

ABSTRACTS FOR

ORAL PRESENTATIONS

(in order of presentation)

THE EFFECT OF pH ON THE CHARGE OF MONOCLONAL ANTIBODIES

Kadina Mazic, Dana Filoti, Thomas Laue, and Carrie May
Department of Molecular, Cellular, & Biomedical Sciences, UNH

Monoclonal antibodies (mAb) can be produced to bind to almost any substance. This unique specificity makes mAb essential therapeutics in the treatment of many types of cancers and autoimmune disorders. In the purification process of mAb therapeutics a wide pH range is utilized in order to ensure efficacy. To better understand the effect of pH on the colloidal properties of the mAb, a titration study was conducted for 3 monoclonal antibodies, mAb A, B, C with emphasis on pH 3, 6, and 9. The electrophoretic mobility was measured by both membrane confined electrophoresis (The Spin Analytical MCE™) and phase analysis light scattering (Wyatt Möbiuz) which determined the effective charge and Debye-Henry Huckel charge. The sedimentation coefficient, molecular weight, and buoyant molecular weight were measured via analytical ultracentrifugation (Beckman Analytical Ultracentrifuge) and used to calculate the Stokes radius. The results differed for each mAb though there was a consistent pattern at pH 3 as both the effective charge and Stokes radius increased while the Debye-Henry Huckel charge decreased.

**THE EFFECTS OF GOLD AND SILICA NANOPARTICLES ON HORIZONTAL GENE
TRANSFER IN *ESCHERICHIA COLI***

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Currently nanoparticle research has been under specific investigation for its ability to be a drug carrier for cancer therapy. Nanoparticles, having dimensions of at least one or less than one hundred nanometers, have exhibited many properties much like biological molecules, thus have interested those to further test the dangers of using them. Although there are many benefits to the use of nanoparticles, the environmental and biological impacts are not fully understood. This area sparked our undergraduate research to help understand more about the effects nanoparticles can have on DNA transfer into bacteria and into plants. We are testing the hypothesis that nanoparticles could facilitate the transfer of DNA into bacteria and between bacteria, thus increasing the possibility of exchange of antibiotic resistance genes among bacteria. This could pose a problem at places like hospitals for the production of bacteria that are resistant to multiple antibiotics. We are using *Escherichia coli* and a plasmid, pGLO to study the effects of gold and silica nanoparticles. Our first challenge is to develop a reliable protocol for gene transfer using heat shock and electroporation to introduce DNA into bacteria. The different methods of gene transfer will be quantitatively measured by the presence of green fluoresce protein to mark the cells that have been transformed. The results would indicate either the safety or potential problems with the abundant use of nanoparticles in human health.

**CHARACTERIZATION OF THE SRS-1 AND SRS-2 ROOT-SKEWING MUTANTS OF
*ARABIDOPSIS THALIANA***

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Department of Molecular, Cellular, & Biomedical Sciences, UNH

This project focuses on cell signaling in *Arabidopsis thaliana* and the role of the enzyme Protein Phosphatase 2A (PP2A) in root growth and elongation. PP2A is a heterotrimer composed of A, B and C subunits. Mutations have been identified in A and C subunit genes that cause a root growth defect when plants are grown on sodium-supplemented medium. The purpose of this project is to identify and characterize additional mutants that have this novel root skewing response to salt stress. Finding other mutants will enable us to better understand the process of root growth and salt stress response. A three-part screen was conducted and, to date, two sodium-induced root skewing (srs) mutants have been confirmed. TAIL-PCR indicated that the mutation in srs-1 was likely located in the region between genes At1g60890 encoding phosphatidylinositol-4-phosphate 5-kinase and At1g60900 encoding U2 snRNP auxiliary factor. The mutation in srs-2 is near At1g75100, encoding a J-domain protein required for the chloroplast accumulation response 1 (JAC1). To determine the mode of inheritance, srs-1 and srs-2 mutants were crossed to wild type and the F1 generation indicated that both mutations are recessive. This will be confirmed by analyzing the segregation ratios in the F2 generation. Because the mutation sites are not within the coding region of a gene, assessment of which gene or genes are impacted by the mutation will be accomplished by analyzing transcript production using real-time PCR.

MEMORY CODING PROPERTIES OF CENTRAL THALAMIC NEURONS: RELATIONSHIP TO PREFRONTAL NEURONAL CODING

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Thalamus is a brain region which relays sensory information to the cerebral cortex via reciprocal connections. Lesions to medial thalamus have been associated with amnesia, as well as spatial working memory deficits comparable to medial prefrontal cortex (mPFC) lesions. Data was collected from tetrode arrays implanted in mPFC and medial thalamus of the rat during a delayed non-matching to position task with a variable start position. Results from both regions suggest that cells are arranged in populations that belong to discrete categories concerned with either action planning or action outcome. Action planning cells are active during phases of the trial leading up to the choice response; whereas action outcome cells are active during the reward period. Preliminary place analyses of video tracking data collected alongside cellular recording supports the major findings. Periods of high cell activity correspond meaningfully to the physical locations where animals were most active. Previous evidence suggests that thalamus filters information sent to cortex. This study indicates that thalamus plays a role in the tuning and sharpening of incoming and outgoing information, whereas mPFC plays a role in processing specific outcomes of actions.

**MUTATIONAL MECHANISMS OF EVOLUTION OF MUCOID TYPES FROM
BURKHOLDERIA SMALL COLONY VARIANTS**

Cody FitzGerald and Vaughn Cooper

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Burkholderia cenocepacia may cause dangerous infections in the lungs of CF patients, during which it forms biofilms. In such infections, these bacteria commonly evolve diverse colony types associated with more robust biofilms. We use laboratory experimental evolution to simulate this process. Mutations in the *wsp* operon, which coordinates surface sensing with altered metabolism of the second messenger cyclic di-GMP, commonly produce small, wrinkly colonies. However, when removed from the diverse biofilm, wrinkly types rapidly give rise to heritable, mucoid types, which resemble the ancestral smooth colony morphology but retain the capacity to form robust biofilms. We hypothesized that a variety of suppressor mutations were favored by strong selection, and sought to characterize their molecular bases and phenotypic consequences. Among 20 independently evolved mucoid genotypes derived from eight different wrinkly ancestors, we found that exopolysaccharide production uniformly increased, but biofilm productivity and fitness both varied. The genetic basis of suppression varied among wrinkly mutants. The more specialized or adapted wrinkly genotypes tended to evolve secondary suppressor mutations in the *wsp* operon, whereas earlier genotypes had a wider scope of mutations. The sites of suppressor mutations revealed a new locus that demonstrates regulatory control of the *wsp* operon, Bcen2424_1486, an uncharacterized two component transcriptional regulator. Experimental evolution therefore served as a nuanced screen of mutations that underlie a potentially important ecological shift from biofilm residence to planktonic growth, and point to a higher regulator of a well described biofilm signaling cascade.

**ABSTRACTS FOR
POSTER PRESENTATIONS**

EVALUATING COLOSTRUM QUALITY WITH NIACIN SUPPLEMENTATION IN THE DIET OF DAIRY CATTLE

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Dairy calves are born with a naive immune system, and must obtain passive immunity through ingestion of colostrum. Colostrum provides the newborn with antimicrobial proteins called immunoglobulins, such as immunoglobulin G (IgG), that protect the calf for the first few weeks of life. Calves that receive good quality colostrum (>50 g/L of IgG) are more likely to survive to adulthood. Niacin is a vasodilator that may increase blood flow to the mammary gland during production of colostrum in the mother. This experiment investigated the effect of niacin supplementation at a rate of 48 g/cow/day for 3 weeks before calving on the IgG content of colostrum. Colostrum samples were collected from 3 participating farms in New Hampshire. All samples were frozen for later analysis with radioimmunoassay plates. The mean IgG concentration of the niacin treatment (n=30) was 89.41 g/L (\pm 25.08). The mean IgG concentration of the control treatment (n=6) was 91.07 g/L (\pm 15.46). Due to limited sample numbers, further research is needed to determine any effect of treatment. This preliminary data is being used to guide further research on this subject. To our knowledge, no other research has been done to date on this subject.

WHERE'S THE BEEF?: A STUDY ON THE AVAILABILITY, PRODUCTION, AND CONSUMPTION OF LOCALLY PRODUCED BEEF IN ROCKINGHAM AND STRAFFORD COUNTIES OF NEW HAMPSHIRE AND YORK COUNTY MAINE

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This study consisted of assessing the availability of local beef in Rockingham, Strafford, and York counties and examining the behaviors and attitudes of consumers towards the local beef industry. The decision process for purchasing and consuming beef is more complex when locally produced beef is taken into consideration and will be driven primarily by a broad set of personal values including product.

The decision making process was found to be complex, and personal values were not always the driving factor. The general awareness level of locally available beef was about 75% among college aged students, and price was their leading factor. Societal and cultural influences were stronger driving factors for most than personal values. Elements such as lifestyle, finances, product availability, and company were among these factors.

QUANTIFYING CARBON ALLOCATION TO MYCORRHIZAL FUNGI BY TEMPERATE FOREST TREE SPECIES ACROSS A NITROGEN AVAILABILITY GRADIENT

Shersingh Tumber-Davila¹ and Andrew Ouimette²

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This project aims to provide a more thorough understanding of whole-plant carbon allocation in temperate forests. While trees may allocate up to 50% of their photosynthetically fixed carbon belowground, carbon allocation belowground has been historically overlooked. In particular, very few studies have quantified the amount of carbon allocated to mycorrhizal fungi – the symbiotic fungi found on tree roots that provide the plant with water and nutrients in return for sugars (carbon). We will employ three distinct methods (including new isotopic techniques) to quantify carbon allocation to mycorrhizal fungi across a range of New Hampshire forest types. Preliminary results show that in nutrient poor conifer forests, mycorrhizal fungi may receive as much as 30% of the total plant carbon. This is one of the first studies that will quantify carbon allocation to mycorrhizal fungi under a range of natural forests.

