health of Female College Students**

Sarah E Pogany, Gretchen L Arnold
Nutrition, UNH Durham

Sarah E Pogany, Jesse Stabile Morrell, Maggie Dylewski Begis, Gretchen Arnold

Objective: Identifying individuals with low bone ultrasound attenuation (BUA) z-scores under the age of 30 can allow for improvements of bone health through increased intake of calcium and vitamin D, physical activity, and avoidance of excessive alcohol or caffeine intake. The goal of this study was to assess changes in bone health and observe related risk factors among female college students.

Participants and Methods: Female students (n=38) enrolled in the Nutrition Program at the University of New Hampshire (UNH) who participated in the College Health and Nutrition Assessment Survey were recruited to participate in a follow-up study during the fall 2019 semester. Subjects completed a bone health questionnaire and repeat bone ultrasonography measurements approximately 2.5 years after their first measurement. Bone ultrasound attenuation (BUA) z-scores from bilateral calcaneus bone were used to assess bone health. Subjects were categorized as low or normal bone status according to World Health Organization z-score criteria. Data are presented as means±SD; changes in z-scores over time were assessed by a paired t-test; group differences were examined using independent t-tests.

Results: No significant differences in bone status were observed between 1st and 2nd measurements (-0.72 ± 0.10 vs. -0.90 ± 0.86, p=0.08). At the follow-up visit, 19 participants were classified as having normal bone (-0.22 ± 0.53) and19 participants had low bone (-1.59±0.43). Subjects with normal bone status participated in more vigorous or moderate physical activity compared to subjects with low bone status (9.4±7.6 vs. 6.03±5.3 hours/week, p=0.07), but this observation was not statistically significant. Alcohol intake, milk intake, and body mass index were not different between groups.

Conclusion: Among female college students, bone status as measured by ultrasound did not significantly change over time, however, findings suggest physical activity may be related to improved bone health. Alcohol intake, milk intake, or body mass index did not differ between students with normal vs. low bone status. Further research should be conducted to measure changes in bone health over time in a similar population using a larger number of participants.

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| Presenter: | Sarah E Pogany |
| Presenter's Major: | Nutrition |
| Year at UNH: | Senior |
| Research Interest: | Bone Health |
| Adviser: | Gretchen L Arnold |

**Diagnostic Findings of Wild Moose Submission to NHVDL from 2017-2019**

David B Needle, Colleen F Monahan, Ji Yoon Park, Inga F Sidor
Molecular, Cellular, and Biomedical, UNH Durham

Diagnostic findings from 123 moose submitted to the New Hampshire Veterinary Diagnostic Laboratory (NHVDL) from 2017-2019 will be presented. Animal are from VT, ME, NH, and MA. All animals are free ranging and are either those encountered by chance by citizens or those being studied by wildlife biologists. The findings include common lesions and distributions seen in youngstock and adults. The most common diagnoses were septicemia, emaciation, and encephalitis. Diagnoses will be presented with respect to geospatial and temporal distribution.

Presenter: Ji Yoon Park

Presenter's Major(s): Animal Science

Year at UNH: Senior

Adviser: Colleen F Monahan

Adviser: David B Needle

Adviser: Inga F Sidor

**Determining the Relative Bioavailability of Two RP-Lys Prototype Supplements Using the *In Vivo* Plasma Dose-Response Method**

Sara E Connell, Nancy L Whitehouse
Agriculture, Nutrition, and Food Systems, UNH Durham

The bioavailability of lysine supplements given *in vivo* is a new area of study as lysine is one of the two amino acids that limit milk production. This study focuses on the relative bioavailability of two prototypic rumen-protected lysine (RP-Lys) supplements (Product A and Product B) and compares them to the positive control Lys-HCl (supplied by Balchem), a known RP-Lys product AjiPro-L, and the negative control water. Five multiparous holstein cows with ruminal cannulas were set up in a Latin 5x5 square in 7d periods. Product A, Product B, and AjiPro-L were fed thrice a day before feeding. The positive and negative controls were infused continuously into the rumen via abomasal cannula. Blood and milk samples were taken on the last three days of each experimental week. The blood samples were taken four times per day and sent to the University of Missouri-Columbia for testing. Milk samples were taken at the am and pm milkings and sent to Dairy One Milk Laboratories in Ithaca, NY. It was found that there was a difference in milk protein yield with the Lys-HCl (1.44kg/d) and AjiPro-L (1.44kg/d) being significantly higher than Product A (1.40kg/d) and Product B (1.39kg/d). The bioavailabilities of each supplement were Product A 23.7% TAA-Lys µM (19.6-27.8%), Product B 5.7% TAA-Lys µM (1.3-10.1%), and AjiPro-L 43.8% TAA-Lys µM (37.8-49.8%). Products A and B had significantly lower bioavailabilities than AjiPro-L, with Product A being significantly higher than Product B.

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| Presenter: | Sara E Connell |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Animal Nutrition |
| Adviser: | Nancy L Whitehouse |

**Sampling Ebullitive Methane Flux From Freshwater Streams: What Worked and What Needs Adjustments**

Wilfred M Wollheim, Carter R Snay, Andrew Lean Robison
Natural Resoures, UNH Durham

During the summer of 2019, I assisted research to further understand GHG mass flux in freshwater streams. By measuring overall gas flux in four different headwater streams in the Plum Island watershed, methane, carbon dioxide, and nitrous oxide concentrations were measured to determine the overall mass flux of these gases at spatially varied sites. We know that GHG flux occurs out of freshwater streams, but we have a very limited understanding of the factors and characteristics that regulate the flux. By examining the different sites physical characteristics, the data can then be used to make predictions about what causes increased (or decreased) emissions of GHGs. Within the sites we looked at water temperature data, sediment depth, and sediment composition. From this information, it was found that further sampling was required to understand trends in spatial and temporal variability.

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| Presenter: | Carter R Snay |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Senior |
| Research Interest: | Green house gas emissions from freshwater streams |
| Adviser: | Andrew Lean Robison |
| Adviser: | Wilfred M Wollheim |

**Exploring the Properties UAS for the Assessment of Ecological Processes and Its Resulting Social Impact**

Hannah A Stewart, Russell G Congalton
NREN, UNH Durham

During the summer and fall of 2019, imagery from unmanned aerial systems (UAS, UAV, or drone technology) was used to generate land cover mapping data to compare with field data across multiple UNH woodland properties and local conservation areas. The purpose of this project was to determine the feasibility and accuracy of this novel aerial technology to assess forest health and stress, determine cover, and evaluate other ecological properties. In addition, the social implications of conducting this type of research were also considered. Through the use of UAS imagery the forest coverage, species, and best forest management practices were, and will continuously be, determined by comparison with previously collected ground sampling plots, pilot studies, and training missions begun in 2016. Previously unattempted local analyses on the capture of forest health, coverage, social and economic implications, and management needs are possible with these new technologies which sense both in the visible part of the electromagnetic spectrum (natural color) and beyond. While assessing land cover data is common, there is a lack of research which discusses the actual social implications and psychological effects which are paired with UAS research, and the repercussions on its surrounding environment. The collection of additional imagery broadens our knowledge regarding the use of UAS to assist ecological research and management practices and begin to understand how this technology effects the surrounding ecosystem.

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| Presenter: | Hannah A Stewart |
| Presenter's Major(s): | Environmental Conservation and Sustainability, Environmental and Resource Economics |
| Year at UNH: | Senior |
| Research Interest: | UAS and social applications |
| Adviser: | Russell G Congalton |

**Multilocus Sequence Analysis of Global Streptococcus canis and Staphylococcus pseudintermedius Reveals Genetically Diverse and Frequently Recombining Lineages**

Cheryl Marie P Andam, Michael James Pellitteri, Griffin Joel-Michael Nye
MCBS, UNH Durham

***Multilocus Sequence Analysis of Global Streptococcus canis and Staphylococcus pseudintermedius Reveals Genetically Diverse and Frequently Recombining Lineages***

Griffin J.M. Nye, Michael J. Pellitteri, Cooper J. Park, Cheryl Marie P. Andam

The public health threat of diseases caused by *Streptococcus* and *Staphylococcus* species is growing significantly with the rise of antibiotic resistance. *Streptococcus canis* is a beta-hemolytic pathogen that causes toxic shock syndrome, necrotizing fasciitis and pneumonia. In humans, *S. canis* has been found to cause a growing number of infections, many of which are due to dog-to-human transmission. *Staphylococcus pseudintermedius* is a gram-positive opportunistic pathogen causing infections in humans and dogs. We aimed to perform a multilocus sequence analysis of these species to elucidate their global diversity and population structure. Using multilocus sequence typing, we analyzed a total of 201 *S. canis* strains and 1,576 *S. pseudintermedius* strains associated with multiple hosts and are globally distributed. We calculated diversity metrics, topological differences, and ancestral derivations. We also created phylogenetic trees using RAxML and examined the presence of recombination by calculating the pairwise homoplasy index using the program Splitstree. For each bacterial species, we discovered highly diverse populations with 2987 unique sequence types (STs) of *S. canis* and 1,389 unique STs of *S. pseudintermedius* datasets. We also report evidence of numerous switching events between different hosts or habitats. These results have broad and significant implications in understanding how antibiotic resistant bacteria can be transmitted from animals to humans.

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| Presenter: | Griffin Joel-Michael Nye |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | Genomic and phylogenetic analysis of global pathogens |
| Presenter: | Michael James Pellitteri |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Cheryl Marie P Andam |

**Investigating the Role of Protein Phosphatase 2A in the Salt Stress Response in *Arabidopsis thaliana***

Estelle M Hrabak, Daniel J DiRocco
COLSA, UNH Durham

Protein Phosphatase 2A (PP2A) is a ubiquitous enzyme in eukaryotes that regulates a large array of cellular signaling processes. PP2A is composed of three subunits: catalytic C subunit, regulatory B subunit, and scaffolding/regulatory A subunit. In Arabidopsis thaliana, the A subunit has three isoforms - A1, A2, and A3 - that are highly conserved at the protein level, indicating that these proteins may be functionally interchangeable. In comparison to wildtype plants, roots of seedlings with a mutation in the A1 gene develop obvious cell file rotation when grown under moderate salt stress. Twisted root cells result in a characteristic root curling phenotype on the surface of vertically-oriented agar plates. Mutations in the A2 and A3 genes do not result in any observable root phenotype, despite all three A subunit isoforms being expressed in roots. To test the hypothesis that differences in expression are responsible for the variation in mutant's phenotypes, hybrid genes were constructed containing promoters from one subunit and genomic coding regions of a different subunit, then transformed into a1 mutant Arabidopsis to test for complementation. a1 mutants transformed with transgenes containing A1 or A3 promoters, regardless of coding region, were fully complemented, while a1 mutants transformed with hybrid genes containing A2 promoters were only partially complemented. This supports the hypothesis that differences in gene expression, rather than subunit function, cause the a1 mutant phenotype.

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| Presenter: | Daniel J DiRocco |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Senior |
| Research Interest: | Molecular Biology |
| Adviser: | Estelle M Hrabak |

**Roost Site Preference of Long-tailed Bats (*Chalinolobus tuberculatus*) in the HÅ«nua Ranges**

Ellen Gonzalez Rossi, Carrie L Hall

Little is known about the roost site preference of long-tailed bats (*Chalinolobus tuberculatus*) on the North Island of New Zealand. However, such information is important to protect this species from population decline. Both native New Zealand bats are facing population difficulties: *C. tuberculatus* is classed as “nationally critical”, and *Mystacina tuberculata* is classed as “nationally vulnerable”. Bat populations are declining because of predation from introduced mammals, habitat degradation, and roost site disturbance caused by human development. In this study, we assessed the presence of *C. tuberculatus* in and around the HÅ«nua Ranges Regional Park to better understand roost site preferences. Methods included harp traps, used to catch, tag, and release bats, and automatic bat monitors, which record bat activity. Pregnant female bats were fitted with a small radio transmitter, which enabled us to track that bat back to her roost site. A total of 2357 *C. tuberculatus* flight passes, or bat movements, were recorded in the HÅ«nua Ranges throughout nine nights in November of 2019. Most of these were recorded in areas where invasive mammal management practices, such as bait traps for rodents and mustelids, are currently in use to protect native bird species like the kÅ• kako (*Callaeas wilsoni*) from predation. A total of eight bats were caught, of which three were tagged and tracked back to communal roost trees. All roosts were located at least 10m off the ground; tree species included rewarewa (*Knightia excelsa*) and rimu (*Dacrydium cupressinum*). Our data can help invasive species management operations target areas of known bat activity and roost sites to increase the efficiency of predator trapping and help protect the bat population.

Presenter: Ellen Gonzalez Rossi

Presenter's Major(s): Zoology

Year at UNH: Senior

Adviser: Carrie L Hall

**Abundance of Methanogens at Forested vs. Urban Stream Sites in New England**

Wilfred M Wollheim, Andrew Lean Robison, Annie R Cotter, Jessica G Ernakovich
Natural Resources and the Environment, UNH Durham

Streams and rivers emit an unexpectedly large amount of greenhouse gases , such as methane ($CH_4$), into the atmosphere. The causes of the differences in $CH_4$ production rates between and within streams is not well understood, but one hypothesis is that variation can be attributed to the microbial communities present in sediments. Previous studies have found a significant correlation between the abundance of methanogens ($CH_4$-producing archaea) or genes associated with $CH_4$ production and $CH_4$ ebullition (bubbles) from a stream. Many factors affect the microbial community of a given environment and one key factor is land use. The contribution of streams to the global carbon cycle depends on how and whether land use alters the abundance of methanogens. Previous studies have found higher concentrations of $CH_4$ in urban areas, and we hypothesize that methanogens will also be found in greater relative abundance in urban streams We analyzed microbial communities, and targeted methanogen abundance, in two contrasting stream environments: forested and urban streams. DNA was extracted from sediments at two depths (0-2 and 9-11 cm) and amplified using primers specific to bacteria and archaea. DNA sequences were collected by the Hubbard Genome Center and we used Qiime2 to analyze the microbial communities from each stream site. The results of this study are important because there is a complex web of interactions that possibly affect $CH_4$ production and persistence in aquatic ecosystems. Ideally, the information gained from this research will give us a better idea of how land use and microbial communities might play a role in this complex web of interactions.

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| Presenter: | Annie R Cotter |
| Presenter's Major(s): | Genetics |
| Year at UNH: | Senior |
| Research Interest: | Natural Resources and the Environment |
| Adviser: | Jessica G Ernakovich |
| Adviser: | Andrew Lean Robison |
| Adviser: | Wilfred M Wollheim |

**Characterization and Evaluation of Streptomyces Species in Managed and Abandoned Apple Orchards**

Anissa M Poleatewich, Patrick J Kaplan
ANFS, UNH Durham

Plants interact with a diversity of microorganisms that play a significant role in plant health. Soil and root associated microbes can enhance plant access to nutrients, stimulate plant growth, enhance tolerance to abiotic stressors, and provide protection from plant pathogens. Exploiting the agroecosystem services these beneficial microbes provide is becoming an increasingly important tool in sustainable agriculture. Beneficial microbes and their metabolites have diverse modes of action, have low risk for developing resistance, and are more environmentally friendly. Species within the *Streptomyces* Genus are common soil inhabitants, with documented plant beneficial functions including plant growth promotion and antifungal activity. These filamentous rhizosphere bacteria have great potential for use as a biopesticide or a biofertilizer. The objective of this research is to characterize Streptomyces species in managed and abandoned apple orchards in southern New Hampshire. Isolates extracted from soil samples were characterized based on morphology, biochemistry, and evaluated for biocontrol potential using dual culture plate assays. Long term, this research will help identify potential beneficial microorganisms that could be used as biocontrol agents.

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| Presenter: | Patrick J Kaplan |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Research Interest: | Agriculture |
| Adviser: | Anissa M Poleatewich |

**Comparison of Relative Fat Mass Equation and Body Mass Index (BMI) in Predicting Body Composition of Male Collegiate Athletes**

Tiana Marie DiBenedetto, Madeline Fjord Quigley, Kevin J. Pietro, Briannah Taylor DeLorme, Sophie M Kenny

Body Mass Index (BMI) has been widely used as a predictor of adiposity and overall health status in the general population. It is recognized that using BMI leads to misclassification among athletes as BMI does not adequately account for the fat-free mass in this population. In 2018, Woolcott and Bergman developed the Relative Fat Mass (RFM) equation (64 − (20 × height/waist circumference) + (12 × sex); sex = 0 for men and 1 for women) by using National Health and Nutrition Examination Survey (NHANES) 1999–2004 data, as an alternative to BMI to predict body fat in the general population. This study examined to what extent the RFM equation would serve as a predictor of body fat in male collegiate athletes. To address the primary research question, participants (n=119; basketball (n=10), soccer (n=34), hockey (n=29), and football (n=46)) were invited to undergo body composition testing through air displacement plethysmography via the BOD POD. From this sample, BMI (r=0.855), RFM (r=0.842), and waist circumference (r=0.877) demonstrated strong and statistically significant correlations ($p<0.001$) to body fat percentage (BFP). Examining RFM, BMI and BFP at the sport-specific level, BMI displayed a stronger correlation to BFP in basketball (r=0.829, $p<0.005$) and soccer (r=0.527, $p<0.005$) compared to RFM (r=0.761, $p<0.05$; r=0.360, $p<0.05$). Unlike for hockey, RFM demonstrated a moderate and statistically significant correlation (r=0.475, $p<0.01$) to BFP, while BMI was not statistically significantly correlated (r=0.359, p=0.56). Football, both RFM (r=0.867) and BMI (r=0.833) had strong, statistically significant correlations ($p<0.001$) to BFP. This was consistent even when separating football players based on position. Based on the findings, it does not appear that the RFM equation offers greater accuracy than BMI in predicting a male collegiate athlete's body composition. More research is needed to determine if this is consistent among female collegiate athletes and professional athletes


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| Presenter: | Briannah DeLorme | Presenter: | Tiana DiBenedetto |
| Presenter's Major(s): | Nutrition | Presenter's Major(s): | Nutrition |
| Year at UNH: | Senior | Year at UNH: | Senior |
| Presenter: | Madeline Fjord Quigley | Advisor: | Kevin Pietro |
| Presenter's Major(s): | Nutrition | | |
| Year at UNH: | Senior | | |
| Presenter: | Sophie M Kenny | | |
| Presenter's Major(s): | Nutrition | | |
| Year at UNH: | Senior | | |

**Abstract: Cognitive Abilities of Caribbean Hermit Crabs in Navigating a Known Location**

Samantha C Dionne[2], Leslie J Curren[1]
[1]Biological Sciences, UNH Durham
[2]COLSA, UNH Durham

**Navigation is essential for an animal's survival as they must understand the area they live in to find resources and shelter. Coenobitidae is one of the many Families of hermit crabs that uses multiple sensory cues, such as tactile, visual, chemical, and olfactory, to navigate, but it is not understood if one modality is more important than the others. The goal of this study is to ascertain the relative importance of visual and chemical cues in how Caribbean hermit crabs (Coenobita clypeatus) navigate a familiar space. The hermit crabs will first learn a simple maze with access to chemical cues (the scent of food) and no visual restraints. After learning the puzzle, four different treatments will be conducted, each with a different combination of access to chemical and visual cues: blindfolded with food, blindfolded without food, seeing with food, and seeing without food. I will use speed to complete the maze to determine which navigational cue aids the hermit crabs the most. I hypothesize that the hermit crabs will be most efficient at solving the maze given no visual restraints and a chemical cue of food, as past studies have shown, they use combinations of cues to navigate best. Hermit crabs play an important role in regenerating energy into the ecosystem and are prey for many species, so as the environment continues to change, it is important that these bottom-dwellers are able to adapt.**

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| Presenter: | Samantha C Dionne |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | Navigational Skills of Caribbean hermit crabs |
| Adviser: | Leslie J Curren |

**Effect of Fetal Bovine Serum (FBS) on Expression of Cellular Communication Network Factor 1 (CCN1) in Bovine Granulosa Cells**

Paul C Tsang, Abigail Rose Palin
MCBS, UNH Durham

The adult mammalian ovary contains follicles at various stages of development, from primordial to antral. Follicles of all sizes house oocytes and somatic cells that support oocyte maturation through the production of regulatory factors. We have shown that somatic granulosa cells from small and large follicles produce CCN1, which is involved in the formation of new blood vessels. In the present study, our goal was to determine the effect of serum on CCN1 expression in granulosa cells from small follicles. To do so, bovine granulosa cells were obtained from follicles (<5mm) and seeded into T-25 flasks containing DMEM medium supplemented with 1% FBS, 1 ng/mL follicle stimulating hormone (FSH), and 10 ng/mL insulin. At 100% confluency, cells were split into 6-well plates until 80-90% confluency was reached. During this process, 2 of 4 cultures were contaminated. In the 2 remaining cultures, granulosa cells were serum-starved for 2 hours before they were treated with 1%, 5%, or 10% FBS for 2 hours. Then, quantitative polymerase chain reaction was used to determine CCN1 expression. Clearly, granulosa cells from follicles <5mm produced CCN1, and all FBS concentrations appeared to increase CCN1 expression. However, the magnitude of response to FBS differed between the 2 experiments. In a corollary experiment, granulosa cells were not serum-starved, but were maintained with 1% FBS. When they were treated with 10% FBS, CCN1 expression appeared to be higher than in granulosa cells concurrently maintained with 1% FBS. The magnitude of response to FBS appeared to differ between the starved and un-starved cells. Overall, more replicates are needed to confirm these observations.

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| Presenter: | Abigail Rose Palin |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Senior |
| Adviser: | Paul C Tsang |

**Using CRISPR to Generate Novel Mutants in *Arabidopsis thaliana***

Benjamin H Kaphan, Estelle M Hrabak
Molecular, Cellular, and Biomedical Sciences, UNH Durham

Protein S-acyl transferases (PATs) are enzymes found in all eukaryotes that add fatty acids to specific target proteins. PATs play significant roles in many processes, including protein-membrane interactions, protein stability, and cell signaling. In *Arabidopsis thaliana*, 11 of 24 genes that code for PAT enzymes are highly expressed in pollen, although their specific roles are unknown. The large number of pollen-expressed genes may indicate that S-acylation is critical for pollen development or function. One major obstacle to investigating PAT proteins is a lack of high-quality mutants. We are using a CRISPR-Cas9-based gene editing system to produce novel mutants with deletions of important functional regions of PAT proteins. PAT 14 was chosen as the first target for CRISPR editing because a homozygous *pat14* mutant has an obvious leaf senescence phenotype that should make it easy to identify homozygous deletion mutants. We have identified heterozygous mutants with small deletions in the first exon of *PAT14*. Identification of homozygous *pat14* mutants is in progress and CRISPR editing of other *PAT* genes is in underway.

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| Presenter: | Benjamin H Kaphan |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Senior |
| Adviser: | Estelle M Hrabak |

**The Influence of Road Density and Land Cover on Population Demographics of Common Snapping Turtles**

Owen R Kanter, Peter J Pekins
Department of Natural Resources and the Environment, UNH Durham

Turtles are particularly vulnerable to road mortality which can be the sole driver of severe population declines. Their life history characteristics, including delayed sexual maturity and low recruitment rate, require low adult mortality to sustain stable populations. Specifically, females suffer higher rates of road mortality than males resulting in unequal sex ratios and less productive populations. Because females travel moderate distances across land to find appropriate nesting habitat, wetlands surrounded by extensive road coverage tend to have male-biased populations. I explored these concepts for common snapping turtles (*Chelydra serpentina*) in southern New Hampshire by analyzing biological data collected by New Hampshire Fish and Game biologists. From physical measurements of adult 301 snapping turtles captured in 37 wetland complexes, I first determined the sex and age structure of each population. The total sample included 39 females, 137 males, and 125 unknowns with average carapace length in millimeters of 294 ± 52, 329 ± 54, and 300 ± 53.3**,** respectively. Using geospatial techniques, I measured the wetland size, road density, and land cover associated with 12 wetland complexes in which $\geq$ 6 turtles were captured; this sample was male-biased (82:25). I then tested potential relationships between the population characteristics and geospatial parameters in these 12 wetlands to assess potential impacts on local snapping turtle populations.

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| Presenter: | Owen R Kanter |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Senior |
| Research Interest: | Nongame and Endangered Wildlife Management |
| Adviser: | Peter J Pekins |

**The Effects of Urbanization on Mallard Duck Anti-Predator Response**

Leslie J Curren, Alexandra J Powers
Biological Sciences, UNH Durham

As humans continue to urbanize the environment, it is important to consider how land and resource use influences the natural world. In response to the challenges our impact poses, some species have adapted to life alongside humans by modifying their behavior. However, it remains uncertain how these behavioral changes influence ecological trade-offs. In order to examine the effects of urbanization on behavioral trade-offs in wildlife, I will observe the anti-predator responses of mallard ducks (*Anas platyrhynchos*) living in urban and rural locations: the Boston Common and Mill Pond in Durham, NH, respectively. Ducks in each setting will be subjected to three different playback treatments featuring the sound of a natural predator (hawk), anthropogenic noise (car traffic), or a control (neutral tone). I will video record individual ducks before and after the playback to quantify the following anti-predator responses: vigilance (e.g., upright alertness), movement (diving, swimming/running away), and warning vocalizations. I hypothesize that habituation to human presence and a lack of natural predators will cause urban ducks to lessen their anti-predator behavior. I therefore predict that urban ducks will be less responsive to both predatory and human stimuli than will rural ducks. This study will aid in understanding the impact that urbanization and human interaction have on the trade-offs and life history of local wildlife.

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| Presenter: | Alexandra J Powers |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Adviser: | Leslie J Curren |

**Dietary Energy Source and Rumen-protected Amino Acids: Effects on Milk Production, Plasma Amino Acids Concentration, and Methane Emissions in Dairy Cows**

Alexia Gianoulis, Andre Fonseca De Brito, Yu Zang
ANFS, UNH Durham

We aimed to investigate the interactions between energy source and the rumen-protected (RP) amino acids (AA) Met, Lys, and His (MLH) on nutrient use efficiency in dairy cows. Sixteen Holstein cows were used in a replicated 4 × 4 Latin square with a 2 × 2 factorial arrangement of treatments. Each period lasted 21 d with 14 d for diet adaptation and 7 d for sample collection. Treatments included high starch (HS), HS+RPMLH, reduced starch+RP-fat (RSF), and RSF+RPMLH. Basal diets consisted of 50% forage and 50% grain. The HS diet contained 26% ground corn, while the RSF diet had 16% ground corn replaced with 15% soyhulls and 1.5% RP-fat. Data were analyzed with the MIXED procedure of SAS. Diets had no effects on dry matter intake (DMI) and milk yield. However, feeding RSF diets enhanced feed efficiency (1.57 vs. 1.54; $P = 0.03$) and milk fat yield (1.65 vs. 1.50 kg/d; $P < 0.01$) compared to HS diets. Milk fat content increased, while that of milk true protein decreased with RSF vs. HS diets. Milk urea N (MUN) was greater for RSF vs. HS diets. RSF diets elevated plasma Arg, Ile, and Thr but reduced Leu relative to HS diets. Plasma Met and His increased with RPMLH ($P \leq 0.04$). Diets had no effects on $CH_4$ production (mean = 534 g/d), $CH_4$ yield (mean = 18.5 g/kg of DMI), and $CH_4$ intensity (11.6 g/kg of energy-corrected milk). In brief, substitution of ground corn with soyhulls and RP-fat improved feed efficiency and milk fat yield but appeared to reduce N utilization due to higher MUN.

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| Presenter: | Alexia Gianoulis |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Dairy Cow Nutrition |
| Adviser: | Andre Fonseca De Brito |
| Adviser: | Yu Zang |

**The Effect of Predator Cues on Carpenter Ants' Worker Task Efficiency**

Gianna K DeMarco, Leslie J Curren
Biological Sciences, UNH Durham

Ants are one of the most abundant types of insect on the planet, partially due to their eusocial behavior. A fundamental component of eusocial behavior is the division of labor that allows a colony to carry out tasks efficiently. This coordination and communication among group members, usually through chemical signaling, results in better foraging efficiency, or "worker task efficiency." Worker task efficiency can be interrupted by threats to the colony, such as the presence of a predator, but we do not know which predator cues are most likely to incite vigilance and hinder foraging behavior in ants. In this study, I will examine how ants recognize predators by examining the effect predator sensory cues can have on ants' foraging abilities. Carpenter ant (*Camponotus pennsylvanicus*) colonies will be exposed to one of four predator cue treatments: chemical cues, visual cues, both chemical and visual cues, or no cues. I hypothesize that a predator's chemical cue will be more disruptive to foraging behavior than a visual cue, so the ants will be least efficient when presented with treatments involving chemical cues. I hypothesize that ant foraging efficiency in the visual treatment will be similar to that of the control group because ants do not primarily rely on visual cues. This study will give further insight into how ants' perception of their predators can affect the productivity of the colony, which is crucial to ecosystem health because ants are ecosystem engineers.

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| Presenter: | Gianna K DeMarco |
| Presenter's Major(s): | Zoology |
| Year at UNH: | Junior |
| Research Interest: | Animal Behavior |
| Adviser: | Leslie J Curren |

**Increasing Bottom Temperatures and their Influences on Benthic Biota**

Daniel Thomas Brammer, Lok H Cheng, Zackary B Vajda, Larry G. Harris, Matthew C Derrick, Emma F Orzech, Tyler G Dunn
Biological Sciences, UNH Durham

In an era dominated by climate change, epitomized by sliding baselines in the structure of various ecological communities, The Gulf of Maine increases in water temperature at a greater rate than approximately 99% of other marine systems. In this study, we sought to quantify the extent of temperature change in the Gulf of Maine, via statistical analysis of comprehensive temperature datasets collected by HOBO temperature data loggers over a four-year time period in various sites in the Gulf. The effects of climate change upon marine organisms include decreased immunity, and increased pathogenicity and virulence by pathogenic organisms and entities. In addition to analysis of abiotic temperature data collected in the Gulf of Maine, we investigated the effect of specific temperature values on disease induction and recovery in native echinoderms: *Strongylocentrotus droebachiensis* (green sea urchin) and *Henricia sanguinolenta* (Atlantic blood star). In its natural habitat, *S. droebachiensis* is susceptible to epizootic bacterial disease, whereas *H. sanguinolenta* populations are compromised by sea star wasting syndrome (SSWS).

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| Presenter: | Daniel Thomas Brammer |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Research Interest: | Evolutionary Biology |
| Presenter: | Emma F Orzech |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Junior |
| Presenter: | Lok H Cheng |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Presenter: | Matthew C Derrick |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Senior |
| Presenter: | Tyler G Dunn |
| Presenter's Major(s): | Ocean Engineering |
| Year at UNH: | Senior |
| Presenter: | Zackary B Vajda |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Senior |
| Research Interest: | Fishes and aquatic invertebrates |
| Adviser: | Larry G. Harris |

**Comparison of Methane and Nitrous Oxide Emissions along a Nitrate Gradient in the Ipswich River, Massachusetts**

Diane M DeVries, Ruth K Varner

In an aquatic ecosystem, freshwater is filtered by fluvial wetlands into streams which are a source of several greenhouse gases (GHG) contributing to climate change. Natural features and urban development affect the production of GHG such as methane ($CH_4$), nitrous oxide ($N_2O$) and carbon dioxide ($CO_2$). Nitrogen (N) loading into a watershed due to human activities is a possible source of elevated nitrate ($NO_3^-$) and therefore potentially higher emissions of $N_2O$ (Beaulieu et. al, 2011). The source of $CO_2$ and its effects as a GHG are well-studied, but less is known about the production and emission of $N_2O$ in rivers and streams. My objective was to study the relationship between gas flux and environmental parameters to gain insight into how flux responds to land-use.

I addressed the relationship between gas flux and environmental parameters by measuring gas flux and water quality at six locations in a temperate watershed along a nitrate gradient. These measurements provided insight into how $N_2O$ flux varies along the gradient and across the season as well as its relationship with $NO_3^-$. These measurements were compared with temperature, discharge, dissolved oxygen concentration, and pH to determine if any correlations existed.

Studying the relationships between the atmosphere and terrestrial ecosystems can provide meaningful data that helps quantify global GHG flux rates and could provide important information about groundwater quality or nitrogen load reduction initiatives.

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| Presenter: | Diane M DeVries |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Senior |
| Adviser: | Ruth K Varner |

**Cognitive Abilities of Caribbean Hermit Crabs in Navigating a Known Location**

Samantha C Dionne[2], Leslie J Curren[1]
[1]Biological Sciences, UNH Durham
[2]COLSA, UNH Durham

Navigation is essential for an animal's survival as they must understand the area they live in to find resources and shelter. Coenobitidae is one of the many Families of hermit crabs that uses multiple sensory cues, such as tactile, visual, chemical, and olfactory, to navigate, but it is not understood if one modality is more important than the others. The goal of this study is to ascertain the relative importance of visual and chemical cues in how Caribbean hermit crabs (Coenobita clypeatus) navigate a familiar space. The hermit crabs will first learn a simple maze with access to chemical cues (the scent of food) and no visual restraints. After learning the puzzle, four different treatments will be conducted, each with a different combination of access to chemical and visual cues: blindfolded with food, blindfolded without food, seeing with food, and seeing without food. I will use speed to complete the maze to determine which navigational cue aids the hermit crabs the most. I hypothesize that the hermit crabs will be most efficient at solving the maze given no visual restraints and a chemical cue of food, as past studies have shown, they use combinations of cues to navigate best. Hermit crabs play an important role in regenerating energy into the ecosystem and are prey for many species, so as the environment continues to change, it is important that these bottom-dwellers are able to adapt.

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| Presenter: | Samantha C Dionne |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | Navigational Skills of Caribbean hermit crabs |
| Adviser: | Leslie J Curren |

**Assessing How the Diversity of Groups Affects the Frequency of Vigilant Displays in Birds**

Leslie J Curren, Jessica Erin Tremblay
Biological Sciences, UNH Durham

Research has shown that more diverse groups of people are more productive than less diverse groups because people of varying backgrounds contribute different perspectives to the group. To determine whether groups of animals possess similar tendencies, Freeberg et al. (2017) tested this idea among multispecies flocks of birds. They found that more diverse flocks were better able to solve a foraging task than less diverse flocks. Freeberg et al. believed this was due to the birds spending less time on vigilance, but their study did not test this idea. Here, I will test this hypothesis by measuring vigilance in birds foraging in groups of varying species diversity. I hypothesize that because each species possesses different sensory perceptive abilities, individuals in more diverse groups will be less vigilant than birds in less diverse groups. I will conduct two minute observation sessions at a bird feeder in which I record group composition to quantify the frequency and duration of vigilance displays of each species present. I will then use the group compositions to calculate a species diversity index for each session, and compare those indices to the vigilance rates. The results of this study will provide information about how successfully multispecies groups can utilize diverse sensory perceptive abilities to complete a common task, such as predator detection. These results may also be useful in our understanding of the benefits of cooperation in diverse groups of humans.

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| Presenter: | Jessica Erin Tremblay |
| Presenter's Major(s): | Zoology |
| Year at UNH: | Senior |
| Adviser: | Leslie J Curren |

**The Effect of Transcriptome Assembly Quality on Phylogenetic Relationships**

Troy Matthew LaPolice, Matthew D MacManes
MCBS, UNH Durham

Technology is constantly improving and evolving. Now more than ever, genetic sequencing is easier and more affordable. Because of this, many scientists have adopted a quantity-over-quality approach to genetic research. The processing of these data and the quality of the assemblies we make from them, however, is vital for studying the genetic code of organisms. Researchers often move on to downstream data analysis and overlook the quality of their genomic assemblies. This study sought to determine if the quality of the assembled genetic data affected the resulting inferences about the relatedness between species. I assembled publicly available transcriptomic sequence data from vertebrate animals into transcriptomes using the multiple assembler, multiple kmer approach built into the Oyster River Protocol. I took the best and worst assemblies generated from this process and compiled each into datasets, one with high-quality and one with low-quality data. I did this for three different quality metrics and created phylogenetic trees for each dataset. I then compared the trees from the high- and low-quality datasets to an accepted vertebrate tree to assess the differences in the datasets. I show that that poor assembly quality does have an effect on the amount of downstream data and the quality of phylogenetic results. Through the process, I also developed an understanding of the strengths and weaknesses of each assembly software and assembly quality metric.

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| Presenter: | Troy Matthew LaPolice |
| Presenter's Major(s): | Biology |
| Year at UNH: | Junior |
| Research Interest: | Genomics and Transcriptomics |
| Adviser: | Matthew D MacManes |

**Identification of the Virulence Factors of *Serratia* sp. SCBI**

Jessica J Hodgkins, Louis S Tisa
MCBS, UNH Durham

A *Serratia* species of bacteria, termed South African *Caenorhabditis briggsae* Isolate (SCBI), was isolated from the nematode *C. briggsae* KT0001. This bacterium forms an early symbiotic relationship with the nematode host and alters its behavior to kill insects. *Serratia* sp. strain SCBI is nonpathogenic to *Caenorhabditis* nematodes, but is lethal to lepidopteran insects including *Galleria mellonella*. Comparative genomic analysis shows that *Serratia* sp. SCBI is closely related to the broad-host-range pathogen *Serratia marcescens* Db11 which kills *Caenorhabditis* nematodes. This project will identify the virulence factors of *Serratia* sp. strain SCBI to gain deeper understanding of the transition from a mutualistic state to a pathogenic lifestyle, ultimately aiding the design of precision antibiotics. Previously a transposon mutant library of 2,100 mutants was screened for defective lipase activity or siderophore production. Nine mutants exhibited reduced production of one or both exoenzymes. These defects were confirmed and their effects on pathogenesis were tested via a *G. mellonella* bioassay. Three mutants lost or nearly lost insecticidal activity, while two mutants were insecticidal to a lesser degree than the wildtype. The weakness of the bioassay is noted by conflicting results produced by three mutants. One mutant retained wild type level insecticidal activity. The ninth mutant could not grow in selective medium, suggesting it lacks a region of virulence. To identify the site of the transposon insertion, rescue cloning was used on the three mutants with absent insecticidal activity. These clones are being sequenced to identify insertion sites within the *Serratia* sp. SCBI genome.