**SPECIES COMPOSITION AT THE SUB-METER LEVEL IN DISCONTINUOUS
PERMAFROST IN SUB-ARCTIC SWEDEN**

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Northern wetlands underlain by permafrost are particularly vulnerable to warming which results in changes in vegetative cover. Knowledge of species composition allows for the systematic change and quantification of emissions. We found that ground-based remote sensing allows for quick quantification of vegetation cover. We suggest that ground based remote sensing methods may provide an efficient method to quantify vegetation in northern latitude wetlands.

IS PROTEIN SUPPLEMENTATION IN MALE WEIGHT TRAINERS, AGES 18-24, ASSOCIATED WITH INCREASED LEAN BODY MASS, UPPER BODY STRENGTH AND DIETARY INTAKE?

Kaitlin Dresser and Jesse Morrell

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Protein supplementation is a popular behavior among young people who are interested in physical activity; however the safety, efficacy and cost are still concerns. The purpose of this study is to determine if protein supplementation in male weight training students (n=187, 18-24 years) is associated with increased lean body mass, upper body strength and dietary intake. Protein supplementation and weight training frequency were based on questionnaire responses from the ongoing College Health and Nutrition Assessment Survey. Weight trainers were defined as those students who trained at least two times per week. Upper body strength was measured by the amount of pushups completed during fitness testing. Dietary protein intake was measured using a 3 day food record (Diet Analysis 10+). Approximately 50% of college age males report using protein supplementation at least one time per week. Supplement users consumed more protein per day than non-users (154.0 vs. 108.4grams, $p < 0.01$). There was no difference in lean body mass between users and non-users (17.8% vs. 17.5% body fat, $p = 0.548$). Supplement users tended to weight train more often and were able to complete the highest number of pushups compared to non-users (50 vs. 31 pushups, $p < 0.01$). Findings from this cross sectional project indicate a relationship between protein supplementation, protein intake and upper body strength; however, further research is necessary to determine a causal relationship.

KINGSWOOD LAKES MANAGEMENT PLAN: BROOKFIELD, NH

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Department of Biological Sciences, UNH

High water quality and natural buffers exist on Kingswood Lake located in Brookfield, New Hampshire. A comprehensive lakes inventory (CSI) was recorded and health of the land, wildlife, and waterways were observed. Educational outreach was taken to inform the local community and to instruct them on proper stewardship of the land. A completed watershed management plan was constructed including key recommendation of limiting nitrogen loading in the area, checking septic systems for leaching, stabilizing shoreline from erosion, and establishing man-made rain gardens to help preserve water quality. The Kingswood watershed management plan acts as a guide for the town of Brookfield, New Hampshire to help protect water quality for future generations and to provide residents with the necessary tools needed to begin this commitment to their natural environment.

NUMBER DISCRIMINATION IN THE CLARK'S NUTCRACKER (*NUCIFRAGA COLUMBIANA*)

Noor Alsalihi¹, Sheri Martin², Lindsay Michaud¹, Arika Zielfelder², and Brett Gibson²

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The Clark's Nutcracker (*Nucifraga Columbiana*) is known for its extraordinary spatial memory as they store and recover 30,000 pine seeds in up to 7,000 caches, or holes in the ground, throughout the fall, and recover them throughout the winter. Nutcrackers also may need to consider the number of nuts they have recovered from each hidden cache and they may have a sophisticated sense of quantity or number. We examined the quantity discrimination abilities of three nutcrackers; birds were tested in two different phases of experiments in an operant chamber. The birds were trained to peck the larger of two piles of up to 10 virtual nuts on a computer touch screen. The birds were able to make these discriminations easily and at the start of testing. We then manipulated the surface area of the two piles so that on some occasions both piles had the same "nut" surface area, but on other trials the larger pile had less surface area than the small pile. Despite these changes the birds continued to choose the larger pile. The results suggest that nutcrackers have a fine ability to discriminate quantities of items that is not controlled by volume or surface area.

THE EFFECT OF PARENT EDUCATION LEVEL ON DIET QUALITY

Mackenzie Gavin and Jesse Morrell

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Education level and socioeconomic status are positively correlated, however it is unknown if parent's education level influences the diet quality of young adults. The purpose of this study is to determine if parents' education predicts diet quality among young adults (ages 18-24). Intake of sodium, fruits and vegetables, and discretionary calories were evaluated using three-day food records from the ongoing CHANAS survey. Discretionary calories are extra calories that provide little nutritional value to an individual's diet. Parents' education level was divided into three groups: neither parents have earned a college degree, one parent has earned a college degree, and both parents have earned a college degree. The results indicate that students whose parents have both earned a college degree consume less discretionary calories (669.7 vs. 566.5 kcals, $p < 0.05$) and less sodium (3,269.7 vs. 2,935.6 mg, $p < 0.05$) compared to student's parents who have not earned a college degree. There was no significant difference in the fruit and vegetable (1.52 vs. 1.47 cups, $p > 0.05$) intake between the three groups. Findings from this cross-sectional project indicate that students whose parents both have earned a college degree consume less discretionary calories and sodium compared to students parents who did not attend college. All three groups of students failed to consume the recommended intake of fruits and vegetables per day.

DISTRIBUTION AND EXPRESSION OF GLYCOPROTEIN HORMONE SUBUNITS, GPA2, GTH β , AND GPB5, IN THE SEA LAMPREY, *PETROMYZON MARINUS*

Timothy Marquis and Stacia Sower

Department of Molecular, Cellular, & Biomedical Sciences, UNH

The pituitary glycoprotein hormone (GpH) family in jawed vertebrates (gnathostomes) consists of follicle stimulating hormone (FSH), luteinizing hormone (LH), thyroid-stimulating hormone (TSH), and a new member called thyrostimulin. In contrast, in the jawless basal vertebrate, the sea lamprey, there is only one newly identified GpH and thyrostimulin (Sower et al., 2009; Kosugi et al., 2011; Decatur et al., 2011; Kosugi et al., unpublished; Ul-Hasan et al., unpublished). The distribution of these glycoprotein hormones in the lamprey pituitary has yet to be examined. Therefore, the objective of my study was to determine the location and distribution of these three GpH subunit mRNAs, GpA2, GpB5 and GTH β in the pituitary from three life stages (larval, parasitic, and adult) in the sea lamprey by in-situ hybridization. Lamprey GpA2 and IGpB5 mRNA were co-expressed in the three major areas of the pituitary, the rostral pars distalis (RPD), the proximal pars distalis (PPD), and the pars intermedia (PI), from parasitic and adult lampreys. Lamprey GTH β RNA was expressed in the RPD and PPD. Previous immunohistochemical studies showed IGTH β protein was expressed only in the ventral half of the PPD. The results from my study suggest that the location of the subunits in similar areas of the pituitary could give rise to the two heterodimers, the novel GpH, and the putative thyrostimulin, in the sea lamprey. Funded by NSF, NHAES, and UNH URA.

SURVEY OF THE RARE FLORA OF THE TIDAL REACHES OF THE SQUAMSCOTT RIVER AND LAMPREY RIVER, NEW HAMPSHIRE

Natalie Feldsine and Gregg Moore
Department of Biological Sciences, UNH

The purpose of this study was to conduct a rare species survey on the tidal reaches of the Squamscott River and Lamprey River. This study was also meant to update observation records of rare plants for the New Hampshire Natural Heritage Bureau (NHNHB). It is important to document observations of rare species because it reflects the biodiversity of an area and can represent how the distribution of flora can change over time (Prather et al., 2004). Some species of interest are found in the rare habitat type known as brackish tidal riverbank marsh (Sperduto & Nichols, 2004). The vascular flora observed in this study include *Samolus valerandi* ssp. *parviflorus*, *Eleocharis parvula*, *Sagittaria montevidensis* ssp. *spongiosa*, *Lilaeopsis chinensis*, and *Limosella australis*. It was expected that there would be more rare species populations on the Squamscott River because longer length could allow for more area for suitable habitat. It was also thought that some species may have migrated to the river in which they were not previously observed, as some species were regarded as "historical". The survey was conducted from late May 2013 to late August 2013. Surveys began at the head of tide, which were marked by dams in both rivers, and continued downstream to the Great Bay Estuary. Of the five rare species observed between the two rivers, all five were observed on the Lamprey River while three were observed on the Squamscott River.

THE EFFECT OF RIDERS WITH DISABILITIES ON EQUINE MEAN HEART RATE IN THE THERAPEUTIC SETTING

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The effect of a rider with a disability on the mean heart rates of horses used in the therapeutic setting was investigated. Nine horses were ridden in the therapeutic setting by riders with various disabilities and in control sessions by an unchallenged rider. The mean heart rates during the sessions were analyzed using a paired two samples t-test for means, and it was found that there was no significant difference in mean heart rate for the horses as a group when ridden in the therapeutic setting ($p > 0.05$). A few horses, however, did show individually different means from the control. The results indicate that riders with disabilities may have no negative influence on horses' heart rate, and that the horses studied were well-suited to the therapeutic riding program.