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| Presenter: | Jessica J Hodgkins |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Identification of Virulence Factors of Serratia sp. SCBI |
| Adviser: | Louis S Tisa |

**Does Treatment with Angiogenic Factors (VEGFA and FGF2) Increase Expression of Hypoxia-Inducible 1 alpha (HIF1a) in Bovine Steroidogenic Luteal Cells?**

Paul C Tsang, Trey E Patno

Angiogenesis, the building of a new blood vessel network from an existing one, is mediated by a variety of factors, including vascular endothelial growth factor (VEGFA) and basic fibroblast growth factor (FGF2). These growth factors are present in the bovine corpus luteum (CL) and both are known to be upregulated under hypoxia. Furthermore, in other cell types, a positive feedback loop exists, whereby VEGFA and FGF2 regulate HIF1a expression. Thus we asked- *Is HIF1a expression regulated by VEGFA and FGF2 in bovine steroidogenic luteal cells?* One million bovine steroidogenic luteal cells from early and mid-cycle CL were seeded into six-well plates containing Ham's F12 + insulin/transferrin/selenium (ITS) and cultured for two days until about 60% to 80% confluency. Cells were then treated with VEGFA (10 or 20 ng/mL) and FGF2 (1 or 5 ng/mL), alone or in combination, for 2 and 4 hours. Afterward, total RNA was extracted followed by complementary DNA generation. Lastly, quantitative polymerase chain reaction was performed to determine HIF1a expression. In mid-cycle cells, treatment with VEGFA (n=2) or FGF2 (n=1) for 2 and 4 hours appeared to have no effect on HIF1a expression. When combined (1 ng/mL FGF2 + 10 ng/mL VEGFA), they appeared to increase HIF1a (n=1) after 4 hours of treatment. In the early CL cells, neither concentration of FGF2 had an effect on HIF1a expression after 2 hours of treatment (n=4). Additional replicates are needed to confirm these findings.

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| Presenter: | Trey E Patno |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Senior |
| Adviser: | Paul C Tsang |

**Effects of Mutation on Structure and Binding of the Intrinsically Disordered Protein PopZ.**

Ryan Zachary Puterbaugh[2], Krisztina Varga[1]
[1]Biomedical Molecular and Cellular Biology, UNH Durham
[2]Biomedical, Molecular, and Cellular, UNH Durham

Cellular organization has been key factor in creating and maintaining the complex biochemical functions that underlie cellular function. Organization is particularly important in cellular division as the uneven division of important proteins can lead to the death of one or more of the resulting daughter cells. Despite their relative simplicity, bacteria also have a complex subcellular anatomy for cellular organization. For example, the bacteria Caulobacter cresentus processes a 177-amino acid protein known Polar Organizing Protein Z (PopZ) that self assembles into multiprotein superstructures at the cell poles of the bacterium. These superstructures then bind to at least 8 different proteins at the cell poles that are linked to cell cycle regulation and chromosome segregation. The Varga lab has determined the structure of a truncated version of PopZ that stays monomeric and soluble in solution, using Nuclear Magnetic Resonance (NMR) spectroscopy. PopZ is mostly intrinsically disordered with a small alpha-helix located near the N-terminus of the protein. NMR titration experiments with one of the known protein binding partners of PopZ, RcdA, has also revealed that this alpha-helix is the region of the protein that interacts with the protein binding partner. To further characterize this interaction, an amino acid substituted isoform of the protein, PopZI17A, was recombinantly expressed and subjected to the same titration experiment, to determine if isoleucine 17 was critical in the electrostatic binding of PopZ to the protein binding partner. This experiment displayed that the I17A amino acid substitution resulted in a complete loss of function of the PopZ isoform, indicating that isoleucine 17 is critical in the binding of PopZ to its binding partner.

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| Presenter: | Ryan Zachary Puterbaugh |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Junior |
| Research Interest: | Physical Biochemistry |
| Adviser: | Krisztina Varga |

**Recognition of Self and Conspecifics in Tufted Capuchins**

Leslie J Curren, Carissa L Charbonneau
Biological Sciences, UNH Durham

Conspecific recognition aids in a variety of social behaviors, especially in species with dominance hierarchies. Although there is an abundance of research on kin recognition, in-group non-kin recognition and self recognition are both less well studied. Previous research has shown primates prefer photos of conspecifics to scrambled images, and spend more time looking at novel photos than familiar photos. Tufted capuchins (Cebus apella) have been found to show signs of self awareness and regard photos as icons, but their ability to distinguish between photos based on familiarity has yet to be explored. My study asks if tufted capuchins are able to distinguish between photos of conspecifics within their social group, including themselves, and unknown conspecifics. Capuchins at Southwick's Zoo will be shown three photos: an unknown conspecific, a social group member, and themselves. Each photo will be shown separately, and I will record how much time the focal monkey spends looking at each photo. I hypothesize that individuals can distinguish between known and unknown conspecifics and cannot self recognize. I therefore predict individuals to look longer at photos of unknown conspecifics than of group members, and there to be no difference in looking time between photos of themselves and unknown conspecifics. Studying these relationships in non-human primates may help answer questions about primate evolutionary history and the ecology of group-living species.

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| Presenter: | Carissa L Charbonneau |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Junior |
| Adviser: | Leslie J Curren |

**HOW VEGETATION COMPOSITION & TIMING OF HAYING THE PREVIOUS YEAR INFLUENCE BOBOLINK ABUNDANCE IN FIELDS IN SOUTHERN NH**

Veronica L Bodge, Matthew David Tarr

Bobolinks are grassland-obligate birds whose populations have been declining in New England for the past 80 years due to loss of large field habitat and changes in field management practices. Bobolinks require tall grasses for nesting, and they nest directly on the ground under the cover of these grasses between late May and mid-July during the time that farmers normally mow their fields to produce high-quality hay for livestock. However, best management practices to conserve bobolinks recommend delaying haying until late summer after bobolinks have completed nesting, but this results in economic loss to farmers and isn't necessary in fields not used by bobolinks for nesting. During the 2019 nesting season, we conducted vegetation surveys and counts of male bobolinks occurring in 42 fields located in southeastern NH to determine if vegetation conditions (litter depth, total vegetation height, vegetation density and vegetation composition) could be used to predict which fields were most likely to support nesting bobolinks. Pearson's correlation and multiple linear regression indicated that male bobolink abundance was correlated positively with the percent grass, and correlated negatively with the % litter, estimated in fields. These conditions are most common on fields managed for hay production, suggesting that hayfields may serve as biological traps by attracting bobolinks to vegetation conditions preferred for nesting, but are destroyed when these fields get mowed prior to nest completion in late-July. Mowing fields and removing the cut grass once yearly after August 1 will create the vegetation and nesting conditions most beneficial for bobolinks. Existing state and federal cost-share programs to pay farmers to conduct this management may be a critical strategy for conserving bobolinks in NH.

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| Presenter: | Veronica L Bodge |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Senior |
| Adviser: | Matthew David Tarr |

**Fear and Social Learning in the Land Snail *Bulimulus guadalupensis***

Leslie J Curren, Sarah M Rebillard, Savannah F Pirello-Spraggins
Biological Sciences, UNH Durham

Social learning, which is when an individual learns from observing the experience of a conspecific, can include adopting the conditioned response of other individuals. Conditioning is only possible when a species can form memories of stimulus connections, which is the case for snails. Conditioning snails to a negative stimulus has been shown to elicit a fear response, an emotion usually attributed to vertebrates, but can that fear be socially learned? Here we will test this in land snails (Bulimulus guadalupensis) by creating a conditioned food aversion and asking if other snails can socially learn that aversion. We will establish food aversion in one group of snails ("negative group") by exposing them to a food source lightly coated in KCl; another group ("positive group") will have access to the unaltered food source. We will then use "naive" snails, with no experience with the food source, to determine if conditioned food aversion can be socially learned. We will expose each naïve snail to a snail from one of the conditioned groups and the food source, and record the time it takes the naïve snail to begin eating. If snails can socially learn food aversion, naïve snails paired with negative group snails should take longer to approach the food than should naïve snails paired with positive group snails. This research could allow for a more complex understanding of how emotions and social learning have coevolved, which may also further research on diseases and drugs.

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| Presenter: | Savannah F Pirello-Spraggins |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Junior |
| Research Interest: | Animal Behavior |
| Presenter: | Sarah M Rebillard |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Sophomore |
| Research Interest: | Animal Behavior |
| Adviser: | Leslie J Curren |

**An Evaluation of Master Plan Topics at Three Scales of Planning in New Hampshire**

Audrey M Prior, Mary Adamo Friedman
Natural Resources and the Environment, UNH Durham

Land use planning authority in New Hampshire is shared between the state, planning regions, and municipalities. Each of these levels of planning has its own master plan, the document that guides development and provides a vision for the future. These guides for development and land protection should support one another through common areas of concern and methods for addressing these concerns. In order to determine whether municipalities in New Hampshire are addressing similar issues in their master plans, and to see whether these issues are reflected in the regional and state levels of planning, an analysis of horizontal and vertical consistency among master plans was conducted for the Rockingham Planning Commission planning region. For the purpose of this study, horizontal consistency refers to whether the same themes are included across different municipal level master plans. Vertical consistency refers to whether the municipal, regional, and state plans all discuss the same themes. Additionally, this study seeks to understand whether municipalities are addressing the issue of sustainability in their master plans. Given the many issues the world is facing at this time, sustainability in planning is more important than ever. The results show moderate levels of horizontal consistency among municipalities as well as moderate levels of vertical consistency between the municipalities and the state and the region and the state. Vertical consistency was greatest between the state and the municipalities. Key issues being addressed in master plans include housing, infrastructure, natural resources, and the preservation of character. The results of the sustainability keyword search indicate that some terms are being used frequently while others are used infrequently if at all. For example, water was the most frequently used term in many of the municipal plans, emphasizing its importance as a resource in these communities. It is also a high priority in the region and the state. While further research on consistency in master planning is necessary, this study serves as a starting point in exploring how the different levels of planning are working together to provide a sustainable future for New Hampshire.

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| Presenter: | Audrey M Prior |
| Presenter's Major(s): | Community and Environmental Planning |
| Year at UNH: | Senior |
| Research Interest: | Planning in New Hampshire |
| Adviser: | Mary Adamo Friedman |

**Microplastics in *Carcinus maenas* and *Mytilus edulis* within the Gulf of Maine**

Marissa M Cartee, Emma F Orzech, Bonnie L Brown

Microplastics are plastic fragments <5mm that enter the environment through the breakdown of waste products. The amount of microplastics in the ocean has been increasing and they have been detected in a variety of animals across multiple trophic levels. Nothing is known yet about the occurrence of microplastics in Great Bay Estuary and nearby habitats. We examined two common species, *Carcinus maenas*, the green crab, and *Mytilus edulis*, the blue mussel, to determine if their tissues contain microplastics. Both species were collected biweekly over several months, at four locations along the coast of the Gulf of Maine: Jackson Estuarine Lab, the UNH Coastal Marine Lab, Wells National Estuarine Research Reserve, and Hampton Estuary. Tissues were dissected, weighed, and biogenic material was digested. The residue was filtered (0.2µm) and analyzed using Fourier-transform infrared spectroscopy (FTIR) microscopy to identify spectral signatures of plastic particles. The amount of plastic per gram of crabs or mussels was compared across sites and species. *C. maenas* is a known predator on *M. edulis* and through this study we garnered initial information on trophic transfer in a natural environment between these two organisms. This study provides insight to bioaccumulation in consumers farther up the food chain. Documenting amounts of microplastics in these animals helps determine the ambient levels of microplastics within the Gulf of Maine, and their potential impact on other organisms.

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| Presenter: | Emma F Orzech |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Junior |
| Presenter: | Marissa M Cartee |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Junior |
| Adviser: | Bonnie L Brown |

**Linking Sponge Morphological Characteristics with Phylogeny**

Marissa M Cartee, David C Plachetzki
BMCB, UNH Durham

*Porifera*, commonly known as sponges, are designated as one of the simplest phyla within the animal kingdom. However, through observation and research, sponges have been identified to display a wide variety of characteristics and morphologies. In the past, these traits were used to differentiate the sponges into separate phylogenetic groups. Due to recent advancement in genomics, the phylogeny and subsequent groupings of sponges has been greatly improved. As new sponge phylogenies are discovered, there is a need to determine how the morphological characteristics of sponges may have changed. The goal of this project is to identify the differentiation of sponge spicule characteristics (megascleres, microscleres, and growth forms) when plotted on a hypothesized phylogeny. Through a literature review, the characteristics of 116 families of sponges were documented. Megascleres and microscleres were a predominant form across sponges and represent the hard features that provide structure to sponges. Growth forms served as a distinguishing feature due to the diversity of shapes and morphologies in which sponges can occur. A character count completed was completed of the preceding characteristics to identify presence within all 116 families. The presence and absence of each trait will be modeled on a time calibrated phylogenetic tree to observe patterns and correlations across sponge evolution and track the divergence of traits. By evaluating sponge traits and morphologies, a better understanding of sponge evolution will be gained.

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| Presenter: | Marissa M Cartee |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Junior |
| Adviser: | David C Plachetzki |

**Small Mammal Reproductive Patterns During Masting Years in Northeastern Forests**

Rebecca J Rowe, Lily H Gilbert
Natural Resources, UNH Durham

**Abstract**

Masting is when trees synchronously release a multitude of seeds, and this generally happens every other year. Although small mammals are known to respond numerically to masting, it is unknown whether this is because they are having more pups in the same litter or because more females are giving birth. To test these hypotheses, I examined the reproductive data of seven small mammal species over seven years (four of which were beech masting years). The small mammal species include three mice, one vole and three shrews. I found that the litter size does not vary between masting years and non-masting years. However, the number of reproductive females increased in the masting years relative to non-masting years for certain species. The three species of mice have almost twice as many breeding females during the masting year than the non-masting year. The vole species trended in the opposite direction, having more breeding females in the non-masting year than the masting year. One of the shrew species trended toward having more breeding females during the masting year, while the other two shrew species showed no response to the non-masting and masting years. In conclusion, I did not find evidence for larger litters, rather there are more adult females breeding for the mice. Variation in breeding response among species may reflect differences in their diet. For species that do not eat seeds as their main food source (e.g. two of the shrew species that eat insects and the vole species that eats fungi and seeds), a masting event would be less likely to affect their breeding patterns.

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| Presenter: | Lily H Gilbert |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Junior |
| Adviser: | Rebecca J Rowe |

**Comprehensive Diagnostic Results of Poultry Submissions to NHVDL from 2008 – 2019**

Amanda Jean Patev[2], David B Needle[1], Colleen F Monahan
[1]Molecular, Cellular, and Biomedical, UNH Durham
[2]NHVDL, UNH Durham

Diagnostic results from poultry samples from New Hampshire, Massachusetts, Maine, Vermont, and New York submitted to the New Hampshire Veterinary Diagnostic Lab (NHVDL) from 2008–2019 will be presented. Data was generated using the NHVDL's laboratory information management system (VADDS), and managed and analyzed using Microsoft Excel. Diagnostic testing data including serology (227,737 individual tests), microbiology (333 individual tests), and necropsy (528 individual cases) were analyzed. Diagnoses include common diseases of backyard poultry to reportable diseases of regulatory importance. Common diagnoses will be displayed for each category. Included are the most common diagnoses for serology (*Salmonella spp.*), microbiology (*Escherichia coli*) and necropsy (Marek's disease). Overall prevalence of diagnostic results for the entire period of the study as well as change over time will also be presented.

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| Presenter: | Amanda Jean Patev |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Comprehensive Diagnostic Results of Poultry Submissions to NHVDL from 2008 to 2019 |
| Adviser: | Colleen F Monahan |
| Adviser: | David B Needle |

**Using Estuarine Microbial Ecology to Mitigate Human Health implications Concerning Oysters in Great Bay, NH**

Elizabeth M Martin[1], Stephen H Jones[1]
[1]Natural Resources and the Environment , UNH Durham
[2]Natural Resources and the Environment, UNH Durham

*Halobacteriovorax* are small predatory bacteria found in marine environments that have been used as a natural mitigator against pathogenic bacteria in shellfish (Richards, Fay, Uknailis, Olanya, & Watson, 2016). For this reason, studies of BALO and their interactions with *Vibrio* species have been a topic of investigation in communities that have a prominent shell fishing industry. *Bdellovibrio* is one of the four genera collectively included in *Halobacteriovorax*, the other genera are *Bacteriolycticum, Peredibacter*, and *Bacteriovorax*. *Bdellovibrio* are gram-negative bacteria that prey on other gram-negative bacteria including *Vibrio parahaemolyticus (Vp).*

This study focuses on first identifying and isolating BALO in Great Bay, NH and then testing to see if BALO found in this body of water are Vp specific (meaning only prey on Vp) or generalist (prey on other marine bacteria). These are the preliminary steps to determining if *Halobacteriovorax* could be used as a natural mitigator against food poisoning caused by pathogenic *Vibrio parahaemolyticus.*

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| Presenter: | Elizabeth M Martin |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Senior |
| Research Interest: | Environmental Microbiology |
| Adviser: | Stephen H Jones |

**Assessment of Recycling Behavior on UNH and ECSU Campuses**

Acadia E Momm-White, McKenna L Wells, Patricia M Jarema
COLSA, UNH Durham

Research Question:

What are the differences between UNH and ECSU in terms of recycling habits and behaviors?

**Abstract**:

Patricia Jarema has been working on a project titled, "Plastics Recycling Awareness and Assessment" for several years at the UNH campus. During the fall semester of 2019, Patricia Jarema and her EREC 525 class surveyed a random sample of UNH students regarding their recycling habits. A modified version of the same survey was sent to Eastern Connecticut State University to be distributed in the same random fashion (for the first time since this survey has been administered). The survey attempted to reach on-campus, off-campus, and commuter students, as well as staff and faculty. The questions ranged from quizzing participants on their knowledge of proper recycling techniques to asking each person's personal plastic use and their motivations behind recycling (or not). All participants consented to have their responses recorded and used for research purposes, and there was no incentive offered for participating.

Research Plan:

McKenna Wells and Acadia Momm-White are two students who took Professor Jarema's EREC 525 class in 2019, and were interested in the results found from the survey. Using statistical analysis, we plan to look into the findings of the survey and compare them to past years, contrasting UNH's habits with ECSU's, as well as looking into how factors such as biological sex influence some of those choices.

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| Presenter: | Acadia E Momm-White |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Sophomore |
| Research Interest: | Sustainability |
| Presenter: | McKenna L Wells |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Junior |
| Adviser: | Patricia M Jarema |

**Finding a Better Method for Minimizing Human-Gull Interaction on New Hampshire Beaches**

Leslie J Curren, Elizabeth K Mackenzie
Biological Sciences, UNH Durham

Gull-human conflict on beaches has been an ongoing issue. Gulls have been shown to prefer human food over their natural diet which, in addition to being a nuisance to beach-goers, can threaten the health and safety of both the birds and humans. When gulls gather in flocks to scavenge for human food, bacteria such as *E. Coli* can be spread both intraspecifically and to humans. Human food also does not supply the essential nutrients that gulls would receive from a natural diet. Although there are a multitude of bird repellent methods on the market, most are expensive and not practical for everyday beach use. My study therefore aims to ask if low-cost, beach-friendly visual, auditory, or physical barrier methods will be effective in reducing human-gull conflict on the beach. I will test four possible repellents and a control: a bald eagle kite, a playback of eagle sounds, an unpainted beach umbrella, an umbrella painted to resemble eagle eyes, and a control with no repellent. I will sit with a bag of potato chips and record the distance individual gulls are willing to approach me during trials under each individual treatment condition. I hypothesize that all repellents will outperform the control, but the methods that resemble eagle eyes will be most effective. If this study demonstrates that one or more repellents reduces human-gull interactions, these methods could be implemented along beaches to help reduce conflict in a humane and low-cost way.

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| Presenter: | Elizabeth K Mackenzie |
| Presenter's Major(s): | Zoology |
| Year at UNH: | Senior |
| Research Interest: | Wildlife Conservation Behavior |
| Adviser: | Leslie J Curren |

**Investigating Threats of Small Mammal Populations and Associated Predation in Captive Breeding Pens of New England Cottontail**

Jenna N O'del[1], Adrienne I Kovach[2], Melissa Lyn Bauer, Allison M Stefanelli[2]
[1]Biological Sciences, UNH Durham
[2]Natural Resources and the Environment, UNH Durham

The New England cottontail (Sylvilagus transitionalis) is a shrubland habitat specialist, endangered in New Hampshire and Maine. Recovery efforts for this species include captive breeding programs, like outdoor captive breeding pens in Great Bay National Wildlife Refuge, Newington, NH. As with similar programs, there have been challenges with successfully breeding New England cottontails. The fencing and supplemental feeder in the outdoor breeding pen may impact the predators and small mammal communities, with potential negative consequences for cottontails. We hypothesized that the fenced enclosure would attract small mammals inside the pens, in turn attracting predators. We tested this hypothesis with live trapping of small mammals in three separate locations in and around the pen, including at and away from supplemental feeders. Camera traps were also placed at feeders and along the fence to monitor predators. Contrary to our hypothesis, we found that small mammal captures and abundance estimated by the Schnabel method were the highest outside the pen; captures were lower near the feeder than away, while abundance estimates had the opposite pattern. Predators were primarily observed at supplemental feeders. Small mammal abundance may be influenced by habitat variables rather than the location of the feeders, a post hoc hypothesis which we will test by modeling in program MARK. This will inform decisions for captive breeding success.

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| Presenter: | Allison M Stefanelli |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Senior |
| Presenter: | Jenna N O'del |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Senior |
| Research Interest: | Marine Biology |
| Adviser: | Melissa Lyn Bauer |
| Adviser: | Adrienne I Kovach |

**Assessing the Relationship Between Salivary Cortisol, Perceived Levels of Test Anxiety, and Test Performance**

Rebecca Rose Lisowski, Adele J Marone
Medical Laboratory Science, UNH Durham

**Abstract**

**Purpose:** The purpose of this pilot study was to evaluate the relationship between salivary cortisol and perceived levels of test anxiety in Medical Laboratory Science undergraduates at the University of New Hampshire on both an exam day and non-exam day and relate these cortisol levels to academic performance.

**Methods:** Saliva samples and heart rate readings were collected from undergraduate Medical Laboratory Science students prior to an exam on an exam day, as well as on a non-exam day. Participants were asked to rate their perceived levels of test anxiety on a scale from 1-10. Participants were also asked to complete the Test Anxiety Scale in order to quantify their test anxiety on a scale from 0-36. Concentrations of salivary cortisol were obtained using Enzyme-Linked Immunosorbent Assay (ELISA). Ten undergraduate students from a hematology laboratory participated in this study.

**Results:** 70% of participants reported feeling anxious prior to taking an exam, and students had an average salivary cortisol concentration of 0.254 u/dL on the day of an exam, compared to an average of 0.239 u/dL on a non-exam day. The concentration of salivary cortisol was not found to be significantly increased on an exam day compared to a non-exam day ($p=0.860$). The study found a significant correlation between perceived levels of test anxiety and salivary cortisol concentration on an exam day, as well as salivary cortisol concentration and test performance ($p=<0.0001$ and $p=<0.0001$, respectively).

**Conclusion:** Salivary cortisol levels did not seem to significantly differ on an exam day versus a non-exam day. However, the students' self-reported levels of anxiety correlated with their salivary cortisol concentrations on the day of an exam and impacted their overall exam performance. Further research with a larger sample size is needed to establish any significant difference in salivary cortisol levels between an exam and non-exam day.

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| Presenter: | Rebecca Rose Lisowski |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Salivary Cortisol and Test Anxiety |
| Adviser: | Adele J Marone |

**Justifying Socioscientific Decisions: Differences Between Non-Science and Science Major Students**

Kelsey Elise Ahearn[2], Beverly Allen[3], Melissa L Aikens[1], Diya Mehr Anand, Jordan D Bader
[1]Biological Sciences, UNH Durham
[2]Biology, UNH Durham
[3]COLSA, UNH Durham

Socioscientific issues (SSIs) are controversial scientific issues that encompass social, political, economic, and cultural implications. These issues are experienced by all students irrespective of major. When making an SSI decision, students may not rely solely on academic knowledge. Students may be justifying their decisions from personal sources of information (e.g., personal experiences), authoritative sources of information (e.g., religious leaders), or by multiple sources of information (e.g., combination of personal and authoritative sources). Understanding these sources of knowledge that students are utilizing is critical to being able to enhance effective methods of education of an SSI. This study compares how non-science and science majors support decisions about the use of fetal tissue in medical research. Participating students (N= 133) from a UNH science discovery course, responded to a modified Decision-Making Questionnaire, an open-ended survey that asked how they were forming their opinion regarding the issue. Through qualitative thematic coding, our preliminary results portray that nonscience majors (N= 64) may be relying heavily on academic sources to form their opinions while science major students (N=69) may be using sources outside of their academic realm. The results from this study can inform effective teaching practices for SSI decision-making.

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| Presenter: | Beverly Allen |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | Science Education |
| Presenter: | Diya Mehr Anand |
| Presenter's Major(s): | Biology |
| Year at UNH: | Junior |
| Presenter: | Kelsey Elise Ahearn |
| Presenter's Major(s): | Biology |
| Year at UNH: | Sophomore |
| Adviser: | Melissa L Aikens |
| Adviser: | Jordan D Bader |

**Tick-borne Infections in New Hampshire: An Evaluation of the Diagnostic Process in a Local Patient Population**

Katherine R Anderson, Juan U Rojo
Medical Laboratory Science, UNH Durham

Overall, approximately 95 percent of reported cases of vector-borne disease were associated with ticks, making these the most medically important group of arthropods in the United States.[1] Despite the prevalence of tick-borne infections, the process for the diagnosis of this condition is not well studied. This study aims to analyze data from a pool of 100 patients who underwent testing for tick-borne disease in the same institution in Dover, New Hampshire during the most recent peak tick season of 2019. Information utilized in this study included: patient age, sex, location of testing (inpatient versus outpatient), diagnostic testing methods used pertaining to investigation of tick-borne disease, results of tick-borne panel testing, number of days to obtain tick panel results, symptomology, treatments pertaining to the investigation of tick-borne disease, and record of follow-up visits. Analyses of these data points revealed a trend that suggests the current diagnostic process for tick-borne disease is unnecessarily burdensome for patients and medical facilities. There is a need for a faster turnaround time in testing to decrease the need for supplemental tests and follow-up visits pertaining to the investigation of tick-borne diseases. This study also suggests that recognition of symptoms associated with positive results is paramount to improve the detection of tick-borne illnesses. Further investigation of our current methods and possible future adaptations to them are critical if we are to conquer the diverse array of challenges presented by tick-borne diseases.

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| Presenter: | Katherine R Anderson |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Juan Rojo |

**Innovative Tools to Bring Workforce Housing to Durham, NH**

Michael James Slagle, Mary Adamo Friedman
CEP, UNH Durham

New Hampshire is experiencing a housing crisis. Often times, people cannot afford to live and work in the same community. Workforce housing may be a solution for communities. To implement workforce housing, communities need to use innovative planning practices.

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| Presenter: | Michael James Slagle |
| Presenter's Major(s): | Community and Environmental Planning, Sustainability |
| Year at UNH: | Senior |
| Research Interest: | Transportation Planning |
| Adviser: | Mary Adamo Friedman |

**How Does Coral Morphology Change along Ningaloo Reef, Western Australia?**

Helene A Bartsch[1], Thomas D Lee[2]
[1]Abroad, UNH Durham
[2]N/A,

Some of the most common morphologies of coral found along Ningaloo Reef include plating, branching, massive, meandering, solitary and encrusting coral. However, the extent of their abundance is still widely unknown. The aim of this study was to determine the abundance for each morphology in five sites across Paradise Bay, Bill's Bay, and Skeleton Bay. To do this, quadrat photos were taken one meter above the coral canopy every five meters along a 50 meter transect. Photos were later analyzed in Coral Point Count (CPCe) which generated percent cover by assigning 50 randomized points to each photo. After running an ANOVA assuming unequal variances in Microsoft Excel, it was concluded that plating coral was statistically significant among all five sites, and was most abundant in site 1 in Paradise Bay. There was also a near significant result for branching coral in two out of five sites surveyed. The reasoning of why plating coral was found most abundantly vary, however it is believed that they are equipped with mechanisms which aid their survival under stressful circumstances

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| Presenter: | Helene A Bartsch |
| Presenter's Major(s): | Environmental Conservation and Sustainability |
| Year at UNH: | Senior |
| Research Interest: | Coral Morphology |
| Adviser: | Thomas D Lee |

**The Role of Phosphoprotein C1ORF150 During EPO-Dependent Erythroid Progenitor Cell Formation**

Draven L Bishop, Don M Wojchowski
MCBS, UNH Durham

This experiment involved effectively developing red blood cells (RBCs) through all six stages of erythropoiesis and comparing the phenotypes of RBCs that have a “knocked down” C1ORF150 against RBCs that have a normal functioning C1ORF150. To do this, an sh-RNA approach was used to inhibit the phosphoprotein and flow cytometry was used to track the specific biomarkers (c-KIT, CD71, GPA) which are important for the normal differentiation of these cells. During each stage of the RBC development, multiple samples were obtained to be stained and analyzed for phenotypic differences. All of this data was compiled and compared to each specific stage of development to determine where phenotypic changes occur and what impact that may have on the cell. The important phenotype that was observed was how “knocked-down” late-stage erythroblasts (reticulocytes) had doubled in quantity compared to the unmodified cells. This means that the cells may have been compensating for a functional loss by doubling the number created. If this was occurring, then C1ORF150 may play a key functional role in erythropoiesis and needs to be studied more in-depth.

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| Presenter: | Draven L Bishop |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | Role of C1ORF150 During Erythroid Progenitor Cell Development |
| Adviser: | Don M Wojchowski |

**Assessing Topographic Mapping Accuracy using Aerial Drone with Terrestrial and Submerged Aquatic Ground Control Points**

Bonnie R Turek[2], Kevin H Gardner[1]
[1]Civil & Environmental Engineering,
[2]Environmental Engineering Group (CEPS & NREN), UNH Durham

This study aims to improve the accuracy of riverine topographic modeling by testing the use of terrestrial and submerged aquatic ground control points (GCPs). Accurate mapping of river-scapes is critical to investigations of topographic features created by physical, chemical, and biological processes in rivers, fluid mechanics, and overall watershed processes. These studies build on our increasing understanding and quantification of the cycling of chemical and biological substances in rivers and the ecological services watersheds provide. The evolution of remote sensing, drone technology, and digital elevation models (DEMs) provide an alternative to conventional, labor-intensive ground survey measurements and are of increasing importance for creating topographic products valuable to studies of river-scapes and watershed processes. Land-based GCPs are routinely used to develop highly accurate models, however, in rivers we seek to accurately measure submerged topography, which has only been done in limited environments due to numerous technical challenges. Incorporating submerged GCPs into drone workflows may be a simple, yet effective way to improve in-stream topography models. Results of this study are expected to contribute key information for floodplain and sediment transport analyses, restoration planning for rivers and other aquatic habitats, and studies of land use and impacts of infrastructure.

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| Presenter: | Bonnie R Turek |
| Presenter's Major(s): | Environmental Conservation and Sustainability |
| Year at UNH: | Senior |
| Research Interest: | Environmental and Watershed Science; Geospatial Analysis Studies |
| Adviser: | Kevin H Gardner |

**Expression Levels May Explain Phenotypic Differences Between *Arabidopsis* Mutants**

Estelle M Hrabak, Brennan Stone Senecal, Megan Thompson
MCBS, UNH Durham

Protein phosphatase 2A (PP2A) is an enzyme involved in signal transduction pathways in plants and animals that removes phosphate groups from proteins. As one of the most prevelant phosphatases in plants, PP2A plays crucial roles in responses to light and to multiple hormones in addition to regulating key enzymes of primary metabolism. The PP2A heterotrimer is composed of one A subunit (scaffolding), one B subunit (regulatory), and one C subunit (catalytic). Five different isoforms of the C subunit of PP2A are encoded within the genome of the plant *Arabidopsis thaliana*: C1, C2, C3, C4, and C5. The C3 and C4 proteins are nearly identical and both are present in roots, but *c3* and *c4* mutants have strikingly different responses to salt stress. When grown under salt stress, root epidermal cells of *c3* mutants are straight like cells of wildtype roots, while the cells of *c4* mutant roots are twisted. We hypothesized that C3 and C4 subunits are interchangeable but that *C4* is the predominant isoform, resulting in a salt-stress phenotype only in *c4* mutants. To test this hypothesis, intact *C4* or *C3* genes, as well as a hybrid gene (*C4* promoter driving expression of the C3 protein [*C4::C3*]), were transformed into *c4* mutants. As expected, the *C4* promoter expressing the C4 protein (*C4::C4*) complemented the *c4* mutant phenotype. Complementation results for the *C3::C3* and *C4::C3* will test whether the C3 isoform can complement a *c4* mutant.

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| Presenter: | Brennan Stone Senecal |
| Presenter's Major(s): | Genetics |
| Year at UNH: | Senior |
| Research Interest: | Signal transduction |
| Adviser: | Estelle M Hrabak |
| Adviser: | Megan Thompson |

**Using Leaf Chlorophyll and Nitrogen Concentrations of Mixed Species to Evaluate Forest Productivity in New Hampshire Temperate Forests**

Elizabeth A Pederson, Andrew P Ouimette
Terrestrial Ecosystems , UNH Durham

Foliar chemistry and net primary productivity are accurate indicators of forest productivity. Chlorophyll is the pigment within the cell wall, that give leaves a green color. Nitrogen proteins are also present within the cell wall and give leaves the ability to capture sun light and convert it into a useable form of sugar. With greater concentrations of chlorophyll, more light energy is captured. With greater concentrations of nitrogen more of that light energy can be converted to sugars, thus increasing overall net primary productivity. The objective of this study was to use chlorophyll and nitrogen concentrations to accurately depict if forest productivity in temperate forests was greater with mixed species or with a single species and wether this varied throughout the canopy, and over the year. This was done by collecting leaf samples of various species from a temperate New Hampshire forest including, Red Maple (*Acer rubrum*), Red Oak (*Quercus rubra),* and White Pine (*Pinus strobus).* All species samples were taken from different heights in the canopy, throughout different times of the year.

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| Presenter: | Elizabeth A Pederson |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Senior |
| Research Interest: | Forest Productivity |
| Adviser: | Andrew P Ouimette |

**Signalling in Silence: Unraveling the song of the Cicadellidae**

Sarah E Blatchley, Daniel R Howard

Many insects use substrate-borne vibration for communication, including both native beneficial species and pests of agricultural crops. These vibrational signals are transmitted through the stems and leaves of host plants, and are used for mate localization, assessing mate quality, and in courtship and pair-formation. Over the summer of 2019, we conducted research on *Oncopsis sobria*, which is a native leafhopper species common to New Hampshire in early to mid-summer. They feed on native birch (*Betula*) trees from June through July and utilize substrate borne vibration to communicate for purposes of reproduction. However, the acoustic patterns of their calls had not previously been described. Specimens were collected in the field and calls recorded using laser Doppler vibrometry. We analyzed the spectral and temporal characteristics of *O. sobria* calls as a first step in establishing an acoustic analysis workflow focused on extending the research to understand the communication ecology of a destructive agricultural pest leafhopper species, *Empoasca fabae* (potato leaf hopper; PLH). PLH reproduces on over 200 host plant species and causes an economic impact in the hundreds of millions of U.S. dollars each year. Analyzing the call of *E. fabae* would allow us the opportunity to produce a vibrational 'jamming' signal to disturb a potential courtship duet between male and female potato leafhoppers. This signal jamming approach is being tested for use as an environmentally-friendly control method for management of PLH infestations in New Hampshire agroecosystems.

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| Presenter: | Sarah E Blatchley |
| Presenter's Major(s): | Zoology |
| Year at UNH: | Senior |
| Research Interest: | Animal Behavior |
| Adviser: | Daniel R Howard |

**Comparison of Two Soybean Varieties with Contrasting Susceptibility to Iron Deficiency Grown with and without Chitosan Supplementation**

Marta Raquel Martins Lima, Madeline V Young

Comparison of Two Soybean Varieties with Contrasting Susceptibility to Iron Deficiency Grown with and without Chitosan Supplementation

Madeline Young and Marta R. M. Lima

University of New Hampshire, Department of Agriculture, Nutrition, and Food Systems, Durham NH 03824

Iron (Fe) is an essential nutrient to both plant and human health. Fe deficiency is an issue that is globally concerning in human nutrition. A staple food in agriculture that contains significant amounts of this nutrient to combat Fe deficiency is the soybean. Soybeans are a crop affected by Fe deficiency chlorosis (IDC) which is caused by ineffective absorption of Fe from the soil environment. It has been previously seen that chitosan, a derivative of chitin, improves the growth of plants and can improve the absorption of Fe in soybean plants. This is essential information to combat IDC in soybeans in order to manipulate the nutritional content to enhance its health and agricultural productivity. There are multiple different varieties of soybeans that have varying susceptibility to IDC. To study how chitosan affects soybeans with different susceptibility to Fe deficiency, a Fe deficiency susceptible variety and a tolerant soybean variety were grown in hydroponics under Fe-sufficient and -deficient conditions, with or without chitosan supplementation. Chlorosis score, nutrient solution pH, plant weight, chlorophyll content, and root morphology were measured in plants grown for two weeks in hydroponics, and the role of chitosan supplementation in improving Fe status in susceptible and tolerant varieties was assessed.