THE PSYCHOLOGICAL EFFECTS OF CHRONIC ILLNESS IN YOUNG ADULTSJennifer Allen¹ and Judy Stevens²¹Department of Molecular, Cellular, & Biomedical Sciences, UNH²UNH Health Services, UNH

The purpose of this research project was to study the psychological effects of chronic illness in young adults. As part of an internship at UNH Health Services, research was composed of working with chronic illness nurse, Judy Stevens, to explore what affects students with chronic illness. Transitions in life, specifically from high school to college were studied. It was found that support systems, age of diagnosis, dietary limitations, physical limitations, and other factors influenced how young adults psychologically responded to having a chronic illness. Management techniques were researched and found to be beneficial in certain cases. Casual interviews with UNH students with a chronic illness were conducted to assess the degree of awareness of support services and therapeutic services offered on campus.

DO PESTICIDE SEED TREATMENTS EXACERBATE WEED PROBLEMS?

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Pesticide seed treatments, in which crop seeds are coated with a mixture of fungicides and insecticides, are a common feature of conventional corn and soybean production in the US. Given the concern over the effects that some seed treatments may have on beneficial organisms such as honey bees, we were interested to examine whether seed treatments are having additional impacts below-ground that could affect weed populations. We hypothesized that treated seeds are effective in inhibiting soil microfauna and fungal pathogens that would otherwise destroy or damage weed seeds in the soil. To investigate how pesticide seed treatments affect the density and composition of the readily-germinable fraction of the soil weed seed bank, we collected soil cores in the fall in a field experiment that was established in summer 2013 at The Pennsylvania State University Russell E. Larson Agricultural Research Farm in Rock Springs, PA. The experiment consisted of plots planted with corn seed treated with CruiserMaxx (seed treatment) and the identical corn genotype without the seed treatment (control). CruiserMaxx seed treatment is a combination of Cruiser 5FS insecticide (Thiamethoxam) and Maxim Quattro fungicide (which contains Fludioxonil, Mefenoxam, Azoxystrobin, and Thiabendazole) and is commonly used on corn planted in the US. The plots were 3 m by 6 m and treatments were assigned in a completely randomized design with five replications of each treatment. Soil cores were spread on flats in the Macfarlane Greenhouse Facility at UNH and weed seedlings that emerged over the course of four months were identified and removed. Based on preliminary data, there were no statistically significant effects of pesticide seed treatment on the number of seedlings that emerged or species richness; however, trends in these two parameters are suggestive and additional research is currently underway. Research was supported by an Undergraduate Research Award from the Weed Science Society of America.

INVESTIGATION OF NITROGEN LOADING IN THE GREAT BAY ESTUARY: IS MOORE FIELDS CONTRIBUTING TO THE NITROGEN LOADING IN THE OYSTER RIVER?

Katherine Swan and William McDowell

Department of Natural Resources & the Environment, UNH

In the Great Bay watershed, land uses have been changing rapidly from urban sprawl. This has contributed to non-point sources of nitrogen impairment in the Great Bay estuary and tributaries. The Oyster River is one of seven tributaries listed as impaired from excessive nitrogen loading. The purpose of this study was to (1) investigate the nitrogen loading at five sites, Moore Fields tributary (MF2 and MF4) and Oyster River tributary (MF0, MF1, and MF3), along Moore Fields as an agricultural nitrogen input; (2) to examine if changing from inorganic to organic fertilizer has contributed to the nitrogen loading in Oyster River in Durham, New Hampshire during years 2001 to 2013. Field methods used in this study were to collect surface water samples for nutrients; NO_3 , TDN/DOC, and NH_4 bi-monthly. Laboratory methods used were to analyze for the concentrations of the samples by using Ion Chromatography (IC) for NO_3 , SmartChem (SC) for NH_4 , and Shimadzu Total Organic Carbon analyzer (TOC) for TDN/DOC. In result, sites MF2 and MF4 had higher mean concentrations of TDN and NO_3 (>2 mg N/L) than sites MF0, MF1, and MF4. Mean concentrations of DON (.2 to .4 mg N/L) and NH_4 (.03 to .5 mg N/L) were steady throughout the sites from 2001 to 2013. A comparison was done for DOC and DON ($p < 0.05$), TDN and NH_4 ($p < 0.05$), and DOC and DON ($p < 0.05$) throughout the sites. These findings show that the nitrogen may be a source in the Oyster River from agricultural practices.

PLASTICS IN SOCIETY

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The purpose of my internship is to gain insight into the plastics industry, as well as study its effects on the environment. This generation has grown up with plastics surrounding them at all times, and we are now a disposable society. My research will enlighten people about the impacts plastic has on the ecosystems and organisms within these systems. There is growing concerns about the negative effects plastics have on the Earth, and my research supports this idea.

MODELING VIRULENCE OF *V. PARAHAEMOLYTICUS* IN *ARABIDOPSIS THALIANA*

Kylie Weber, Victoria Sicard, and Cheryl Whistler

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Although vertebrate animal models are typically used to study human pathogens, simpler infection models that emulate disease can facilitate the discovery of virulence determinants due to the conserved action of toxins across kingdoms. For the gastric human pathogen *Vibrio parahaemolyticus*, the lack of animal models has impeded research. Our lab has evaluated several infection models and has successfully developed a gastric model in nematodes. Our objective is to evaluate the potential of the plant *Arabidopsis thaliana* to detect virulence factors of *V. parahaemolyticus*. To model pathogenicity and quantify virulence, we first evaluated the influence of both negative and positive and control treatments infiltrated into plant leaves. As expected, the no inoculum control caused no disease. Treatment with a non-pathogenic bacterium, *Escherichia coli* OP50 also resulted in virtually no symptoms, but did cause some mechanical damage indicating technical improvements may reduce this result. Importantly, the positive control human pathogen *Pseudomonas aeruginosa*, and *V. parahaemolyticus* both triggered chlorosis or a yellowing of leaves consistent with disease. Using the plant model *Arabidopsis thaliana* as a means of measuring the difference in pathogenicity in different *V. parahaemolyticus* strains could allow for a more high-throughput, time, and cost effective model for screening virulence factors, *Vibrio parahaemolyticus* mutants and clinically relevant strains.

DRUG REACTIVITY

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Anxiety disorders are prevalent in most populations worldwide, but treatment of these disorders requires further study. This study investigated a possible link between stress and alcohol response. The intermittent swim stress (ISS) served as the stressor during which ultrasonic vocalizations (USV) were recorded. The ataxia effect of alcohol on stressed subjects was investigated using a rotarod. It was hypothesized that rats with many USVs during the ISS demonstrated a greater ability to stay on the rotarod, than the rats that did not call.

HUMAN α -GALACTOSIDASE-A PRODUCTION IN TRANSGENIC PLANTS: HELPING THE PROCESS OF ENZYME REPLACEMENT THERAPY

Brian Hurley¹, Katie Lantz², and Subhash Minocha¹

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Many people struggle with genetic disorders that limit their ability to function as normal human beings. Although there is no cure, some genetic disorders are treatable. One such example is Fabry disease, which can be treated by giving patients regular infusions of an enzyme that they lack because of a genomic mutation that codes for this enzyme. This rehabilitation process is aptly named enzyme replacement therapy (ERT), and it involves giving effected individuals supplemental doses of human α -Galactosidase-A (hGLA) enzyme, which they are unable to produce themselves. However, this type of therapy is extremely costly, and dependent upon an efficient method that can produce large quantities of the functional enzyme. The goal of my research is to test the efficiency of plants (tobacco and *Arabidopsis thaliana*) as an enzyme bio-reactor, and to evaluate whether protein production in plants could provide an effective alternate method to the current approach that utilizes animal cell culture. My predecessor, Katie Lantz, a graduate of Dr. Minocha's lab, has demonstrated *A. thaliana*'s ability to produce hGLA. The current research is intended to isolate the protein produced and test its biochemical activity and functionality as hGLA. The success of this research will demonstrate a beneficial alternative method for enzyme replacement therapy that can potentially lower costs and improve the field of medicine.

QUALITY OF OLIVE OILS AVAILABLE LOCALLY: CHEMICAL, SENSORY AND MARKET INVESTIGATIONS

Madeleine Gould and Joanne Curran-Celentano
Department of Molecular, Cellular, & Biomedical Sciences, UNH

Extra virgin olive oils (EVOO) are obtained through methods created to extract the highest quality oil. The world market of olive oil is rife with accusations of adulteration and false claims regarding quality. These are serious accusations, implying lower quality oils. True extra virgin olive oils contain higher levels of antioxidant phenolic compounds. Mechanisms have been identified in which phenolic compounds in the olive oil matrix exhibit antioxidant activity, helping to prevent cancer, cardiovascular disease, and other pathologies. The question investigated is; "How do olive oils available locally measure up in terms of phenolic compound content and flavor, and does this manifest in the way they are marketed?" Olive oils were obtained from locations around UNH and assessed for total phenolic content through colorimetric absorbance after extraction and reaction with Folin-Ciocalteu reagent. Three EVOO selected for their range of phenolics were evaluated by sensory analysis. Analysis regarding the relationship between storage methods and container type, phenolic contents and Hedonic acceptance followed the sensory investigation. The results of the chemical analysis supported that olive oils vary greatly in the concentration of phenolic compounds; the sensory analysis showed a preference for EVOO with low to moderate levels of phenols. Market analysis of local olive oils found that price is unrelated to consumer preference or phenolic compound content level.