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| Presenter: | Madeline V Young |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Adviser: | Marta Raquel Martins Lima |

**Identifying Spatial Distributions and Bat Species Richness in a Southern Plains Tallgrass Prairie Ecosystem**

Brittany Leigh Robinson, Daniel R Howard

Title: Identifying spatial distributions and bat species richness in a southern plains tallgrass prairie ecosystem

Authors: Brittany L. Robinson and Daniel R. Howard

Bats are important in ecosystems due to their roles associated with insectivory, pollination, and nutrient cycling. Bats can be important ecological indicator species, but populations of many species have been in decline due to disease, anthropogenic disturbance, and climate change. While most bat research has focused on forest ecosystems, little is known regarding bat space use in grassland environments. Here we studied the spatial distributions and species richness of bats at a restored tallgrass prairie site in the Flint Hills ecosystem of Northeastern Oklahoma, with the aim of identifying which species forage at the grassland site during the early summer months after bats emerge from seasonal hibernation but before insect populations reach their zenith later in the summer. We sampled 30 sites across the 16,000 Ha study for 2 night each site during May and June 2019 using acoustic biomonitoring techniques. Using auto classification software (Kaleidoscope Pro), we identified five species of bats across the site, with high levels of spatial heterogeneity with respect to species richness. Lower species richness was associated with regions of the site where oil and gas extractive activities are concentrated, and in cattle grazed areas. Our data are the first to identify these interactions between bat species richness and land management features in the southern Flint Hills, where cattle grazing and energy development are both common practices impacting the grassland landscape.

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| Presenter: | Brittany Leigh Robinson |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Senior |
| Research Interest: | Bat acoustics |
| Adviser: | Daniel R Howard |

**Mindful Eating and Metabolic Syndrome Among UNH College Students**

Rachel Anne Zampini, Maggie D Begis

Rachel Zampini, Jesse Stabile Morrell, Maggie Dylewski Begis

Mindful eating, defined as non-judgmental awareness of food intake, is a treatment strategy for weight regulation and may be related to cardiometabolic health. The primary objective of this study was to explore the relationship between mindful eating and metabolic syndrome (Mbs) among college students. Subjects (n=142; 66% female) were recruited in Fall 2019 from the College Health and Nutrition Assessment Survey, an ongoing cross-sectional study examining the health of young adults. Students completed a Mindful Eating Questionnaire (MEQ), a 28-item validated tool adapted from the Fred Hutchinson Cancer Research Center. The MEQ assesses 5 subscales (disinhibition, awareness, external cues, emotional response, distraction); higher scores (1-4) indicate a higher degree of mindful eating. Subjects were evaluated for meeting 5 Mbs criteria. Data are reported as frequencies or means±SD. ANOVA was used to assess group differences. Total MEQ scores were similar between men and women (2.79±0.26 vs. 2.81±0.26, $p$=.30). All subjects scored the highest in the MEQ emotional category and lower in the external and awareness categories. No differences among MEQ categories were observed between men and women (all $p$>0.05). No differences in total MEQ scores were observed between students with 0 Mbs criteria (44%), 1 Mbs criteria (44%,), or 2 Mbs criteria (12%) ($p$=0.77). More research is needed to further explore the applications of mindful eating in this population.

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| Presenter: | Rachel Anne Zampini |
| Presenter's Major(s): | Nutrition |
| Year at UNH: | Senior |
| Adviser: | Maggie D Begis |

**The Effect of Acute Bouts of Aerobic Exercise on Recognition Memory**

Kaylan RB Williams[1], Ronald V Croce, Robert S Ross[2]
[1]Brain Science and Cognition; BioMechanics, UNH Durham
[2]Psychology; Neuroscience and Behavior, UNH Durham

As people age memories begin to fade, and hippocampal volume gradually degrades …but what if that can be slowed down? Whether someone is going on a walk, riding a bike, or even running a marathon, aerobic exercise has a positive effect on both physical and mental health. Aerobic exercise has been linked to enhancing recognition memory, particularly in the medial temporal lobe (MTL) of the brain which includes the hippocampus, perirhinal, entorhinal, and parahippocampal cortices. An electroencephalogram (EEG) will be used to determine whether alpha and beta frequencies are desynchronized after exercising. The test will involve twenty-five non-athlete participants that will learn half the stimuli before exercising and the other half after exercising. The participants will be asked to learn and remember objects presented at fixation and whether the stimuli were previously presented on the left or right side of the screen. The exercise will involve riding on a bike ergometer for 15 minutes to achieve 40-60% maximum heart rate. Three days after encoding the stimuli, the participants will come back to the lab and be shown the old stimuli mixed in with new stimuli. They will be asked to indicate if the stimulus was old and presented on the left, old and presented on the right, or new. Performance for the items remembered between the exercise and non-exercise conditions will be compared as will alpha and beta oscillatory power. The expectation is that aerobic exercise will desynchronize alpha and beta oscillations to enhance recognition memory.

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| Presenter: | Kaylan RB Williams |
| Presenter's Major(s): | Neuroscience and Behavior |
| Year at UNH: | Senior |
| Research Interest: | Cognition |
| Adviser: | Ronald V Croce |
| Adviser: | Robert S Ross |

**The Sound of Inattention: Predicting Mind Wandering with Automatically Derived Features of Instructor Speech**

Ian S Gliser[1], Caitlin S Mills[1]
[1]Psychology , UNH Durham
[2]Psychology, UNH Durham

Lecturing in a classroom environment is a challenging because instructors are tasked with maintaining students' attention for extended periods of time. Previous work has investigated the influence of speech on attention, but has not been extended to live classroom lectures. In the current study, we automatically extracted acoustic features from live lectures to see how they related to rates of classroom mind-wandering (i.e., lack of student attention). Results indicated that five speech features reliably predicted classroom mind-wandering rates (Harmonics-to-Noise Ratio, Formant 1 Mean, Formant 2 Mean, Formant 3 Mean, and Jitter Standard Deviation). These speaker correlates of mind-wandering may be a foundation for developing a system to provide feedback in real-time for the lecturers online and in the classroom. Such a system may prove to be highly beneficial in developing real-time tools to retain student attention, as well as informing other applications outside of the classroom.

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| Presenter: | Ian S Gliser |
| Presenter's Major(s): | Neuroscience and Behavior |
| Year at UNH: | Junior |
| Research Interest: | Behavioral Neuroscience |
| Adviser: | Caitlin S Mills |

**The Effects of Devil's Club Extracts on GDF1 Expression in Acute Myeloid Leukemia Cells**

Brian M Barth, Bert F Prince, Emma Jane Arsenault, Olivia Tsang

Acute Myeloid Leukemia (AML) is a hematopoietic malignancy that has been, and continues to be, in need of the development of a novel, non-toxic, and efficacious therapeutic. AML is characterized by the dysregulated growth of myeloid lineage progenitors, termed myeloblasts, and disproportionately affects the adult population, with the average age of diagnosis around 68.1 Although it only accounts for about one percent of all cancers, it's low five year survival rate of 27.7% gives cause for concern, and further establishes the need for the development of new and effective therapies.1-2 Devil's Club, Oplopanax horridus, is a native Alaskan plant that is known for its versatility in treating a variety of ailments including cancer. Specifically, Devil's Club has been shown to exert anti-cancer efficacy in a murine model.3 Devil's Club has been hypothesized to be a regulator of growth differentiation factor 1 (GDF1) as a possible pathway to exert anti-cancer effects. GDF1 is a ligand of the transforming growth factor beta (TGF-β) receptor pathway, a pathway associated with differentiation of hematopoietic stem cells. It is proposed that through the upregulation of GDF1, Devil's Club can exert anti-cancer effects and has potential to be a non-toxic, efficacious, therapeutic for AML.

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| Presenter: | Bert F Prince |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Junior |
| Research Interest: | Cancer Biochemistry, Sphingolipid Metabolism |
| Presenter: | Emma Jane Arsenault |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Junior |
| Presenter: | Olivia Tsang |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Brian M Barth |

**The Role of *Growth and Differentiation Factor 1(Gdf1)* as a Regulator of Sphingolipid Metabolism in Acute Myeloid Leukemia**

Andrea L Cote, Brian M Barth, Felicia E Williams
Cancer biology, UNH Durham

Acute Myeloid Leukemia (AML) is a form of blood cancer classified by overproduction and clustering of white blood cells in bone marrow that interfere with production and function of normal blood cells [1]. This disease occurs primarily as pediatric cases, and in the aging population [2]. Despite recent developments in treatment of AML, the five-year survival rate is estimated to be as low as 28.3% [3]. With an estimated 60,530 new cases of AML in 2020, there is a need for development of new chemotherapies [4]. Growth and differentiation factor 1 (*Gdf1)* produces a protein that binds to TGFβ receptors on the cell membrane. *Gdf1* is bicistronic with the gene *Cers1*, which produces the pro-death lipid ceramide. A developing therapeutic approach for AML treatment is to increase the concentration of this pro-death lipid in cancer cells. To maintain high levels of ceramide, therapies aim to decrease the expression of enzymes (such as UGCG and SGMS1) which metabolize ceramide into other sphingolipids. Preliminary research suggests an inverse relationship between expression of *Gdf1* and expression of these undesired enzymes. In this project, the level of Gdf1 was increased in mice and in mouse AML cells by treatment with a recombinant Gdf1 protein. Results from this project will provide insights into the potential application of the recombinant Gdf1 protein as a new chemotherapeutic for the treatment of AML.

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| Presenter: | Andrea L Cote |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Senior |
| Research Interest: | Sphingolipid metabolism in cancer |
| Presenter: | Felicia E Williams |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Brian M Barth |

**Effects of Two Diabetic Conditions on Inflammation Molecules Related to Atherogenesis**

Daniel Alexander Banas, Thomas L Foxall
Department of Biological Sciences, UNH Durham

Atherosclerosis is the main cause of cardiovascular disease (CVD) which is the leading cause of death in the US. Atherosclerosis is an inflammatory disease of the arteries and is initiated by injury to the endothelial cells (EC) that line blood vessels. Diabetes accelerates CVD. This study evaluated the effects of 2 diabetic conditions, hyperglycemia and dyslipidemia separately and in combination, on the expression of an inflammatory molecule using porcine arterial EC (PAEC) in vitro. Normal growth medium (100 mg/dL) was a negative control and TNF- (10 ng/ml) was a positive control(all treatments n=8). Cellular and soluble forms of the inflammatory Vascular Cell Adhesion Molecule-1 (VCAM-1) were measured using ELISA. A cell proliferation assay was used to determine toxic concentrations of glucose and adverse blood lipids. PAECs showed morphological differences between treatments that indicated an adverse effect based on levels of glucose and dyslipidemic serum, higher doses of glucose (200, 400 mg/dL) and dyslipidemic serum (2 & 4%) showed a higher number of dead or damaged cells. No statistical significance was observed when total VCAM-1 was analyzed with ANOVA but a difference was seen in t-test analysis of the total produced by cells in treatment groups containing M199+2% FBS and M199+2% dyslipidemic serum. Demonstrating that under diabetic conditions, even dyslipidemic serum alone is enough to affect the total amount of VCAM-1 produced.

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| Presenter: | Daniel Alexander Banas |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Atherosclerosis |
| Adviser: | Thomas L Foxall |

**Obesity Mediates the Progression of Acute Myeloid Leukemia through the Dysregulation of Sphingolipid Metabolism**

Sara E Connell, Brian M Barth, Maya-Grace X Ginsberg, Tamara Hathorn, Alexus M Day
Agriculture, Nutrition, and Food Systems, UNH Durham

Acute myeloid leukemia (AML) is a group of closely-related and genetically-heterogenous leukemias that arises from defects in the myeloid hematopoietic cell development. Ultimately, these defects result in clonal expansion of immature myeloid progenitors also known as blasts. Studies have shown that obesity may be a possible risk factor for several types of cancers and leukemias. In the present study, we sought to develop a transgenic murine model to study the effects of obesity of leukemia development and progression. More specifically, we have developed a Leptin(ob/ob) x Flt3-ITD transgenic mouse. We have used this novel mouse to study aspects of sphingolipid metabolism. This is important because dysfunctional sphingolipid metabolism has been associated with both obesity and cancer/leukemia development and progression.

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| Presenter: | Alexus M Day |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Sophomore |
| Presenter: | Sara E Connell |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Animal Nutrition |
| Year at UNH: | Senior |
| Presenter: | Maya-Grace X Ginsberg |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Presenter: | Tamara Hathorn |
| Presenter’s Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Brian M Barth |

**Assessing Nutrient Adequacy among Food Insecure Students at the University of New Hampshire**

Isabelle S Todd, Raegan E Lynch, Keirra S Bartley, Jesse Stabile Morrell
COLSA, UNH Durham

Objective: Food insecurity is an emerging issue facing college students. Many Americans are not consuming adequate amounts of calcium, potassium, dietary fiber, and vitamin D, yet are exceeding recommendations for sugar, saturated fat, and sodium.1 The purpose of this study is to determine if there are differences in these nutrients between food secure (FS) and food insecure (FI) students. Methods: Students (n=344, 64% female) were recruited to participate in the ongoing College Health and Nutrition Assessment Survey during the Fall 2018 semester. Students completed an online survey that included a 6-item food insecurity questionnaire and were categorized as FS or FI. Three-day food records were used to complete nutrient analysis. Differences were assessed via ANCOVA using sex and body mass index as covariates. Results: Eighteen percent (17.7%, n=61) of students were categorized as FI. No between group differences were observed between FS vs. FI students for calcium (900±26 vs. 906±57), potassium (2,272±59 vs. 2,275±130), dietary fiber (19.4±0.6 vs. 20.4±1.3), or vit D (3.9±0.2 vs. 3.4±0.4) (all P>.05). Further, no between group differences were observed between FS vs. FI students for sugar (80.9±2.2 vs. 83.5±4.9), saturated fat (23.7±0.6 vs. 22.6±1.3), and sodium (2,959±62 vs. 2,841±135) (all P>.05). Conclusions: Both FS and FI students are consuming diets that fail to meet nutrient recommendations, however, no differences in nutrient intakes were observed between groups.

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| Presenter: | Isabelle S Todd |
| Presenter's Major(s): | Nutrition |
| Year at UNH: | Senior |
| Presenter: | Keirra S Bartley |
| Presenter's Major(s): | Nutrition |
| Year at UNH: | Recent Graduate |
| Presenter: | Raegan E Lynch |
| Presenter's Major(s): | Nutrition |
| Year at UNH: | Senior |
| Research Interest: | Nutrition |
| Adviser: | Jesse Stabile Morrell |

**_Frankia_ and Friends: Roles of Various Nodule Inhabitants in the Actinorhizal Symbiosis**

Kelsey C Mercurio, Louis S Tisa
MCBS, UNH Durham

Actinorhizal plants are woody dicotyledons from eight families that form symbiotic root nodules with the genus *Frankia*, nitrogen-fixing actinobacteria. Recent studies have found that actinorhizal nodules contain other bacterial inhabitants besides *Frankia.* The roles that members of the actinorhizal microbiome play are largely unknown. In this study, several bacterial strains were isolated from alder (*Alnus*) nodules growing at Adam's Point in Durham, NH in spring 2018 and 2019. These isolates were tested for chemotactic/chemotropic properties and their impacts on alder seedlings and nodulation. A chemotaxis/chemotropism assay was developed to detect the response of these bacteria to actinorhizal root exudates. Additionally, sterile *Alnus glutinosa* seedlings grown under nitrogen-deficient conditions were inoculated with bacterial isolates alone or in co-culture with *Frankia* to assess impacts on plant health. For the chemotaxis assay, a few strains including *Kocuria*, *Curtobacterium*, *Streptomyces*, and *Herbaspirillum* exhibited differences in motility or produced crystals depending on conditions. The *Streptomyces* isolate and one of the *Kocuria* strains exhibited attraction to root exudates from the actinorhizal plant *Eleagnus angustifolia*, and *A. glutinosa* to a lesser extent. Preliminary plant studies suggest *Streptomyces* strain 23 decreased nitrogen stress symptoms in *A. glutinosa*, and the *Streptomyces* and *Bacillus* isolates may play a role in promoting secondary root formation.

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| Presenter: | Kelsey C Mercurio |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology, Sustainable Agriculture and Food Systems |
| Year at UNH: | Junior |
| Research Interest: | Plant-Microbe Interactions |
| Adviser: | Louis S Tisa |

**The Catbird's Meow: An Acoustic Analysis of Gray Catbird (*Dumatella carolinensis*) Vocalizations**

Nick Charron, James Thomas Taylor
Zoology, UNH Durham

The Gray Catbird (*Dumatella carolinensis*), like other birds in the Mimidae family, has the miraculous ability to mimic the calls of other species. Despite this, *D. carolinensis* song and mimicry have yet to be studied in detail; few studies exist on the topic of mimic thrush mimicry in general. Using recordings of *D. carolinensis* song from the Cornell lab of Ornithiology, I conducted an analysis of Gray Catbird calls, including the meow call, startle cry, and mimicry, the final of which was compared alongside recordings of identified mimicked species. These data help further illustrate the ability of our mimic thrushes, and, with further study, could spark insight into dialectic differences between populations, cultural transmission, and learning and acquisition of mimicked calls in *D. carolinensis* and other mimids.

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| Presenter: | Nick Charron |
| Presenter's Major(s): | Zoology |
| Year at UNH: | Senior |
| Research Interest: | Ornithology |
| Adviser: | James Thomas Taylor |

**Analysis of a Morphological Clinal Zone of the Poison Frog *Ranitomeya imitator* to Identify Genome-Wide Differentiation**

Matthew D MacManes, Jackson E Hastings
Molecular, Cellular, and Biomedical Sciences, UNH Durham

Aposematism is a biological defense mechanism used by animals to advertise to potential predators that they should not be eaten or attacked. In the poison frog Ranitomeya imitator, this takes the form of distinct coloration and visual patterns on their skin. In northern Peru, there is a morphological hybrid zone between populations of the orange banded and yellow striped variants. In this study, we aim to characterize the genetic differences between individuals along this phenotypical gradient in order to correlate these physical characteristics to specific genetic loci. This will be achieved by constructing Restriction Site Associated DNA Marker sequence assemblies (RADseq) of these individuals and running comparitive genomic analyses on the resulting data.