THE EFFECT OF pH ON THE CHARGE OF MONOCLONAL ANTIBODIES

Kadina Mazic, Dana Filoti, Thomas Laue, and Carrie May
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Monoclonal antibodies (mAb) can be produced to bind to almost any substance. This unique specificity makes mAb essential therapeutics in the treatment of many types of cancers and autoimmune disorders. In the purification process of mAb therapeutics a wide pH range is utilized in order to ensure efficacy. To better understand the effect of pH on the colloidal properties of the mAb, a titration study was conducted for 3 monoclonal antibodies, mAb A, B, C with emphasis on pH 3, 6, and 9. The electrophoretic mobility was measured by both membrane confined electrophoresis (The Spin Analytical MCE™) and phase analysis light scattering (Wyatt Möbiuz) which determined the effective charge and Debye-Henry Huckel charge. The sedimentation coefficient, molecular weight, and buoyant molecular weight were measured via analytical ultracentrifugation (Beckman Analytical Ultracentrifuge) and used to calculate the Stokes radius. The results differed for each mAb though there was a consistent pattern at pH 3 as both the effective charge and Stokes radius increased while the Debye-Henry Huckel charge decreased.

**MIGRATION AS A LIFESTYLE: EFFECTS OF DIEL VERTICAL MIGRATION ON THE
ZOOPLANKTON COMMUNITY OF RUSSELL POND**

Kelsey Dobe, Alan Baker, Jonathan Dufresne, and James Haney
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The serenity of Russell Pond in Woodstock, New Hampshire is misleading to the vibrant community below the surface that many may not see. Russell Pond is an oligotrophic lake based on its chlorophyll a concentration, total phosphorus concentration, and secchi disk measurements. Migration of *Chaoborus*, *Bosmina*, *Daphnia*, and copepods were examined using zooplankton discrete depth counts and sonar. *Chaoborus* demonstrated diel vertical migration as a consolidated population was not seen migrating until 7 pm after sunset, and *Bosmina* migrated towards the surface as their relative abundances are greater from 0-2 m at 8 pm than at any other time of day; while *Daphnia* migrated down to avoid *Chaoborus*, and the copepods did not migrate.

EXPRESSION AND CHARACTERIZATION OF RECOMBINANT PDE6C GAF DOMAIN

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The visual signaling pathway in rod and cone photoreceptors in the retina has been intensively investigated, but much is still unknown about the initial steps in vision. Several genetic and environmental diseases of the retina are known to result from dysfunctional photoreceptor proteins including those directly involved in the signaling pathway. Studying the structure and regulation of the proteins responsible for this signaling pathway will provide a better understanding of the molecular basis of retinal diseases. One such protein, photoreceptor phosphodiesterase (PDE6), is a key effector protein within the visual transduction pathway. PDE6 is a dimer, and the regulatory domains (GAFa and GAFb) are believed to have a major role in dimerization of the catalytic subunits and in allosteric binding of cGMP. In an effort to better understand the role of the GAF domains, we subcloned the corresponding GAFa-GAFb sequence, expressed the recombinant protein in bacteria, purified it, and characterized its properties. Whereas human cone PDE6 GAFa-GAFb could not be expressed as a soluble protein, the corresponding chicken cone PDE6 was well expressed, easily purified, and could bind cGMP. Based on gel filtration chromatographic estimations of its size, the chicken GAFa-GAFb is primarily monomeric. The basis for the species differences in our ability to express functional protein is unclear. However, further characterization of the PDE6 GAFa-GAFb protein is currently underway.

THE DEVELOPMENT OF POLYAMINES THROUGHOUT *BRASSICA RAPA* OVER ITS LIFECYCLE

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Polyamines are naturally produced chemicals that are found in all plants and are involved in growth, development and stress response. Studies have shown that they provide resistance to certain stress factors, such as temperature, drought and salt. They are also essential for regulation of cell division and differentiation in plants. It is expected that their biosynthesis must change during the plant's development and from environmental changes. The primary objective of my study is to create a profile of changes in the entire life of the plant, in every organ at all stages of development from seed germination to seed formation. This will reveal the changing correlations between polyamines and their role in development and in stress response. We have analyzed polyamines putrescine, spermidine and spermine in all parts of *Brassica rapa*, a small, rapid growing plant. The plant finishes its entire life within 6-8 weeks, thus allowing us to do an in-depth analysis of these multifunctional metabolites. Parallel to the polyamines, we will also study changes in the activities of the polyamine biosynthetic enzymes and the expression of their genes in different organs at different times. In the next stage of the study, the expression of selected genes will be inhibited by RNAi constructs, allowing further analysis of their role in growth and stress response. Because polyamines are important in development and lifecycle of plants, altering their presence may be useful in altering seasonal plant growth such as in crops. Further research would be needed to fully understand the potential of polyamine inhibitions in the stress response and growth of plants.

**INCREASE IN SEDGE BIOMASS ACROSS A PERMAFROST THAW GRADIENT
CORRELATES TO CHANGES IN THE MAGNITUDE AND ISOTOPIC COMPOSITION OF
METHANE EMISSIONS**

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Intermediate vegetative species in the sub-arctic have been noted to change in accordance to rises in average air temperatures. The rise of these intermediate species is in close connection to greenhouse gasses such as carbon dioxide (CO₂) and methane (CH₄), which has three times the global warming potential than CO₂ and is primarily emitted from wetland ecosystems. Tracking these two methane relationships furthers knowledge in quantifying methane production and tracing atmospheric CH₄ back to sources such as wetlands and understanding of how this intermediate stage will continue to contribute to climate change as positive feedbacks persist. Transects were constructed along a thaw gradient, where gas fluxes were recorded from above ground vegetation and ground pore water was collected to find CH₄ concentration and isotopic signatures. Significant differences were found between the CH₄ fluxes of the different vegetation classes, lowest fluxes recorded in the frozen tundra (mg m⁻² day⁻¹ = 0.73 + 4.41), mid-range fluxes in *Sphagnum* sites (mg m⁻² day⁻¹ = 14.2 + 15.8) and highest fluxes from the wet graminoid (mg m⁻² day⁻¹ = 165.4 + 136.6) The best indicator of methane flux was found to be biomass of sedge vegetation such as *Eriophorum vaginatum* and *Carex* (R²= 0.86 p= 0.001). The best indicator of below ground methane concentration was sedge biomass (R²= 0.73 p= 0.0294) at 30 cm below ground.

WHAT SUBSET OF A CLINICAL POPULATION OF ACUTE MYELOGENOUS LEUKEMIA (AML) PATIENTS EXHIBIT CYTOPLASMIC SEQUESTRATION OF P53 AND IS MORTALIN INVOLVED?

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The human p53 protein is involved in regulating the cell cycle and preventing cancers by inducing apoptosis, or genetically programmed cellular death. Recent studies in Dr. Walker's laboratory have demonstrated that cytoplasmic sequestration of wild-type p53 protein (wtp53) by a mitochondrial heat shock protein (Hsp70, called mortalin) occurs in several animal cancers (e.g., cancerous clam hemocytes, human colon carcinoma (the cell line HCT-116) and neuroblastoma cells (the cell line IMR-32). Cytoplasmic sequestration or tethering of wtp53 by mortalin protein inhibits its apoptotic functions by preventing p53-induced apoptosis. Apoptosis induced by p53 can remove cancer cells from multicellular organisms and prevent tumor formation. My research interrogates a repository of cells derived from human AML patients by focusing on a particular mechanism that may be responsible for this disease. I will focus on a subset of AML cells derived from patients that share a unique phenotype and cellular anomaly, specifically cytoplasmic sequestration of p53 and inactivation of its apoptotic functions. A certain number of patient AML cells have exhibited cytoplasmic sequestration of p53 and I plan to characterize the larger population. I will also address the question: Is mortalin involved in cytoplasmic sequestration of p53 and abrogating its apoptotic function? Support from NCI R15 (1R15CA182761-01) to CWW.

DOES A REDUCTION IN CATERPILLAR ABUNDANCE CAUSED BY THE EXOTIC SHRUB *FRANGULA ALNUS* REDUCE PLASMA CAROTENOIDS IN NESTLING COMMON YELLOWTHROATS (*GEOTHYLPIS TRICHAS*)?

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Carotenoids are naturally occurring pigments that in birds function in pigmenting feathers and as antioxidants responsible for improving hatching success, nestling growth, parasite resistance, and adult survivorship. Birds must acquire carotenoids from their diet and for insectivorous birds such as common yellowthroats (*Geothlypis trichas*), caterpillars are more carotenoid-rich than any other arthropods. Further, caterpillars are the main source of the carotenoid lutein, the sole pigment that yellowthroats use to color their yellow feathers which serve important roles as cues in mate selection. Thus habitat conditions which reduce the amount of caterpillars available to birds may have indirect negative consequences on overall health, survival, and mating success. Exotic shrubs are one factor that can reduce caterpillar abundance because few caterpillars can tolerate the chemicals these plants produce to discourage herbivory. This study measured blood carotenoid concentrations of nestling common yellowthroats raised in territories where the proportion of exotic shrub cover spans a gradient from zero to nearly 100%. We expect nestlings raised in territories composed primarily of native shrubs will have higher blood carotenoid concentrations than nestlings raised in territories composed primarily of exotic shrubs.

**EFFECTS OF CHRONIC REBOXETINE ADMINISTRATION ON INTERMITTENT SWIM
STRESS-INDUCED ULTRASONIC VOCALIZATIONS AND SUBSEQUENT
PERFORMANCE ON THE FORCED SWIM TEST**

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The majority of current research on treatment for depression focuses on the vulnerable brain. In order to hasten novel drug discovery, research must begin to focus on the resilient brain as well. This study examined the effects of chronic antidepressant administration on ultrasonic vocalizations (USVs) during the intermittent swim stress (ISS) paradigm and subsequent forced swim test performance (FST). The ISS paradigm produces behavioral depression in rats by intermittently exposing them to 80-5 second bouts of cold water swim on an average of once per minute. Rats that emit USVs during the ISS spend less time immobile in the FST which predicts that USVs are a marker of resiliency. Therefore it is predicted that if USVs are working through the same neural pathway as antidepressants then when rats are chronically administered the antidepressant reboxetine, the amount of USVs will increase and they will subsequently show less immobility in the FST.

EFFECT OF INSULIN-LIKE GROWTH FACTOR-1 (IGF-1) ON THE EXPRESSION OF NF κ B AND CFLIP IN BOVINE GRANULOSA CELLS

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Infertility, often attributed to follicular atresia, is a growing problem in the agricultural industry. Programmed cell death, also known as apoptosis, is a contributing factor of follicular atresia. It occurs in both the granulosa cells and the oocyte that comprise ovarian follicles. Here, mechanisms influencing the process of apoptosis, via the death receptor Fas, were explored using bovine granulosa cells (bGCs) because Fas-induced apoptosis is a plausible mechanism of follicular atresia. Cell culture techniques, optimized for bGCs, were developed and used throughout the current study. In brief, cultures of bGCs were exposed to Fas ligand (100ng/mL) for 24 hrs. This induced cell death, as measured by MTS assay ($p=0.024$, $n=3$ experiments). Subsequent experiments in which doses of insulin-like growth factor (IGF-1) were co-administered indicated that 100ng/ml IGF-1 provides the greatest protection against Fas-induced apoptosis ($p=0.001$, $n=3$ experiments). Currently, we are testing the hypothesis that IGF-1 protects bGCs from Fas-induced apoptosis by stimulating the expression of cellular FLICE-like inhibitory protein (cFLIP) and the activation of nuclear factor- κ B (NF κ B), two molecules thought to protect granulosa cells from apoptosis. IGF-1-stimulated expression of cFLIP and NF κ B will be assessed by immunoblots and in-cell western assays. This project is supported by the Hamel Center for Undergraduate Research (SD) and USDA grant no. 2013-67016-21071 (DHT).

METABOLIC SYNDROME AND WHOLE GRAIN INTAKE IN UNH MEN AND WOMEN

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Inspired by the American Heart Association's *My Heart My Life* and a recently published study, we compared the association between whole grain intake and metabolic syndrome in the UNH College Health and Nutrition Assessment Survey (CHANAS) men and women. Metabolic syndrome is characterized by central adiposity, low HDL cholesterol levels, high blood pressure, high triglycerides, and high fasting blood glucose and has increased in global prevalence, partially due to refined carbohydrate intake. Metabolic syndrome is a risk for cardiovascular disease and research at UNH has shown even some young adults displayed one or more criteria for metabolic syndrome. Consuming whole as opposed to refined grains has been linked to improved cardiovascular fitness. This study was designed to address the relationship between dietary intake of whole grains and characteristics of metabolic syndrome in CHANAS participants, ages 18 to 23. We utilized data collected in AY 2012 through CHANAS. As the dietary recall data did not specifically include whole-grain intake, our first task was to define a surrogate for whole-grains using marker micronutrients, specifically vitamin E, vitamin B6, folate, magnesium, and iron. These nutrients were categorized as low, adequate, and high intake and correlated with blood pressure, waist circumference, glucose and lipid profile. The data was analyzed using SPSS. The correlations between dietary intake of key micronutrients, estimates of whole grain versus refined grain (and sugar) intake, and physiological measures are compared to the metabolic risk factors to compare CHANAS results with published studies showing higher whole grain intake as associated with lower risk of metabolic syndrome. Improving the estimates of whole grain consumption and efforts to increase intake of whole grains and reduce intake of refined grains may help improve cardiovascular risk in emerging adults.

DO FLAME RETARDANTS PROMOTE VITAMIN D DEFICIENCY?

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Vitamin D deficiency in the United States is increasing. Environmental chemicals induce liver enzymes that inactivate Vitamin D, but the role of these chemicals in promoting Vitamin D deficiency is unknown. The purpose of this study was to determine if exposure to a common flame retardant chemical, polybrominated diethyl ethers (PBDEs), promotes vitamin D (D3) deficiency. Fifteen rats were fed a diet marginally deficient in D3 for 8 weeks. For the final 4 weeks of the study, 7 rats were gavaged daily with 7 mg PBDE/kg BW and 8 rats were gavaged daily with corn oil. Body weight and food intake were measured every 2 days, urine was collected during weeks 3 and 7, and blood and liver were collected at 8 weeks. Final body weight of the PBDE-treated rats tended to be lower than controls (370 ± 40 vs 401 ± 32 grams, respectively, $P=0.06$). Liver weight as a percent of body weight was higher in PBDE-treated rats compared to controls ($4.24 \pm 0.2\%$ vs $3.18 \pm 0.1\%$, respectively, $P < 0.05$). There was no significant difference in urinary calcium/creatinine between treatment and controls at 3 or 7 weeks. There was no difference in serum levels of inactive 24,25 diOH D3 and 4 β ,25 diOH D3 in PBDE-treated vs control. However, active D3 level tended to be lower in PBDE-treated vs control ($P=0.187$). Liver enzyme and D3 metabolism measurements are currently underway. This work will deepen our understanding of how PBDEs could promote vitamin D deficiency.

EXPLORING THE IMPORTANCE OF SINGLE NUCLEOTIDE POLYMORPHISMS OF HSPA9 GENE IN DNA OF SARCOMA PATIENTS

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The aim of this project was to identify genetic variants that may influence the risk and progression of sarcoma through targeted genotyping of HSPA9 gene. It is important to look at genetic variants in DNA samples because if a variant is determined to be more likely than another, a screening for the particular variant can be done to identify a patient's risk of sarcoma. The study population was sarcoma patients from the International Sarcoma Kindred Study. These patients had no mutations in p53 or MDM2. Genotyping data from the HapMap project (hapmap.org) for HSPA9 was used to identify the polymorphisms needed to tag the entire region. In order to genotype the DNA sample, KASP reagents (KBioSciences, UK) were used. KASP uses a two-set PCR process. Allele specific primers are used to preferentially amplify each allele of a given SNP. The specific genetic variations of HSPA9 in sarcoma patient DNA samples with no mutations in p53 or MDM2 amplification are not more or less likely to occur than in DNA samples with the mutation or amplification. If continued research can show that MDM2 is not amplified, but activated through other mechanisms such as the interaction between polymorphisms of mitochondrial genes, p53, or MDM2, we can propose anti-MDM2 therapies to the patients with these polymorphisms.

ASSESSMENT OF CONSERVATION REQUIREMENTS AND CONCERNS FOR RARE NEW HAMPSHIRE GRASS TAXA WITH EMPHASIS ON THE GENUS *GLYCERIA* (POACEAE)

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The conservation and management of New Hampshire's native plant species is a growing concern in the presence of global climate change and man-made disturbances. Wetland species are of particular concern due to sensitivities posed by fluctuating water regimes and dynamic nutrient cycling. This study focused on the conservation and potential limiting factors for three species of *Glyceria* (Poaceae) native to New Hampshire, as well as the production of publicly available "Fact Sheet" resources for 17 vulnerable grass taxa occurring in the state. *Glyceria acutiflora*, *Glyceira obtusa*, and *Glyceria septentrionalis* are listed as threatened or endangered in New Hampshire and little is known about factors crucial to population success. In this study, pollen viability and root hair development were analyzed as potential limiting factors. Plant samples were collected within southern New Hampshire and tested for successful development of viable pollen grains using the stain aniline-blue in lacto phenol, and for vegetative and root hair development following seed germination. In addition to this experimental research, information was compiled from various online databases and resource articles in order to produce species Fact Sheets. These resources will be made available through the New Hampshire Natural Heritage Bureau in order to inform decisions made by landowners, property developers, and conservationists.

SOIL FOOD WEB COMMUNITY RESPONSE TO MAIZE TREATED WITH PESTICIDE SEED TREATMENTS

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In conventionally managed agroecosystems, crop pests are commonly managed with pesticide seed treatments. This practice may adversely affect biological processes by altering the soil biota that underpin important agroecosystem services. We assessed the effects of pesticide seed treatments on rhizosphere faunal community composition and function in Rock Springs, PA in 2013. Treatments were planted with maize seeds either pretreated with a fungicide-insecticide mixture or untreated and were assigned in a completely randomized design. Litter decomposition bags were placed on the soil surface in two locations in each plot on May 31. At crop harvest, the litter bags were removed and fauna inhabiting the crop rhizosphere were sampled to a depth of 15 cm in two locations in each plot. Fauna were extracted from soil samples with Berlese funnels and identified by morphology. We found distinct communities in each treatment. The soil community inhabiting maize pretreated with pesticides was associated with a greater abundance of predators whereas detritivores were more associated with untreated seeds. Even with distinct soil faunal communities, we did not observe treatment differences for surface litter mass loss, crop yields, or soil fauna diversity indices. Collectively, our results show pesticide seed treatments can influence rhizosphere faunal community composition even at harvest; however, these effects do not appear to influence rates of decomposition and yields.