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| Presenter: | Jackson E Hastings |
| Presenter's Major(s): | Genetics |
| Year at UNH: | Senior |
| Research Interest: | Molecular Genetics |
| Adviser: | Matthew D MacManes |

**Identification of STAT3 Target Genes that Promote Ovarian Cancer Metastasis**

David F Walker, Sarah R Walker, Yuri I Makar
BMCB, UNH Durham

Authors: David Walker, Yuri Makar, Sarah Lacroix, Dr. Sarah Walker

Ovarian cancer is the 5th leading cause of cancer related deaths in women. The high morbidity comes from the cancer's late stage detection and chemo-resistant properties. The work of the we discovered that the signal transducer and activator of transcription 3 (STAT3) protein had higher activation in spheroids compared to two-dimensional cells. After decreasing the activity of STAT3 the cancer was not able to grow properly in the three-dimensional spheroid form. After the diminished growth was observed we made the connection that metastasis could also be affected. Through a novel mesothelial clearance assay procedure that models the first steps of ovarian cancer metastasis, the movement of ovarian cancer cells was monitored in real time, and the area of invasion was analyzed. Through this data the we showed that STAT3 activation is needed for metastasis. To identify how STAT3 promotes ovarian metastasis, gene analysis of STAT3 binding sites was performed, and downstream targets were identified. These genes were compared to genes known to promote metastasis, and we identified 5 genes as potential STAT3 target genes that promote metastasis. The metastatic effect of the downstream targets: Slug, TMEM173, ITGB3, EFEM12, and ICAM-1 were tested, and several targets showed potential relationships with metastatic ability. The next steps for the project are to continue the research on the new downstream targets.

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| Presenter: | David F Walker |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | STAT3 in Ovarian Cancer |
| Presenter: | Yuri I Makar |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | Ovarian Cancer Metastasis |
| Adviser: | Sarah R Walker |

**Influences on the vigor and distribution of crab apple (*Malus sylvestris*) on Appledore Island, ME**

Noah J Abasciano, Gregg E Moore
MEFB, UNH Durham

Several authors have catalogued plant species richness of the Isles of Shoals, including Appledore Island, Maine. Although these surveys are useful resources for understanding the current diversity of flora on Appledore Island, they do not provide details about the distribution of extant taxa or trends in populations over time. This study compares the present distribution of crab apple (*Malus sylvestris*) to historical reports and structures; it also compares metrics of morphological variation and plant vigor to uncover factors that may have contributed to the current patterns of variation in apple trees across the island. Included in these metrics are tree crown diameter, diameter at breast height, red-edge vegetation stress, and quantification of sap well damage caused by *Sphyrapicus varius* (Yellow-bellied sapsuckers). We hypothesized that larger, older trees would closely adhere to known historic distribution, and that morphological variation would be controlled by *S. varius* damage. Although we did not find a strong correlation morphological variation and *S. varius* damage, we found that apple trees were significantly more likely to be found near sites of historic trees and property lines.

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| Presenter: | Noah J Abasciano |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Research Interest: | Shoals Marine Lab, Apple Trees |
| Adviser: | Gregg E Moore |

**Trellis Systems Modify Grape's Health-Beneficial Properties**

Molly K Hanlon, Marta Raquel Martins Lima
Agriculture, Nutrition, and Food Systems, UNH Durham

The objective of this research is to find the optimal combination of grape variety and grapevine training systems to maximize the nutritional properties, phenolics, and antioxidant potential of the grapes after harvest. This research is important because not enough consumers intake the recommended amounts of fruits and vegetables to maintain health and prevent chronic disease. The question exists of whether growing and consuming fruits richer in phytochemicals could balance the too low intake of fruits and vegetables of 75% of the United States population. By learning the best way to maximize the health benefits in grapes using their grapevine training systems, consumers will have access to fruit with higher nutritional, antioxidant, and phenolic properties to enhance their health. To achieve this, samples of two seedless grape varieties, Mars and Canadice, were grown using two different grapevine training systems, Modified Munson (MM) and Vertical Shoot Positioning (VSP). Using the different grapevine training systems allows us to study the impact of light exposure and air flow on the nutritional properties of the fruit. Two clusters per vine were collected for sampling. The grapes were harvested and stored in a cold room at 0â„ƒ when necessary. They were blended, homogenized, and analyzed shortly after harvest observing Brix, titratable acidity, antioxidant potential, and total phenolics. The antioxidant potential was examined using a Ferric Reducing Antioxidant Power (FRAP) assay kit, and the total phenolics were examined through a total phenolics assay kit. The data collected from the tests were analyzed using 2-way ANOVA. The results of the study thus far indicate that the grapevine training system chosen for the grapes does have an effect on the nutritional qualities of the grapes. Grapes grown using Modified Munson resulted in greater phenolics, antioxidant potential, and Brix than those grown using Vertical Shoot Positioning. Knowing how the grapevine training system can manipulate the phenolics and antioxidant potential of the grapes can play a role in guaranteeing that grapes in grocery stores maintain the maximum health benefits for consumers, even if it takes time for the fruit to get to their homes.

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| Presenter: | Molly K Hanlon |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Biochemical Analysis of Grapes for Nutritional Quality |
| dviser: | Marta Raquel Martins Lima |

**Mastitis Pathogen Incidence Patterns in Conventional versus Organic Dairy Operations in Northern New England**

Kaylah S Caires[1], David B Needle[1]
[1]Molecular, Cellular, and Biomedical Sciences, UNH Durham
[2]Molecular, Cellular, and Biomedical, UNH Durham

Mastitis, an inflammation disease condition of the mammary glands caused by trauma or infectious agents, is the most common disease affecting dairy cattle (*Bos taurus*) in the United States causing an estimated $400 to 500 million in losses to farmers annually. While worldwide demand for milk is currently decreasing, demand for organic dairy products, produced without the use of antibiotics, pesticides, and synthetic fertilizers, nearly doubled between 2011 and 2018 and is projected to grow another 50% between 2018 and 2024. The New England dairy industry, characterized by small, family-owned farms and an ideal climate for dairy farming, has become a hub of organic dairy farming with Maine, New Hampshire, and Vermont housing over 10% of the country's organic dairy farms. As organic dairy cattle are strictly limited in their ability to receive antibiotics, mastitis is an even greater concern for organic dairy farms. This retrospective study examines the pathogens isolated from 533 mastitis cases from conventional farms and 629 mastitis cases from organic farms submitted to the New Hampshire Veterinary Diagnostic Laboratory between 2008 and 2018 from New Hampshire, Maine, and Vermont dairies. The study aims to analyze the differences between the pathogen incidence patterns for the two farming styles and propose husbandry and veterinary practices to reduce mastitis incidence in both conventional and organic dairy farms.

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| Presenter: | Kaylah S Caires |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Epidemiology of Animal Populations |
| Adviser: | David B Needle |

**The Prevalence of *Cryptosporidium* and *Giardia* Amongst New Hampshire Dairy Calves**

Alexis A Efriamson, Andrew B Conroy
COLSA, UNH Durham

This research was purposefully conducted in hopes to raise awareness amongst dairy farmers and consumers regarding the prevalence of Cryptosporidium (crypto) and Giardia. throughout commercial dairy farms in New Hampshire. The protozoan parasite Cryptosporidium has the potential to be fatal due to its ease of transmissibility; it is a fecal-oral disease meaning that the ubiquity of feces when working with cattle can increase the risk of illness. Giardia is also an enteric protozoan parasite however, in general there is less research to show if it is zoonotic between cows and people. Like Cryptosporidium, Giardia is the most prevalent in calves and can cause the same symptoms in hosts through direct fecal-oral contact.

This study utilized fecal samples taken from pre-weaned calves throughout New Hampshire where they then were tested for the presence of antigens of both protozoan parasites Cryptosporidium and Giardia by using a Fisher ELISA test. Cryptosporidium poses a risk to public health due to the disease's potential to become fatal in immunocompromised victims such as those with HIV/AIDS. A farmer survey was then conducted in order to relate farmer perceptions of related illness to the presence of the disease. After visiting half of New Hampshire commercial dairy farms and 80 samples; 35% of farms tested positive for cryptosporidium. Likewise, 57% of farms tested positive for Giardia. The importance of this research will aid in the understanding of infection, transmission, and prevention of the disease.

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| Presenter: | Alexis A Efriamson |
| Presenter's Major(s): | Equine Studies |
| Year at UNH: | Junior |
| Research Interest: | The Prevalence of cryptosporidium in NH Diary Calves |
| Adviser: | Andrew B Conroy |

**Species Diversity of Methicillin-Resistant Staphylococcus from Domestic and Wildlife Animals**

Jennifer L Mydosh, Cheryl Marie P Andam, John T Ball, David B Needle, Robert E Gibson
Molecular, Cellular, and Biomedical, UNH Durham

In the United States, antibiotic resistance bacteria cause at least 2 million infections and approximately 23,000 deaths annually. Majority of these pathogens originate from animals (called zoonosis) and are transmitted to humans through direct contact or through food, water and environment. One important cause of infection in hospitals and communities worldwide is methicillin-resistant Staphylococcus aureus (MRSA), which can cause serious damage to skin and soft tissue. MRSA in animals has raised concern over their role as potential reservoirs or vectors for human MRSA infection in the community. Other species of Staphylococcus are widespread in animals and are potentially transmissible to humans, although there is limited epidemiological data about them. In this project, we aimed to characterize the prevalence and distribution of different species of methicillin-resistant (MR) and methicillin-susceptible (MS) Staphylococcus isolated from domesticated (pets and livestock) and fur-bearing wild animals. We were mentored by Dr. Cheryl Andam (MCBS Department), in collaboration with Robert Gibson and David Needle from the NH Veterinary Diagnostic Laboratory (NHVDL). We have collected approximately 1,120 *Staphylococcus* isolates sampled from different animal species from 2017-2019. These isolates were obtained from swabs collected from animals which are sent by veterinary practices to NHVDL for diagnostic testing. We extracted the DNA of each isolate and the genomes of some samples were sequenced. MR Staphylococcus in animals are genetically diverse, many of which also harbor genes encoding resistance against other classes of antibiotics. Output from this project will bring important insight on the diversity of Staphylococcus species circulating in New England and the different animal hosts that carry antibiotic resistance genes.

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| Presenter: | Jennifer L Mydosh |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Pathogenic Microbiology |
| Presenter: | John T Ball |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Cheryl Marie P Andam |
| Adviser: | Robert E Gibson |
| Adviser: | David B Needle |

**What Killed Luna? Biomagnification of BMAA and Microcystins as a Possible Cause of Common Loon Death in Province Lake, NH**

James F Haney, Michelle Borley Verstraaten, Alissa N Shea
COLSA, UNH Durham

After years of unsuccessful breeding among the Common Loons of Province Lake, NH, locals were delighted when a single loon chick hatched last summer (July 2019) and affectionately dubbed it Luna. The body of the chick was found 5 weeks later, having died of an unknown cause. To investigate a possible underlying cause, a necropsy was performed on the deceased loon. Biomagnification of cyanotoxins, especially the neurotoxic BMAA or the hepatotoxic microcystins, was postulated as a potential cause for the death of the bird. Cyanobacterial blooms have previously been observed in Province Lake. Cyanotoxin levels were measured in each level of the food web in order to establish whether biomagnification was occurring in the lake. Phytoplankton and zooplankton samples have already been collected and will be analyzed for the presence and concentration of the two cyanotoxins, together with samples of sunfish muscle and liver, and lung and liver from the loon.

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| Presenter: | Alissa N Shea |
| Presenter's Major(s): | Environmental Sciences |
| Year at UNH: | Senior |
| Research Interest: | Ecotoxicology |
| Presenter: | Michelle Borley Verstraaten |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Junior |
| Research Interest: | |
| Adviser: | James F Haney |

**Milk production and methane emissions in Jersey cows grazing forage canola.**

Andre Fonseca De Brito, Cassandra M Collimore
ANFS, UNH Durham

Canola (CAN) herbage is a forage that can be used to extend the fall grazing season. We aimed to evaluate the effect of partially replacing silage with CAN herbage on milk production and methane ($CH_4$) emissions. Twenty Jersey cows were assigned to control (CTRL) or CAN diet in a randomized complete block design. Cows in the CTRL group were kept indoors, while CAN cows stayed indoors during the day and had access to pasture overnight. Diets were formulated to yield 60:40 forage:concentrate ratio with 67% of the silage replaced by CAN. The experiment lasted 7 wk with sample collection done during wk-3 and 5. Data were analyzed with repeated measures in SAS. CAN herbage yield 6,662 kg of dry matter (DM)/ha. Estimated herbage DM intake averaged 7.62 kg/d. Milk yield did not differ between diets. Milk true protein concentration was greater in CAN than CTRL, but milk protein yield was similar between diets. Milk fat yield tended to decrease with feeding CAN. Feeding CTRL raised milk lactose concentration relative to CAN without change in yield. A diet by week interaction was found for milk urea N (MUN), with CTRL cows showing greater MUN in wk-3 than wk-5. No change was observed for CAN. Methane emissions were greater for CTRL (415 g/d) than CAN (295 g/d) cows. Methane intensity (g/kg of energy-corrected milk) was also greater in CTRL vs. CAN cows. CAN herbage can partially replace up to 67% of silage in the diet DM without negative effects on milk yield and reduced $CH_4$ emissions.

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| Presenter: | Cassandra M Collimore |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Dairy Cattle Nutrition |
| Adviser: | Andre Fonseca De Brito |

**Effects of supplemental mycotoxin deactivator on lactation performance of Holstein cows fed natural mixed mycotoxin contaminated feed**

Hannah C Robertson[3], Nancy L Whitehouse[1], Benjamin K Kerns[2]
[1]Agriculture, Nutrition, and Food Systems, UNH Durham
[2]COLSA, UNH Durham
[3]College of Life Science and Agriculture, UNH Durham

Whitehouse, N.L*,[1], H.C. Robertson[1], B.K. Kerns[1]
[1] University of New Hampshire, Durham, NH - USA

Mycotoxin contamination of feed ingredients poses a serious health risk to dairy cows. The objectives of this trial were to determine the effects of a mycotoxin deactivator on lactation performance and plasma leukocyte concentration in dairy cows fed mixed mycotoxin contaminated feed. Molds are fungi that occur often in the complex diets of ruminants, consisting of roughages, concentrates and preserved feeds. Molds can affect dairy cows by producing poisons called mycotoxins, resulting in mycotoxicosis. Mycotoxins can have a negative effect on cows by altering their production, feed intake and overall health parameters. The goal of feeding a mycotoxin called deoxynivalenol is to look further into the health parameters that go along with it and how this specific mycotoxin effects dairy cows. The mycotoxin deactivator used in the study was UNIKE plus, acting as a detoxifier. This product specifically uses modified high adsorbent minerals to overcome the mycotoxins in feedstuffs while also eliminating the toxicity by changing the chemical structures. Twenty-four Holstein cows (147±58 DIM) were used in a replicated randomized block trial for 7 weeks (1 covariate and 6 treatment weeks). Treatments were 1) a negative control diet (**NC**); 2) a positive control diet with mycotoxin exposure from contaminated dried distillers grains (**PC**); and 3) a PC diet plus 30 g/d of mycotoxin deactivator (UNIKE Plus, Adisseo; **UP**). Milk yield and DMI was determined daily, averaged by week. Milk samples were collected on the last 3 days of each week. Blood samples were collected from the coccygeal vein for 3 consecutive days at the end of the covariate week and weeks 3 and 6. Data were analyzed using the MIXED procedure of SAS (v.9.4, 2012) with REPEATED measurements. Significant effects were noted at $P \leq 0.05$. The PC diets increased zearalenone from 290 to 683 µg/kg and deoxynivalenol from 2,013 to 4,772 µg/kg compared to NC diet. Intake decreased for cows fed PC compared to NC, but improved for cows fed UP compared to PC ($P=0.02$), whereas ECM yield was decreased for cows fed PC compared to NC but unaffected for cows fed UP ($P=0.008$). Cows fed PC and UP had elevated SCS compared to NC ($P=0.01$). Leukocytes were unaffected by treatment, but monocytes were elevated for cows fed NC and UP compared to PC ($P \leq 0.05$). Supplementation of UNIKE Plus improved DMI and ECM yield of cows fed natural mixed mycotoxin contaminated feed.

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| Presenter: | Benjamin K Kerns |
| Presenter's Major(s): | Animal Science |
| Year at UNH: | Senior |
| Research Interest: | Dairy Science |
| Presenter: | Hannah C Robertson |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Agriculture, Nutrition, and Food Systems |
| Adviser: | Nancy L Whitehouse |

**SPECIATION OF THE GALÁPAGOS HAGFISH**

Andrew D Sullivan, David C Plachetzki
BMCB, UNH Durham

Hagfish (class Myxini) are a group of jawless fish of a lineage that split from the rest of fishes early in the evolution of vertebrates. Hagfish are found throughout global waters with about 80 species described to science. The GalapaÌ• gos Islands present a site of particular interest in the history of hagfish evolution and speciation due to the unique geology and relative young age of the archipelago. This study aims to understand the phylogenetic relationships among GalaÌ• pagos hagfish using molecular data from specimens collected from the deep water of the GalaÌ• pagos. Mitochondrial â€‹16Sâ€‹ and â€‹CO1â€‹ genes were sequenced and used to construct a phylogeny of hagfish that incorporated the new GalaÌ• pagos specimens. Preliminary molecular clock analysis showed the earliest GalaÌ• pagos hagfish split from multiple lineages concurrently around 20,000 years ago. It is proposed that the ancestral hagfish arrived from around the Pacific Ocean on oceanic currents, with some originating as far away as Indonesia. Additionally, the ancestral hagfish arrived on GalaÌ• pagos islands that have since subducted and have been riding a chain of new islands as they form.

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| Presenter: | Andrew D Sullivan |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Senior |
| Research Interest: | Phylogenetics and Sensory Evolution |
| Adviser: | David C Plachetzki |

**Inhibiting STAT 3 with Atovaquone in Ovarian Cancer**

Sarah R Walker, Kayli E Neil
Molecular, Cellular, and Biomedical Sciences, UNH Durham

Ovarian tumors can arise from inappropriate and uncontrollable growth of either stromal, germ, or epithelial cells. It has recently been found that the inappropriate activation of transcription factor 3 (STAT3) has been linked to the vigorous growth and survival of cancer. Therefore, there is a need to target the uncontrollable activation of STAT3. We have found that Atovaquone inhibits STAT3 by affecting GP130 expression in other tissues. We are further analyzing the mechanism of action by introducing mutants of STAT3 into the ovarian cancer cells to determine if that will rescue cells of Atovaquone treatment. We have also determined that Atovaquone reduces the ability of ovarian cancer cells to promote the first step in metastasis (mesothelial clearance). Based on this data, we believe this may be a useful form of therapy for ovarian cancer.

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| Presenter: | Kayli E Neil |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Ovarian Cancer |
| Adviser: | Sarah R Walker |

**The effect of biomedical bleeding process on the mating habits of the American horseshoe crab, *Limulus polyphemus* in its natural habitat.**

Abigail G Lemmon, Winsor H Watson
COLSA, UNH Durham

The American horseshoe crab, *Limulus polyphemus,* is harvested by the biomedical industry for the purpose of creating *Limulus* amoebocyte lysate; a substance used to sterilize pharmaceutical drugs and medical equipment by detecting any present endotoxins.The impact of bleeding horseshoe crabs on their behavior and mortality rates have been studied previously whereas this study focuses more on the mating behaviors of the American horseshoe crab after being released into its natural habitat. A total of 20 horseshoe crabs were released into Great Bay Estuary, New Hampshire during the Spring of 2019. Acoustic transmitters were used to locate the horseshoe crabs as they traveled along the estuary's muddy floor. The bled horseshoe crabs approached a beach at high tide to mate less often than the control horseshoe crabs throughout the first two weeks after release, with the most evident differences within the first several days of release. Through this data, it can be concluded that there is an impact on the mating behaviors of horseshoe crabs that have been bled by the biomedical industry.

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| Presenter: | Abigail G Lemmon |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Freshman |
| Research Interest: | Marine Invertebrates |
| Adviser: | Winsor H Watson |

**Determining Plasma Methionine Concentrations for Lactating Holsteins Supplemented With 24g/d of Methionine from Smartamine M, AminoShure M, MetiPearl or Timet**

Nancy L Whitehouse[1], Alexis R Blanchard[2], Jenna A Randall[3]
[1]Agriculture, Nutrition, and Food Systems, UNH Durham
[2]Dairy Nutrition, UNH Durham
[3]Dairy nutrition, UNH Durham

The objective was to investigate if, through using total sulfur AA (TSAA) concentrations as a % of total amino acid– sulfur amino acid concentrations, the plasma amino acid dose-response method could statistically differentiate the metabolizable methionine (MET) content in 4 unique methionine supplements in lactating Holstein cows. Ten multiparous Holstein cows (175±59 days in milk) were used in a replicated 5 x 5 Latin square with 7-day experimental periods. The 5 treatments were: 1) a negative control (CON); 2) 24 g/d Met from Smartamine M (SMM); Adisseo; Met bioavailability ≥ 80%); 3) 24 g/d Met from AminoShure-XM (AXM; Balchem); 4) 24 g/d Met from MetiPEARL (MPL; Kemin); and 5) 24 g/d Met from Timet (TMT; Vetagro). Intake and milk yields were collected daily. Blood was collected from the tail vein the last 3 days of the 7day period at 2, 4, 6, and 8 hours after the 0500am feeding. Data was analyzed using the MIXED and REG procedures of SAS. Significance was declared at $P \leq 0.05$. Milk yield (37.1 kg/d) and DMI (25.6 kg/d) were unaffected by the treatments. Plasma Met, cystathionine/allocystathionine, and TSAA concentrations (µM) were increased for cows fed AXM compared to CON and MPL, and further increased for SMM compared to AXM ($P<0.001$). Based on the comparison of dose-response slopes using TSAA expressed as a percentage of TAA-TSAA, AXM, MPL, and TMT were 35.0 (± 4.0), 9.3 (±3.7), and 24.0% (±7.2) as effective as SMM in providing metabolizable Met.

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| Presenter: | Alexis R Blanchard |
| Presenter's Major(s): | Wildlife and Conservation Biology |
| Year at UNH: | Senior |
| Presenter: | Jenna A Randall |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Nancy L Whitehouse |

**Global Examination of the Effects of Methamphetamine on Histone Post-Translational Modifications in the Rat Striatum**

Tyler Elliott Silverwood, Adriana Radosavljevic, Feixia Chu
MCBS, UNH Durham

Methamphetamine (METH) is a highly addictive psychostimulant that has been associated with deleterious physical and social consequences. A variety of factors ranging from life experiences to genetics are believed to play a role in the addiction process. Post-translational modifications (PTMs) on histone proteins can lead to alterations in the organization of nucleosomal arrays and the accessibility of transcriptional factors to DNA as a form of epigenetic regulation. This study investigated the effects of chronic METH self-administration in rats on PTMs of histones H3 and H4 in the striatum using liquid chromatography-mass spectrometry. Chronic METH use induced group downregulation of the following PTMs on histone H3: Lys9 dimethylation with unmodified Ser10 and Thr11 and Lys14 acetylation; Lys18 methylation with Lys23 acetylation; and Lys79 dimethylation with Thr80 phosphorylation. Individual economic demand for METH, measured by the Essential Value, was positively correlated with H3 Lys79 methylation, H3 Lys14 acetylation, H4 Lys5 acetylation, H4 Lys8 acetylation, H4 Lys12 acetylation, and H4 Lys16 acetylation. The significant decrease of H3 Thr80 phosphorylation supports a downregulation of neural progenitor cell proliferation and neurogenesis, which is consistent with previously discovered inhibition of astrocyte and neural progenitor propagation as a result of METH use. Our findings showing correlation between individual demand and the abundance of post-translational modifications offer a novel insight into the epigenetic regulation associated with METH use and further the current understanding of the impact of substance use on epigenome remodeling, while also elucidating potential therapeutic targets for future studies.

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| Presenter: | Adriana Radosavljevic |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Junior |
| Presenter: | Tyler Elliott Silverwood |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Sophomore |
| Adviser: | Feixia Chu |

**Determining Viability of Unmanned Aerial Systems (UAS) to Map Forest Edge Influence in New England Forest Communities**

Vincent G Pagano[2], Russell G Congalton[1]
[1]NREN, UNH Durham
[2]Natural Resources and the Environment, UNH Durham

During the 2019 summer my project was be centered on using unmanned aerial systems (UAS) to detect changes in forest structure and composition and measure depth of edge influence (DEI) through remote sensing. The goal of the research was threefold; to determine if UAS imagery can be used to investigate forest edge, to evaluate methods for generating accurate maps of forest composition using UAS, and to optimize UAS image collection to accurately estimate forest structure. The research was completed in different areas on and near campus including several UNH woodlots and the Blue Hills Conservation Areas. The hope was to further evaluate the viability of using UAS to measure DEI and no longer have to do time exhaustive and expensive field work to measure DEI, which is affected by many variables.

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| Presenter: | Vincent G Pagano |
| Presenter's Major(s): | Environmental Conservation and Sustainability |
| Year at UNH: | Senior |
| Research Interest: | Offshore Wind Viability |
| Adviser: | Russell G Congalton |

**How Group Work Impacts Students' Quantitative Biology Self-Efficacy**

Alexander R Kulacki, Ciara R McCarter, Melissa L Aikens, Jacqueline A Klombers
Biological Sciences, UNH Durham

Quantitative biology is becoming increasingly important, but students often struggle to engage with math in biology. Research suggests that lack of engagement and performance is linked to low confidence, or self-efficacy. Working in groups may increase students' self-efficacy and engagement, but little is known about what students actually experience during group work. This study explores how group work experiences relate to students' self-efficacy. We surveyed two sections of introductory biology where students worked in small groups to complete quantitative biology tasks. Students were asked to report their confidence level before and after two different tasks, as well as describe their experiences during the group work which increased or decreased that confidence. We then qualitatively coded each response to find categories of experiences and evaluated students' change in self-efficacy. Preliminary analyses show that most students (~52%) increased their self-efficacy. The most common reasons for that increase were checking answers with group members (~45%) and guiding each other through problems (~35%), while decreased confidence was often related to feeling anxiety towards the task (~30%) and a lack of group consensus (~25%). Future analyses will examine differences between male and female students. This study will give educators insight into structuring their courses to improve student engagement.

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| Presenter: | Ciara R McCarter |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Presenter: | Jacqueline A Klombers |
| Presenter's Major(s): | Biology |
| Year at UNH: | Junior |
| Adviser: | Melissa L Aikens |
| Adviser: | Alexander R Kulacki |

**The Impact of Atlantic Butterfish (*Peprilus triacanthus*) in the Diet of Common Tern Chicks (*Sterna hirundo*) in the Gulf of Maine**

Olivia A Smith, Gregg E Moore[1], Elizabeth C Craig[2]
[1]MEFB, UNH Durham
[2]Shoals Marine Lab, UNH Durham

Warming in the Gulf of Maine is causing warm-water fishes, such as the Atlantic butterfish (*Peprilus triacanthus*), to expand their range into northern habitats. This is changing the relative proportions of these fish in the diets of common terns (*Sterna hirundo*), which are foraging birds in the Gulf of Maine. This study examines common tern chicks and their diets on Seavey Island, NH.

We compared the handling time, feeding success, growth rates, and productivity during 2018 and 2019. The nest, chick, parent, handling time, and prey involved in failed and successful feedings were recorded. Weight and survival were monitored during the time periods that observations were being recorded and were later used to calculate growth rates (increase in grams per day) and productivity (chick survival).

The two years in this study differed in the relative proportion of butterfish in the chick's diets, with a 10-fold decrease in proportion of butterfish in 2019 from 2018. We found that handling time varied significantly among prey species ($F_{3,296}$=164.2, $p<0.001$). Butterfish had significantly longer handling time and was the prey item most commonly involved in failed feedings when compared with other prey categories. These results are due to the deep-bodied morphology of the fish.The year with fewer butter fish was significantly more productive ($t(114)=3.2$, $p<0.01$) and had significantly greater growth rates ($t(82.6)=3.0$, $p<0.01$).

It is not known whether common terns are selective, but they are feeding butterfish to their chicks despite the prey being difficult to consume. These birds have not exhibited adaptive behavior in foraging in response to warming in the Gulf of Maine, suggesting that they are particularly at risk of climate-induced changes.

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| Presenter: | Olivia A Smith |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Sophomore |
| Adviser: | Elizabeth C Craig |
| Adviser: | Gregg E Moore |

**Two Hearts Beating as One? Testing for Covariation in Horse-Rider Cardiac Rhythms**

Grace Griffin, Daniel R Howard

URC Abstract – Grace Griffin

Horses, *Equus caballus*, and humans have had a close working relationship for thousands of years (Kavar and DovÄ• , 2008). The only form of interspecies communication between humans and horses is through body language and expression, making horses extremely skilled at noticing subtle changes in both (Brand, 2005). Due to adaptations to the herd lifestyle, horses are able to detect the heart rates of nearby conspecifics and induce their flight response when necessary (Thaisen, 2015). Research on heartrate variability indicates that horses can synchronize their heartbeat with that of a human's, although no studies have tested this directly (Thaisen, 2015). The present study hypothesized that the horse's and human's heartrates will synchronize in activities of close contact such as riding. I used a Hylofit Heartrate System to simultaneously measure the heart rates of multiple horse and rider pairs throughout a ride. We found a non-linear covariance between horse-rider hear rates, with a $3^{rd}$ degree polynomial model fit ($P < 0.001$, $R^2 = 0.71$). In general, horse-rider heart rates enter a state of tight linear fit during the rising heart rate phase of interactions (rider between 80-130 bpm, horse = 56-91 bpm), with variability within individual horse and riders, and between horse-rider pairs. Understanding the mechanisms underlying heart rate synchronicity between a horse and rider has implications for advancing sustainable practices in equine therapy.

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| Presenter: | Grace Griffin |
| Presenter's Major(s): | Psychology |
| Year at UNH: | Junior |
| Adviser: | Daniel R Howard |

**Diagnostic Findings in 300 Free-Ranging and Zoo-Housed North American Porcupines(Erethizon dorsatum) from US Northern Border States and Canada, 2000-2019**

Kaylah S Caires[1], David B Needle[1]
[1]Molecular, Cellular, and Biomedical Sciences, UNH Durham
[2]Molecular, Cellular, and Biomedical, UNH Durham

Erethizon dorsatum, the North American Porcupine (NAP), is the second largest rodent on the continent. Due to being adaptable, the NAP range extends from Mexico to northern Canada and Alaska, however, the principle range is the band of forested land stretching across the continent extending south and north of the US-Canadian border. While NAPsare so commonthroughout this principle rangethat some human inhabitants consider the animal a pest species, there is limited data regarding population-wide diagnostic results and disease prevalence. This retrospective study will coalesce diagnostic findings in the 20-year period of 2000-2019 in NAP fromdiagnostic laboratories instates along the northern US border, and throughout Canada. In totalfree-ranging animals from ten states (NH, VT, ME, MA, PA, NY, WA, OR, MI, MN) and 7 provinces (QC, NB, PE, NS, NL, ON, SK)are included. No cases were identified in the archives of the US states of WI, MT, ID, and ND. In addition to free-ranging animals, animals from 34 zoological collectionsare also represented. Diagnostic data include results of cytology, biopsy, bacterialculture, fungal culture, serology, and full postmortem examinations.Comparisons between free-ranging and captive populations withinand across regions will be presented.

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| Presenter: | Kaylah S Caires |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Epidemiology of Animal Populations |
| Adviser: | David B Needle |

**The Effects of White-Nose Syndrome on Bat Wing Microbiome**

Matthew D MacManes, Alexa Rose DeMember

White-nose syndrome is a fungal disease that has devastated bat populations in the U.S., starting in the northeast and spreading west. The fungus, *Pseudogymnoascus destructans*, begins growing on bats during hibernation and depletes their nutrients stores, forcing them to arouse early. The fungus damages the bats wings, noticeably affecting the tissue. Little is known, however, about how the fungus affects the microbiome on the bats' wings and vice versa. Using swabs of affected wings, my research quantifies the amount of fungus growing and the number of bacterial species present at different stages of infection. These data establish a relationship between the host microbiome and the pathogen to give a better understanding of how and why white-nose syndrome has been able to so deeply affect bat populations across the country.

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| Presenter: | Alexa Rose DeMember |
| Presenter's Major(s): | Genetics |
| Year at UNH: | Senior |
| Adviser: | Matthew D MacManes |

**The Role of STAT3 in Ovarian Cancer Sphere Formers**

Jason D Lam, Sarah R Walker

Ovarian cancer is a type of cancer that begins in the ovaries. This type of cancer often goes undetected until it has spread to the pelvis and the abdomen. The OVCAR8 and HeyA8 ovarian cancer cell lines are known to form clusters of cells resulting in spheroids that are similar to spheroids that are found in different locations than the tumor sites in patients. With these particular cell lines, studies have shown that the STAT3 pathway is activated in cells grown in clusters. Therefore, STAT3 may promote sphere formation. With this in mind, this research project is aimed to understand if and how STAT3 plays a role in the formation of spheres within ovarian cancer cell lines. The EFO21 cell line is currently being used as the basis of the project due to their non-sphere forming characteristics in 3D culture. To test the role of STAT3 in promoting sphere formation, we transfected EFO21 cells with different genes that are involved in STAT3. So far, the BCL6, STAT3, CA-STAT3, FAK and SLUG plasmids have been tested. These plasmids have been selected due to their known roles with the STAT3 pathway. First, the BCL6 gene was transfected due to its known involvement in 3D growth and its role it plays in metastasis. Next, the STAT3 gene was used for transfection since the main question is to see the role it plays in the formation of spheres. The CA-STAT3 gene is an engineered version of the STAT3 gene where it is constitutively active which in theory will allow for easier dimerization. This was tested and compared to the STAT3 gene. The FAK or focal adhesion kinases were then transfected due to the interactions between transmembrane proteins and other proteins surrounding the cell. Lastly, SLUG is a transcription factor that is known to promote metastasis. Sphere formation was measured by imaging cells grown in 3D plates after transfection. So far, each plasmid transfection has resulted in a slighty better sphere formation when compared to a GFP control. Future experiments will entail the transfection of a combination of plasmids, since there is a greater chance that the sphere formation of the ovarian cancer cells is due to multiple genes and proteins.

Presenter: Jason D Lam

Presenter's Major(s): Bioengineering

Year at UNH: Senior

Adviser: Sarah R Walker

**Social Media Engagement and Psychological Well-Being in Students at University of New Hampshire**

Kevin J. Pietro, Emily G D'Antonio

Social media use has increased substantially in recent years, and for the college-aged population, it is often the leading method of communication. Research indicates reliance on digital connections could have a negative impact on health. The college years are a time of personal growth and defining actions, but can be burdened by mental health issues. Acknowledging this, the current study explores how college students' frequency and intentionality on social media is related to their psychological well-being. An online survey was administered, aiming to quantify student's social media behavior, as well as the validated *Brief Inventory of Thriving Scale (BIT)*. Participants (n=177) of varying majors (69.5% upperclassmen) indicated spending the most amount of time using Snapchat (2.77 avg. hr./day) and Instagram (2.26 avg. hr./day). Participants (42.9%) expressed editing some to all of their content before posting, and 73.5% indicated checking social media right before going to bed. A Spearman's rank-order correlation did not identify any significant relationships between the number of hours spent using Instagram or Snapchat and any items of the BIT. Additionally, there was a weak, negative correlation between checking social media both when waking up ($r=-0.263$, $p<0.001$) and before going to bed ($r=-0.247$, $p=0.001$), and the BIT item "*my life has a clear sense of purpose".* Therefore, social media intentionality may have a greater impact on psychological well-being than frequency.

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| Presenter: | Emily G D'Antonio |
| Presenter's Major(s): | Nutrition |
| Year at UNH: | Senior |
| Research Interest: | Social Media and Psychological Well-Being |
| Adviser: | Kevin J. Pietro |

**The Effects of Grafting Melon Crops to Interspecific Squash Rootstocks**

Caterina Carolyn Roman, J Brent Loy
ANFS, UNH Durham

Farmers in New England have had very limited success growing melon crops for many reasons; soil pathogens and the cooler temperatures of Northeast growing conditions are the biggest of these barriers. Numerous Asian countries, however have been using grafting techniques for many years to fix these issues but it has yet to be adopted by American farmers.Three varieties of cantaloupe: True Love, Sugar Rush and Sugar Cube, were tested in a randomized block field, comparing both ungrafted plants and grafted plants using an interspecific hybrid squash rootstock for differences in vegetative growth, fruit yield and soluble sugar levels. By grafting the melon plants to squash rootstock, the overall yield and average fruit size for all varieties increased. The vegetative growth of the grafted plants was also accelerated in all grafted plants. Grafting of melon crops to interspecific rootstocks offers a solution for New England farmers to be able to grow this crop without additional inputs.