PREVALENCE OF INTESTINAL PARASITES IN DOGS TRANSPORTED TO NHSPCABrienna Tomlinson¹, Sarah Proctor², and Michelle Fleetwood¹¹Department of Molecular, Cellular, & Biomedical Sciences, UNH²Thompson School of Applied Science, UNH

The NHSPCA transports hundreds of dogs each year from states in the Midwest and Southern United States. The four main places that the NHSPCA transports dogs from are the Franklin County Humane Society in Virginia, Shelby Humane Society in Alabama, Ritchie County Humane Society in West Virginia and Canine Express in Indiana. When the dogs are brought to the NHSPCA a fecal sample is tested for each dog. The fecal sample is tested for hookworms, whipworms, roundworms, tapeworms, coccidia and giardia. I compiled all the data for 2012 and 2013 to look at the prevalence of each intestinal parasite in each state. Therefore, the different states can be compared and the higher risk states can be determined. The human societies' deworming practices can be looked at and improved.

RPA1A AND RPA1C REGULATE PROGRESSION OF MEIOSIS IN *ARABIDOPSIS THALIANA*

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Replication Protein A (RPA) is a protein complex that binds to single-stranded DNA (ssDNA) during DNA metabolism, protecting it from secondary structure formation and enzymatic damage. RPA is made up of three subunits (RPA1-3) with RPA1 being the largest and the main ssDNA binding protein. In the model plant, *Arabidopsis thaliana*, there are five paralogs of the *RPA1* gene (*RPA1A-E*) that fall into two distinct functional groups. Prior results from our lab suggest that RPA1B and RPA1D (BD group) is involved in DNA replication. In contrast, RPA1A, RPA1C, and RPA1E (ACE group) play leading roles in DNA repair and recombination. The *rpa1a* single mutant displays defective meiosis resulting in partial infertility whereas the *rpa1c* single mutant is fertile. Interestingly, the *rpa1a rpa1c* double mutant is completely sterile with incomplete synapsis and chromosome fragmentation observed during meiosis. Therefore, we hypothesize that RPA1A and RPA1C have overlapping roles in meiotic DNA recombination. To address individual roles of RPA1A and RPA1C in meiosis, we generated two additional mutant combinations, *rpa1a^{+/-}rpa1c^{-/-}* and *rpa1a^{-/-}rpa1c^{+/-}*. Phenotypic analyses show that the *rpa1a^{+/-}rpa1c^{-/-}* is fully fertile, while the *rpa1a^{-/-}rpa1c^{+/-}* displays greater infertility than the *rpa1a^{-/-}* single mutant. These results further suggest that RPA1A and RPA1C act cooperatively during the DNA recombination step in meiosis, and that RPA1A has additional specialized roles during other stages.

**DO EXOTIC SHRUBS REDUCE CATERPILLAR ABUNDANCE IN COMMON
YELLOWTHROAT (*GEOTHYLPIS TRICHAS*) BREEDING TERRITORIES?**

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Caterpillars are a critical food that neotropical migrant songbirds feed to their young during the nesting season. Consequently, habitat factors that decrease caterpillar abundance can result in reduced nestling growth rates and fewer numbers of young birds produced. Since most caterpillars require specific host plants for food, the plant species composition within songbird breeding territories could theoretically influence the number of caterpillars that are available for birds. Recent evidence that few caterpillars in the United States use plants introduced from other countries as food is of particular conservation concern, considering that these exotic plants are becoming increasingly prevalent in nearly every habitat type in North America. Here the aim was to quantify the extent to which exotic plants actually affect caterpillar abundance within common yellowthroat (*Geothlypis trichas*) territories. Caterpillar abundance was measured on native and exotic shrub species within mapped territories of color-banded common yellowthroats during the nesting season, to determine if differences in exotic shrub composition results in differences in caterpillar abundance.

WHAT ARE THE TRENDS IN PHENOTYPIC VARIATION IN *HARMONIA AXYRIDIS*?

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Harmonia axyridis (Asian multicolored ladybug) are common throughout Asia and North America. Remarkably, they exhibit a substantial amount of phenotypic variations, yet why so much variation exists remains unknown. This study aims to identify trends in the phenotypic variations that may be beneficial to the organism, and is part of a larger study, which includes the sequencing and annotation of the genome of *H. axyridis*. Ladybugs were collected in New Hampshire throughout the fall and also observed in The Smithsonian Museum Entomology collection, the Harvard Entomology Museum, and the American Museum of Natural History. All specimens were then examined under a dissecting microscope. Observations were made on elytra color, spot number, spot size, color of their head, and gender of the ladybugs. Results showed a bias towards orange-red elytra and 18 spots. Together these results suggest that while there is substantial variation, certain combinations of color and spot number may be favored by natural selection.

THE INFLUENCE OF LANDSCAPE AND HABITAT FACTORS ON THE SEX RATIO OF THE NEW ENGLAND COTTONTAIL

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The New England Cottontail, for protection under the Endangered Species Act, has experienced severe population decline resulting from loss and fragmentation of early successional habitat. Translocations will be an important conservation strategy to increase their numbers in the wild. Understanding patch-specific sex ratios and how they are affected by landscape factors will aid successful translocations. My objective was to test hypotheses of the effects of habitat quality and fragmentation on sex ratio of New England cottontails. Based on our knowledge of mating systems, I predicted that patches with higher connectivity and habitat quality would have a female-biased sex ratio. Conversely, patches with low connectivity and poor quality would be male-biased or equal sex ratio because females (the dispersing sex) experience higher mortality or are in too poor condition to disperse from the patch. To test these predictions, I used sex ratio data from twenty patches throughout Connecticut, Maine, New Hampshire and New York. Molecular sexing of cottontail fecal pellets was performed using two lagomorph-specific primers, which amplified portions of the SRY gene (found on the Y chromosome). Connectivity was characterized by fragmentation metrics and habitat quality was measured by the stem density counts within each patch. By comparing the patch-specific sex ratios with variation in landscape and habitat data, I will test the hypothesized relationships.

DO ANADROMOUS BLUEBACK HERRING (*ALOSA AESTIVALIS*) AND ALEWIFE (*ALOSA PSEUDOHARENGUS*) HYBRIDIZE IN A TANK SPAWNING ENVIRONMENT?

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Anadromous blue back herring and alewives (river herring) are an important component of Atlantic coastal marine ecosystems and once were an important fishery resource. Today, river herring are species of conservation concern, having undergone serious population declines as a result of human impacts, including overharvest, dam construction, and reduced water quality. Another potential threat arising from human-induced habitat disturbance is genetic swamping of pure species through introgressive hybridization. To address this threat, we evaluated the potential for inter-specific spawning in a controlled experimental environment. Known mixed species parental crosses were established in tanks and the fish were allowed to tank spawn. We developed a molecular assay to discriminate hybrids based on species-specific diagnostic sequences of the RAG2 nuclear gene. To identify the maternal species of successful inter-specific crosses, we used the mitochondrial cytochrome B gene. We tested our assay on 30 putative hybrids. This molecular assay can be used to identify naturally occurring hybrids in wild populations in a conservation management context.

DOES WITHANONE REVERSE CYTOPLASMIC SEQUESTRATION OF P53 AND PROMOTE APOPTOSIS IN ACUTE MYELOGENOUS LEUKEMIA?

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Withania somnifera (Ashwagandha) has been used for thousands of years in the traditional Indian medicine system known as Ayurveda, and it is even referred to as "Indian ginseng" for its wide array of purported medicinal uses. Extracts of the Ashwagandha leaves are of interest in human cancer, displaying differentiation-inducing and anti-proliferative effects by selectively killing a number of cancer cell lines. Analysis of the bioactive components of *Withania somnifera* reveals the steroidal lactone withanone to be an active constituent in inhibiting cancer growth. Evidence shows that withanone weakly binds to p53 and mortalin in the cytoplasm. This property of withanone enables it to disrupt p53-mortalin complex formation and prevent the subsequent sequestration of p53 in the cytoplasm, a phenomenon that is commonly reported in the immortalization of a diversity of human cancer types. Here, we have attempted to demonstrate that this mechanism is sufficient to reverse cytoplasmic sequestration of p53 in the human KG1 cell line, a model for acute myeloid leukemia. Treatment with withanone should reactivate p53 function, enabling it to translocate to the nucleus where it will induce apoptosis in the KG1 cells. These findings will support the growing evidence that withanone is effective in killing cancer cells and inspire hope towards the development new cancer-fighting cocktails which remain less toxic to normal cells. Support from NCI R15 (1R15CA182761-01) to CWW.

INVESTIGATING THE INTERACTIONS BETWEEN CYANOBACTERIA AND *VIBRIO PARAHAEMOLYTICUS*

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Over the past few decades the incidences of *Vibrio parahaemolyticus* related illnesses have steadily been increasing, causing an estimated 30,000 foodborne infections per year, typically from ingesting raw oysters. Results from an ongoing study show a potential correlation between abundance of cyanobacteria and *V. parahaemolyticus* in oysters. Cyanobacteria have been shown to act as a long-term reservoir of *V. cholerae* by encasing the Vibrios within mucilaginous sheaths during which Vibrios enter a VBNC state. In this study we investigated the interaction of *V. parahaemolyticus* with cyanobacteria to determine whether cyanobacteria aid in the longevity and survival of *V. parahaemolyticus*. After culturing and isolating a variety of autofluorescent cyanobacteria from the Great Bay Estuary (GBE), NH, we fluorescently-labelled pathogenic and harmless GBE strains of *V. parahaemolyticus*. Vibrios will be grown with and without cyanobacteria, using the fluorescence to observe the interaction with confocal microscopy, and plating methods to quantify the interaction, with *V. cholerae* as a control. Based on the *V. cholerae* study, we expect *V. parahaemolyticus* grown in the presence of cyanobacteria will enter a VBNC state prior to the death of the paired control without cyanobacteria. We will encourage the VBNC bacteria to awaken and replicate, use nalidixic acid to prevent cellular division, and visualize the reawakening and enlarging with confocal microscopy.