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| Presenter: | Caterina Carolyn Roman |
| Presenter's Major(s): | Sustainable Agriculture and Food Systems |
| Year at UNH: | Sophomore |
| Research Interest: | Melon grafting- Weeks Day Fellowship |
| Adviser: | J Brent Loy |

**Species-specific Patterns of Antibacterial Resistance and Genomic Diversity among Cryptic *Escherichia* Species**

Cheryl Marie P Andam, Thomas S Farrar

*Escherichia coli* is an essential model organism in the world of bacterial research and has thus been studied extensively over the years. The genus of *Escherichia*, however, includes a myriad of species that have been researched relatively little, despite growing evidence that suggests pathogenic capabilities in humans and animals. Using a total of 99 publicly available genomes from three *Escherichia* species (*E. albertii*, *E. fergusonii*, and *E. marmotae*), we strove to characterize the genomic content of each species and identify unique genes that are responsible for their pathogenic and antibiotic-resistant behavior. Through a series of computational analyses, we determined significant assemblies of unique genes (termed 'pan-genomes') in all three species, each primarily consisting of genes exclusive to only several individuals. Furthermore, we identified a wide array of pathogenicity and antibiotic-resistance genes in the members of each species. The presence of such variety in genomic profiles of an extremely small number of representatives suggests substantial diversity that is awaiting to be uncovered. The discovery of these pathogenicity and resistance traits indicates that these species may affect the health of humans and animals, further warranting greater exploration of the genetic diversity in the *Escherichia* genus.

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| Presenter: | Thomas S Farrar |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Cheryl Marie P Andam |

**Selection on Pollinator Efficiency and Attractiveness Traits in *Impatiens capensis***

Sarah K Lunn, Melissa L Aikens
Biological Sciences, UNH Durham

Pollinator-mediated selection can drive the evolution of plant traits. In particular, pollinators may select for plant traits that increase attraction of the pollinator to the flower (attractiveness traits) and traits that enhance the mechanical fit of the pollinator and the flower to increase the efficiency of pollination (efficiency traits). This study uses the species *Impatiens capensis*, a bumblebee pollinated plant, to examine selection on both attractiveness traits and efficiency traits. We measured two flowers from 114 unique plants in a population located in College Woods along three 10 meter transects. The attractiveness traits measured were plant height, corolla width, and corolla height; the efficiency traits measured were corolla tube width and depth. We measured plant fitness as the number of seeds each flower produced. We will use regression analyses to assess the relationship of the measured traits with fitness. We hypothesize that there will be directional selection on attractiveness traits for larger flower size and taller plants and stabilizing selection on efficiency traits of the corolla due to mechanical fit of pollinators. The results of this study will aid in further understanding the extent to which pollinators affect the evolution of plant traits, particularly floral traits, through pollinator-mediated selection.

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| Presenter: | Sarah K Lunn |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Research Interest: | Plant Evolutionary Biology |
| Adviser: | Melissa L Aikens |

**Optimizing the Feeding Protocol for Hydra**

Jennifer E Halloran[2], David C Plachetzki[1]
[1]BMCB, UNH Durham
[2]Genetics , UNH Durham

The cnidarian organism, hydra, is a model organism that provides insight into reproduction and the relationship between embryogenesis and the environment. When in a food rich environment, hydra preferentially clone themselves and reproduce through asexual budding. Hydra may also reproduce sexually, producing gametes (eggs and sperm) when starved or in low concentrations of food. The established protocol of keeping hydra is to feed them artemia and change their media every day, which allows for rapid growth of hydra through asexual reproduction. However, hydra is also a focus of transgenics research which requires eggs for micro injections. The goal of this project is to determine the optimal amount of food to feed female hydra for sexual egg production without starvation. The female hydra was divided up into two groups of ten, where group one was fed every other day and group two was fed every four days for about four weeks. The results of this experiment will be to determine the best protocol for sexual egg production to be used for further genome editing.

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| Presenter: | Jennifer E Halloran |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Senior |
| Adviser: | David C Plachetzki |

**“C1ORF150”: A Novel Regulator of JAK2 Kinase, and Candidate Tumor Suppressor in Human Blood Cell Progenitors**

Don M Wojchowski, Tyler M Wade
MCBS, UNH Durham

Erythropoietin (EPO) is an essential growth factor for red blood cell (RBC) production. In response to anemia, hypoxia-sensing cells in the kidney express and release EPO. EPO then acts in bone marrow to drive RBC formation from erythroid progenitors. Upon binding to its cell surface receptor, EPO triggers a JAK2 kinase signaling cascade for progenitor cell growth. Our lab has discovered a novel regulator of JAK2, “C1ORF150” (“150”). “150” is conserved in H sapiens and primates, and is a new orthologue of the B-cell receptor adaptor protein and tumor marker, HGAL. Using a shRNA knockdown approach, I investigated the actions of “150” in both a UT7epo-E cell line model, and in primary human hematopoietic progenitor cells. I first used a clonal colony forming assay approach and discovered that the knockdown of “150” increased the proliferation of erythroid colonies without affecting the development of non-erythroid myeloid cells. Using cell fractionation and Western blot approaches, I further observed that the knockdown of 150 markedly escalates the activation of not only ERK1/2, AKT and STAT5 but also JAK2. Activated, phosphorylated JAK2 (p-JAK2) also aberrantly relocalizes to the cytoplasm. “150” therefore plays roles in compartmentalizing and anchoring JAK2 signaling at the plasma membrane. In conclusion, I have discovered that “150” functions as a new governor of JAK2 activation, and importantly prevents the over-expansion of hematopoietic progenitor cells.

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| Presenter: | Tyler M Wade |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Adviser: | Don M Wojchowski |

**Evaluating the potential of Chitosan for suppression of Gray mold caused by *B. cinerea* on floriculture crops**

Ryan M Spelman, Anissa M Poleatewich
ANFS, UNH Durham

*Botrytis cinerea* is an important plant pathogen of floriculture crops, causing significant losses during production, shipping and retail. While cultural practices to reduce leaf wetness and relative humidity are somewhat effective in preventing the disease, growers often rely on foliar application of fungicides. Because ornamental crops are sold for their aesthetic value, repeated applications of synthetic fungicides are needed to maintain high product quality. *B. cinerea* resistance to several fungicide classes has been recorded in greenhouses throughout North America and Europe. This concern has led to an increased need for alternative products which are sustainable, non-toxic, and less susceptible to pathogen resistance. One alternative is chitosan, a natural β-(1,4)-glucosamine polymer found in crustacean shells and fungal cell walls. Chitosan has been shown to promote plant growth and have some fungicidal activity due to interference with fungal cell wall permeability. The objective of this research was to determine the effect of foliar application of chitosan on gray mold disease severity and identify ideal application rates which do not cause phytotoxicity. The ability of several *B. cinerea* isolates to cause disease in untreated plants was also evaluated. The results of this research will be used to generate recommendations to growers on the efficacy and proper application of chitosan for the control of *B. cinerea* in floriculture production.

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| Presenter: | Ryan M Spelman |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Research Interest: | Plant Pathology |
| Adviser: | Anissa M Poleatewich |

**Differentiation of 3t3-L1 cells into Adipocytes and the Associated Histone Modifications Analysed via Mass Spectrometry**

Feixia Chu, Fern E Schrader
MCBS, UNH Durham

Histone proteins play an integral role in transcriptional control and epigenetic regulation. Among this regulation, is the function of differentiation. Differentiation of preadipocytes from the 3t3-L1 cell line a mouse line into adipocytes has been researched; however, this study researched the specific modifications to the histone proteins surrounding DNA before and after the differentiation into Adipocytes. The histone modifications were analyzed via Mass Spectrometry, allowing in-depth analysis and quantification. Previous research in the Chu Laboratory observed acetylation and dimethylation on H3, specifically, H3K14 acetylation, H3K18/K23, and H3K79 dimethylation. Acetylation was also observed on H4, with H4K16 and K12 acetylation. Further work will continue to replicate and add to the modifications list. Research to add to the results of these previous studies are ongoing and will seek to replicate previous findings, specifically the H3K14, K18/K23 acetylation, and H3K79 demethylation, as well as the H4K16 and H4K12 acetylation.

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| Presenter: | Fern E Schrader |
| Presenter's Major(s): | Biochemistry, Molecular and Cellular Biology |
| Year at UNH: | Senior |
| Research Interest: | Histone Modifications and Mass Spectrometry |
| Adviser: | Feixia Chu |

**Impacts of Inappropriate Human Possession of Wildlife on the Animal's Well-being**

Anika A Frink, Janet L Anderson

Humans have a tremendous impact on the wildlife around them. One such interaction is inappropriate human possession (IHP). IHP is when an unlicensed person tries to rehabilitate an animal on their own or attempts to keep a wild animal as a pet, often an orphaned juvenile animal. Although anecdotal evidence suggests negative repercussions on the well-being and potential release of clinically healthy small mammals, there has not yet been research to quantify the effects of IHP on rehabilitation. The goal of this study is to determine if IHP has an impact on release success rate by comparing the duration of stay at rehabilitation facilities of animals who were inappropriately handled versus those who were not. The prediction is that wildlife affected by IHP will have longer care duration and a lower likelihood of release. Data will be obtained from WILD-ONe, the Wildlife Incident Log/Database and Online Network. This database, maintained by Virginia Wildlife center, contains over 500,000 cases from over 100 organizations in 5 countries from 2011-2018. Focusing specifically on the ~20,000 cases where IHP is the primary rescue circumstance, the length of stay and final disposition of small mammals will be compared to other non-IHP cases. This study, and others of its kind, are important to wildlife rehabilitators as a public educational tool. Many individuals with good intentions could be informed on the unintended impacts they may have on wildlife.

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| Presenter: | Anika A Frink |
| Presenter's Major(s): | Zoology |
| Year at UNH: | Senior |
| Adviser: | Janet L Anderson |

**Microbiology Culture Results from 156 Sheep & 204 Goats at the NHDVL from 2012-2019**

David B Needle[1], Devyn K Enwright[2]
[1]Molecular, Cellular, and Biomedical, UNH Durham
[2]NHDVL, UNH Durham

A retrospective study of the culture results from sheep and goat submissions to the New Hampshire Veterinary Diagnostic Lab from 2012 to 2019. Final diagnoses including all isolated species detected in each case were compiled and analyzed. Overall prevalence of the tests results during the eight-year period of the study as well as change in prevalence over time will be presented. The most common pathogens isolated included Staphylococcus species, Escherichia coli, and Mannheimia haemolytica. This data is used to assess historical disease predilections in these two important agricultural species, and to ascertain any emerging patterns of pathogens in the region. This is the first such species-wide retrospective analysis of cultures done with NHVDL diagnostic data and will serve as a blueprint for similar studies in other agricultural, companion, wild, and laboratory animal species. This information will be useful to the NHVDL, the NH Department of Agriculture, Markets and Foods, and to veterinary practitioners in NH and New England.

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| Presenter: | Devyn K Enwright |
| Presenter's Major(s): | Biomedical Science |
| Year at UNH: | Senior |
| Research Interest: | Retrospective study on Goats and Sheep |
| Adviser: | David B Needle |

**The Tolerance of Sublegal Florida Stone Crabs (*Menippe mercenaria*) During Prolonged Exposure to Hypoxia and Red Tide (*Karenia brevis*)**

Mary K Munley[1], Philip Gravinese[2]
[1]Department of Biological Science, UNH Durham
[2]Fisheries Ecology and Enhancement Program, Mote Marine Laboratory

The dinoflagellate *Karenia brevis* is responsible for the harmful algal bloom (HAB) known as red tide, which frequently occurs along Florida's gulf coast. Florida's southwest coast has experienced repeated and prolonged red tide blooms since 2011 with the most recent bloom lasting 17 months resulting in hypoxic and anoxic events. We therefore determined the tolerance of sublegal stone crabs to *K. brevis* and hypoxia as singular and simultaneous stressors. Crabs were randomly assigned to one of six treatments that included: 1) high concentration of toxic *K. brevis* (> 1 million cells per $L^{-1}$) maintained at normoxic levels, 2) moderate hypoxia (1.6 mg $L^{-1}$ ± 0.43 dissolved oxygen) with no *K. brevis*, 3) moderate hypoxia with a high concentration of *K. brevis*, 4) severe hypoxia with no *K. brevis* (0.69 mg $L^{-1}$ ± 0.36 dissolved oxygen), 5) severe hypoxia and with a high concentration of *K. brevis*, and 6) a normoxic control with no *K. brevis*. Survival and lethargy were monitored every 10–12 hs for six days. Crabs in the *K. brevis* plus severe hypoxia treatment experienced an 82% increase in lethargy by day three and exhibited a 43% decrease in survival within 24 hs. The increase in lethargy during hypoxia indicates that nearshore populations of stone crabs are unlikely to emigrate away from such conditions suggesting that future harvests may be reduced following prolonged red tide and hypoxia events.

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| Presenter: | Mary K Munley |
| Presenter's Major(s): | Marine, Estuarine and Freshwater Biology |
| Year at UNH: | Junior |
| Research Interest: | Fisheries |
| Adviser: | Philip Gravinese |

**Spatial and Temporal Feeding of juvenile alewife (*Alosa pseudoharangus*)**

James F Haney, Ryan A Landon, Nancy Leland

Cyanobacteria blooms are producers of harmful cyanotoxins that are exposed to humans through aerosolization and bioaccumulation of the toxins in aquatic food webs. A study of Lower Mill Pond, Brewster Massachusetts, was conducted to determine the feeding strategy of juvenile alewife (*Alosa pseudoharangus*),[HJ1] [RL2] [RL3] to see how it contributes to bioaccumulation and biomagnification of cyanobacteria liver toxin Microcystis and the neurotoxin BMAA. The community composition of zooplankton within the pond was investigated and most of the zooplankton had disappeared from the system which raised questions as to what juvenile alewife were eating in the absence of their preferred food source. A length weight regression was created to analyze fish condition and the fish were determined to be healthy. High levels of phycoerythrin and phycocyanin were found in the gut contents and the ELISA showed high levels of microcystins and BMAA suggesting that fluorometry could be used to predict toxin concentrations. The high levels of cyanotoxins were not observed in the whole lake water sample implying that the fish might be feeding in the sediments, a known source for cyanotoxins. Concentrations of BMAA and microcystins were measured in the sediments. A stable Isotope analysis was then conducted for δ15N to confirm a switch in feeding strategy from secondary to primary consumer within juvenile alewife. A stable isotope analysis for δ13C was conducted to determine whether the juvenile alewife feeding was linked to organisms in the benthic, littoral or pelagic zone.

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| Presenter: | Ryan A Landon |
| Presenter's Major(s): | Biology |
| Year at UNH: | Senior |
| Adviser: | James F Haney |
| Adviser: | Nancy Leland |

**The Effect of Stress on Individual Demand for Alcohol**

Ian S Gliser[1], Sergios Charntikov[1], Victoria M Madore
[1]Psychology , UNH Durham
[2]Psychology, UNH Durham

Alcohol use disorder accounts for a significant amount of deaths in the United States each year, and has detrimental effects on overall health. Despite the significant amount of research which investigates alcohol use disorder (AUD) there is no account which seeks to describe the nature of the individual differences in propensity for stress and vulnerability, and how this may manifest as a co-morbid relationship with alcohol. Current preclinical studies tend to extrapolate data from averages over a population, but this yields poor significance in clinical application, considering the goal is treatment of the individual. In order to study individual differences, rat subjects went through a battery of behavioral tests which seek to investigate differences of anxiety and vulnerability. Through the use of individual differences, the concurrent relationship of stress and alcohol was examined upon the level of the individual. Current analysis of preliminary results indicate biological factors may underlie the variation in individual demand for ethanol. Furthermore, the initial data is suggestive of a potential relationship between propensity for stress and alcohol consumption.

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| Presenter: | Ian S Gliser |
| Presenter's Major(s): | Neuroscience and Behavior |
| Year at UNH: | Junior |
| Research Interest: | Behavioral Neuroscience |
| Presenter: | Victoria M Madore |
| Presenter's Major(s): | Neuroscience and Behavior |
| Year at UNH: | Junior |
| Adviser: | Sergios Charntikov |

**Determining Plasma Lysine Concentrations for Lactating Holsteins Supplemented with 60 g/d of Lysine From a RP-Lys Prototype Using the In Vivo Plasma Dose-Response Method**

Nancy Whitehouse; Natalie Roth

The objective was to determine the rumen bioavailability of a rumen protected lysine supplement, Nutripass-L, using the plasma amino acid dose response method. Bioavailability estimates are calculated by dividing the slope of the regression line relating changes in plasma lysine concentrations from feeding a rumen protected lysine supplement by the slope of the regression line obtained by continuous abomasal infusion of lysine. Six multiparous Lactating Holstein cows equipped with ruminal cannulas were used. The study was designed as a replicated 3 x 3 Latin square with 7-d experimental periods. Treatments were 1) 0 g/d AA and 4L infusion of water, 2)60 g/d of abomasal infused lysine (75 g/d infused Lys-HCL), and 3). 60 g/d of fed Lys from RP-Lys (147.1 g/d Nutripass-L).. Intake and milk yields were collected daily. Blood was collected from the tail vein the last 3 days of the 7day period at 2, 4, 6, and 8 hours after the 0500am feeding. Milk samples were collected the last 3 days of 7day period. T Data was analyzed using the MIXED and REG procedures of SAS. Significance was declared at $P \leq 0.05$. Milk yield (35.2 kg/d) and DMI (24.2 kg/d) were unaffected by the treatments. Plasma Lys increased for infusion and Nutripass-L compared to control. Calculated lysine bioavailability was 35.1%.

Presenter: Natalie Roth

Presenter's Major(s): Animal Science: Dairy Management

Year at UNH: Junior

Adviser: Nancy Whitehouse

**How Do Field Size, Shape and Openness Influence Bobolink Distribution Among Fields in Southeastern New Hampshire**

Matthew Tarr, Samantha Allen

Bobolinks are grassland-obligate birds in decline from habitat loss associated with changes in landscape management over the last 75 years. Bobolinks require large fields where they nest on the ground under tall grasses that have not been hayed or grazed. Farmers that delay haying their fields until after bobolinks complete their nesting are eligible to receive payment from the Natural Resources Conservation Science (NRCS), but postponing agricultural practices on fields unsuitable for bobolinks is an ineffective conservation practice that creates unnecessary burdens for farmers. Bobolinks have specific requirements for field size, shape, and perceived openness that determine what fields are suitable for conserving as bobolink habitat. These field requirements have been determine largely from studies conducted in Midwestern and northern Vermont landscapes dominated by agricultural habitat; results from these regions may not be applicable to regions such as southern New Hampshire where fields are embedded in a landscape dominated by mature forest and suburbia. My study will be the first to assess how field size, shape, and openness influence bobolink habitat selection in southern NH, My results will be shared with NRCS to help guide effective bobolink conservation and allocation of limited resources to compensate farmers interested in conserving bobolinks.

Presenter: Samantha Allen

Presenter's Major(s): Wildlife and Conservation Biology; Forestry

Year at UNH: Senior

Adviser: Matthew Tarr