MAO-A AND THE EEG RECOGNITION MEMORY SIGNAL IN LEFT PARIETAL CORTEX

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A key part of episodic memory, or memory for the events of our lives, is recognition memory. Recognition memory is the ability to remember previously encountered stimuli. Studies have linked recognition memory to the old/new effect, an EEG indicator of stimulus familiarity. Monoamine oxidase A (MAO-A) is an enzyme that catalyzes monoamines. MAO-A is more efficiently transcribed in individuals with a 4 repeating sequence variation (4R) of the MAO-A gene leading to less monoamine availability. As many of these monoamines have been linked to episodic memory, we hypothesized that individuals homozygous for the 4R MAO-A polymorphism would show differences in mean EEG signal amplitudes during recognition memory. EEG data was recorded as participants viewed both new words and words that had been previously presented. Our results show that mean peak amplitudes over the left parietal cortex 500-800 ms post-stimulus presentation for hits were greater than those for correct rejections, indicating the old/new effect. Critically, our results revealed an interaction between mean hit and correct rejection amplitude over the left parietal cortex and MAO-A group. Individuals homozygous for the 4R variation do not show an old/new effect due to increased correct rejection amplitudes. These results suggest that less monoamine availability leads to new stimuli being identified as old by the left parietal cortex.

**A SCREEN TO IDENTIFY SODIUM-INDUCED ROOT SKEWING MUTANTS IN
*ARABIDOPSIS THALIANA***

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Estelle Hrabak

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The roots of plants usually grow parallel to the gravity vector and the enzyme Protein Phosphatase 2A (PP2A) is required for normal root growth. PP2A consists of three subunits: a scaffolding A subunit, a regulatory B subunit and a catalytic C subunit. Previous research showed that mutations in particular A or C subunits caused a novel sodium-dependent root growth phenotype, known as skewing. When roots skew, they grow at an angle to the gravity vector. Our objective is to learn more about this important root growth pathway by identifying additional genes whose disruption leads to sodium-induced root skewing. We are using a multi-part mutant screen to accomplish this objective. In the primary screen, plants with a root-skewing phenotype on sodium-supplemented medium are initially identified. The secondary screen verifies that the potential mutants from the primary screen have a reproducible phenotype. The primary screen has been completed and 2,200 putative mutants were selected from about 143,750 seedlings. Of the 2,200 putants, to date, 800 have been re-tested in the secondary screen where 37 have shown a reproducible root skewing phenotype. In the tertiary screen, mutants that pass the secondary screen will be evaluated to determine whether the root skewing is sodium specific.

THE EFFECTS OF SUPPLEMENTING A PASTURE-BASED DIET WITH GROUND FLAXSEED IN ORGANICALLY-MANAGED JERSEY COWS

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The effects of a 10% ground flaxseed diet in comparison to a 0% ground flaxseed diet in 20 lactating organically-managed Jersey cows grazing summer pasture housed at the UNH Organic Dairy Research Farm were evaluated in relation to milk yield, milk components, and dry matter intake. Flaxseed contains high levels of omega-3 fatty acids, which are known to increase the amount of conjugated linoleic acid (CLA) in milk. The additional CLAs have benefits to human health. Flaxseed is high in energy, which can be a limiting factor in grazing systems. The cows were blocked into each treatment based on days in lactation and milk yield. There were four periods consisting of 28 days with the last seven days used for data collection. The cows' dry matter intake was made up of 60% total mixed ration and 40% pasture. Intake and milk yields were recorded. Milk samples were composited from AM and PM sample points and analyzed for individual components (fat and protein). There was a slight decline in dry matter intake in cows being fed a 10% flaxseed diet. This could be due to the flaxseed's high level of unsaturated fatty acids, which can depress dry matter intake. This data showed no significant difference in milk yield or milk components due to difference in diet. This finding is beneficial because it shows that supplementing a pasture diet with flaxseed at a level of 10% could be a useful tool for farmers to increase the health benefits of milk without lowering production.

INSIGHTS FROM PROJECT FEEDERWATCH: CHANGES IN THE ABUNDANCE AND OCCURRENCE OF BIRDS IN NEW HAMPSHIRE OVER THE PAST 24 YEARS

Lee Sutcliffe and Rebecca Rowe

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Changes in the climate and land use over time can lead to changes in the composition of wildlife communities. Using data from Project FeederWatch, we examine trends in the abundance and occurrence of birds documented in the winters from 1988 to 2012 in New Hampshire. Changes in abundance and occurrence are summarized for individual bird species as well as across species based on life history traits. In addition, we examined trends for the state as a whole as well as in subregions. We discuss these changes with regards to the variations of climate and land use that are occurring throughout New Hampshire.

ISOTOPIC ANALYSIS OF ARCTIC GROUND SQUIRREL TISSUES AND POTENTIAL FOOD SOURCES

Andrew Ford and Erik Hobbie

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The Arctic Ground Squirrel is a species of ground squirrel native to the Arctic. Being an important prey species in the area it is crucial to understand their food source availability and how it is affected by changes in climate. I hypothesize that Arctic Ground Squirrel Colonies, Atigan and Toolik, will share similarities in their food collection and consumption. An isotopic analysis of stool samples will help to identify differences and similarities in diet.

IDENTIFICATION OF PALMITOYLTRANSFERASE MUTANTS IN *ARABIDOPSIS THALIANA*

Judith Hoskin and Estelle Hrabak

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Arabidopsis thaliana is a small flowering plant often used as a research model because of its short lifecycle, prolific seed production and ease of growth. This research focuses on a family of 24 genes in *A. thaliana* that encode protein S-acyl transferases (PAT). PATs catalyze palmitoylation, the thiol esterification of a C16:0 fatty acid to a cysteine residue in a substrate protein. Palmitoylation of substrate proteins can affect their membrane association, trafficking, stability and protein-protein interactions. Plants with mutations in PAT genes will be important tools in understanding the role of PATs in plant growth and development. Homozygous PAT mutant lines of *A. thaliana* were identified using PCR genotyping followed by gel electrophoresis. Once a homozygous mutant is confirmed, the region around the mutation site is sequenced to identify the exact position of the mutation within the gene. So far, 9 mutant alleles of 3 different PAT genes have been confirmed to be homozygous and the sequence of the mutated gene has been determined. Currently RNA is being isolated from each of these mutants. The mRNA will be reverse transcribed into cDNA and analyzed by PCR to see if transcript can be detected. If the knockout hypothesis is true, then no transcript will be detected, confirming these are null mutations suitable for further research into the function of these PATs in plants.

SEROTONIN TRANSPORTER CHANGES EEG SIGNAL DURING SOURCE MEMORY

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Source memory is the targeted retrieval of stored contextual information. Prior research using fMRI shows a link between genetic variation in the serotonin transporter (5-HTTLPR), prefrontal cortex (PFC) activity and source memory performance. The 5-HTTLPR genetic variation consists of a short (s) or long (l) nucleotide sequence, with the s genotype associated with 50% more synaptic serotonin. Here, we investigated when 5-HTT influences source memory in young adults using event-related potentials (ERPs). During the encoding phase of the task, participants were presented with words and asked to rate how pleasant the word was or imagine a scene using the word. At test, participants were fitted with an EEG recording system and shown the words seen during encoding randomly mixed with new words and were asked to indicate which encoding task they performed (pleasant vs. image). Of particular interest were hits (correctly identifying the source) and correct rejections (new words correctly identified as new). Participants were separated into groups with l homozygotes in one and s-carriers in another. ERP amplitude was decreased in the right PFC of s-carriers 1000-1500 ms post-stimulus presentation compared to l homozygotes when successfully identifying the source. Importantly, ERP amplitudes for hit trials did not differ from correct rejection trials. These results indicate that increased serotonin disrupts source memory signaling in right prefrontal cortex.

DROUGHT SENSITIVITY OF SLASH PINE AND LONGLEAF PINE DEDUCED BY TREE RING ANALYSIS

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Annual tree rings give us the opportunity to investigate the adaptation of trees to climate and environmental stress over a long period of time. In particular, the physical characteristics of each ring (width and early wood and late wood differentiation) can be used to reconstruct past environment conditions. This study explores the effect of water limitation on tree growth for two conifer species (Longleaf pine and Slash pine) at the Austine Cary Memorial Forest in Florida. By looking at the growth rings of over five decades, we can understand how a tree responds to such stresses. Physiological responses of trees will be evaluated for two conifers species, i.e. Longleaf pine and Slash pine, giving the opportunity to compare the two species and understand how each species (Longleaf pine and Slash pine) adapt their water use to thrive in such extreme environments. Growth data will then be related to the intrinsic Water Use Efficiency (δ WUE, i.e., ratio of carbon assimilated relative to stomatal conductance), derived by stable carbon isotope composition ($\delta^{13}\text{C}$) in tree rings, as one of the main tasks included in a NASA-funded project focusing on assessing changes in WUE across the several forests in Northern America.

**METHANE AND CARBON DIOXIDE PRODUCTION RATES IN LAKE SEDIMENTS FROM
SUB-ARCTIC SWEDEN**

Joel DeStasio and Ruth Varner
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(Abstract not available at this time)

DETECTION OF ADHESION MOLECULE EXPRESSION IN THE BOVINE CORPUS LUTEUM

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The corpus luteum (CL) is an ovarian structure that develops from virtually nothing to a functional endocrine tissue capable of supporting pregnancy through the secretion of progesterone. In the absence of pregnancy, the CL undergoes regression, facilitating the onset of the next estrous cycle. In the present study, immunohistochemical (IHC) staining was used to characterize two factors thought to contribute to regression of the CL: (1) expression of adhesion molecules for immune cells, and (2) an influx of immune cells. Initial experiments in which CL from early, middle, and late stages of the bovine estrous cycle were obtained indicated little IHC staining for the adhesion molecules P-Selectin (P-Sel) and intercellular adhesion molecule-1 (ICAM-1) at any stage despite an accumulation of CD45-positive (CD45+) immune cells in middle and late stage CL. Conversely, experiments in which CL collected from cows undergoing induced luteal regression revealed stronger IHC staining for P-Sel, ICAM-1, and a 3-fold increase in CD45+ cells in several instances. Currently we are testing the hypothesis, using cell culture, that endothelial cells of bovine CL express P-Sel and ICAM-1 in response to acute inflammatory challenge. Adhesion molecule expression is anticipated to precede and facilitate immune cell accumulation into the bovine CL during regression. Supported by the Hamel Center for Undergraduate Research (BTG) and USDA Multi-State Project NE-1227 (DHT).

**THE HUMAN PLATELET GLYCOME: STRUCTURAL ANALYSIS REVEALS
GLYCOCONJUGATES IMPACTING PLATELET STORAGE AND TRANSFUSION**

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Platelets are cell fragments derived from megakaryocytic cells in the human body whose primary purpose is to assist in blood clotting. Platelets are rich in glycoproteins that help to direct where the platelets go in the body and bind it correctly to other platelets and factors in the clotting process. The current storage of blood platelets involves keeping them at room temperature; this has a shelf life of five days. The alternative is to refrigerate the platelets to lengthen their shelf life. In this process the platelets become less effective and are quickly flushed from the body. Acquiring the glycome of the supernatant from the platelet plasma and comparing it to the fresh samples can identify the glycans that fell off during storage, and allow for possible solutions to be explored.

RPA1B AND RPA1D GENES ARE REQUIRED FOR NORMAL DNA REPLICATION AND EFFICIENT PROGRESSION OF MEIOSIS IN *ARABIDOPSIS THALIANA*

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Replication Protein A (RPA) is a single-stranded DNA (ssDNA) binding protein composed of three subunits RPA1, RPA2, and RPA3. RPA heterotrimers are required for a wide range of DNA metabolism activities, including DNA repair, replication, and recombination. In the model plant *Arabidopsis thaliana*, RPA1 is encoded by a five-member gene family (RPA1A-E). We hypothesize that this RPA1 gene family represents a division of function to accommodate differential RPA regulation in plants. Our previous studies have indicated RPA1-A, RPA1-C, and RPA1-E are involved in repair and recombination, while RPA1-B and RPA1-D are involved in DNA replication. The *rpa1a rpa1c* double mutant is completely sterile due to defective recombination and synapsis during meiosis. In addition to a growth and developmental abnormality due to a defective DNA replication, the *rpa1b rpa1d* double mutant is partially sterile. Thus, we hypothesized that RPA1-B and RPA1-D may have a role in meiotic progression. To test this, we compared meiotic chromosome spreads of the *rpa1b rpa1d* mutant with DAPI with WT. The results revealed no obvious differences in meiotic chromosome integrity, suggesting that partial sterility could be due to the overall growth and developmental defects caused by abnormal DNA replication and cell division. Alternatively, it is possible there are subtle defects in meiosis that we could not detect or a downstream process that affects meiotic progression in *rpa1b rpa1d* mutants indirectly.

**THE DISTRIBUTION OF FITNESS EFFECTS VARIES FOR DIFFERENT REPLICATION
ERRORS IN *VIBRIO FISCHERI***

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Genetic mutations are the ultimate source of the biological diversity on which natural selection acts, but the vast majority of these mutations are harmful. As such, mutations lead to disease states like cancer, extinction of small populations, and can drive pathogen evolution. Unfortunately, because mutations are rare and past studies have been subject to detection biases, very little is known about the distribution of fitness effects from naturally occurring mutations. In this study, we used mutation accumulation and full genome sequencing to capture naturally occurring mutations before they were exposed to the sieve of natural selection in *Vibrio fischeri*. We then measured the effects of these mutations on the fitness of the individuals harboring these mutations. We hypothesized that deletions and insertions would be more detrimental to fitness than base substitutions, particularly in the coding regions. Additionally, we expect to show that mutations on the more conserved primary chromosome will have more harmful effects than mutations on the accessory secondary chromosomes. Ultimately, these results will broaden our understanding of the distribution of mutational effects and determine whether specific sites in the genome are more susceptible to deleterious variation.

**IDENTIFYING MUTATIONS IN GENES CAUSING SODIUM-DEPENDENT ROOT
SKEWING IN *ARABIDOPSIS THALIANA***

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Multiple genes and pathways are involved in directing growth and stress responses in plant roots. For example, under salt stress, protein phosphatase 2A (PP2A) is critical for maintaining root structure. Mutations in several of the genes encoding subunits of PP2A cause a sodium-dependent root skewing phenotype. To further understand this signaling pathway, more mutants need to be identified. Publicly available collections of *Arabidopsis thaliana* T-DNA mutants were used to screen for new mutants with a sodium-induced root skewing phenotype. TAIL-PCR followed by DNA sequencing was used to identify the mutation site in the *A. thaliana* genome. The locations of T-DNAs in three *srs* mutants have been found so far. The *srs-1* mutation appears to be in the inter-genic region between genes encoding phosphatidylinositol-4-phosphate 5-kinase and the U2 snRNP auxiliary factor, a T-DNA in *srs-2* is located between genes *JAC2* and *RRA2* and in *srs-3* between a pseudogene and a gene with an unknown function. Progress toward determining the T-DNA insertion site of the other mutants identified in the screen will be reported.

**TREATMENT WITH MORTALIN-TARGETED AGENTS WILL PROMOTE NUCLEAR
TRANSLOCATION OF P53 AND APOPTOSIS OF KG-1 ACUTE MYELOGENOUS
LEUKEMIA CANCER CELLS**

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Acute myelogenous leukemia (AML) is a cancer characterized by the production of abnormal myeloblasts in bone marrow. The cause of the tumor is unknown, but sequestration into the cytoplasm and subsequent inactivation of the transcription factor p53 has been documented and proposed as a contributing factor. This transcription factor plays an important role in promoting expression of genes that regulate cell cycle arrest, DNA repair, and apoptosis or programmed cell death, so its inactivation can have fatal consequences. In other animal cancers (clam leukemia and human colon carcinoma), it has been shown that the protein mortalin is responsible for the cytoplasmic sequestration of p53. Similar observations have not been made for AML. The purpose of my study was to determine if mortalin is involved in cytoplasmic sequestration of p53 in the AML cell line KG-1 by using two mortalin-targeted agents that compete with p53 for the binding site in mortalin. These were the cationic dye MKT-077 and the plant-derived anti-cancer agent known as withanone. Treatments of both compounds visibly affected the cells, as noted by data acquired through immunocytochemistry and apoptosis assays. Data resulting from this study may be able to shed light on the molecular basis for AML and might lead to the development of non-invasive targeted therapies for patients diagnosed with this type of cancer.

EVALUATING THE HEALTHFULNESS OF UNH'S VENDING MACHINES

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Food and beverage products sold in vending machines at schools and on campuses have been implicated as a contributing factor to the obesity epidemic we face today. Several assessment tools have been developed to evaluate the variety, price, and healthfulness of vending machine products. The goal of this project was to characterize the availability of healthy snacks and beverages sold in vending machines on the UNH campus. To meet this goal, three vending audits were used: Syracuse University's (SU) Quick Audit, SU Detailed Audit, and Nutrition Environment Measures Survey Vending Protocol (NEMS-V). In February 2014, audits were completed using photographs taken of twenty one vending machines (nine snack and twelve beverage) located in eight UNH buildings (four residential, two academic, one student union, and one recreation center). The healthfulness of each vending item was evaluated via a nutrient density scoring tool. Of the beverage machines evaluated, 24.6% of the slots available for purchase were rated healthy. Among the healthy beverages, variety was available for 51.7% of the slots. Of the snack machines, 27.7% of the slots available for purchase were rated healthy. Among the healthy snacks, variety was available for 61.8% of the slots. The main finding of this audit was that the majority of snacks and beverages available to UNH students via vending machines on campus are of minimal nutritional value.

EXAMINING THE TUMORGENIC ABILITY OF CYTOKERATIN 8/18 FILAMENTS IN CERVICAL CANCER CELLS *IN VITRO*

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Cervical cancer is the second-leading cause of cancer-related death among women. Infection of the cervix by the human papillomavirus (HPV) often leads to cervical cancer. However, the cellular mechanisms by which HPV-infected cells proliferate, migrate, and evade immune attack during metastasis are relatively unknown. We have determined that certain cervical cancer cells (i.e., HeLa cells), not only contain HPV but also have two distinct characteristics: some cells readily express cytokeratin 8/18 filaments (K⁺ cells), while others do not (K⁻ cells). The question posed in this study is: *What is the rate of proliferation and motility between K⁺ and K⁻ HeLa cells, and is the K⁺ cell more aggressive in its growth?* Accordingly, growth experiments over seven days of culture indicated the K⁺ cells multiplied faster than the K⁻ cells (1.3 ± 0.5 vs. 0.8 ± 0.4 doublings per day, respectively), and had a shorter generation time (0.85 ± 0.25 vs. 1.4 ± 0.71 days, n= 3 experiments). These observations suggest K⁺ cells have greater tumorigenic potential than K⁻ cells that comprise HeLa cell populations. Future plans are to conduct an assessment of cell motility and aggressiveness using wound-healing and cell migration assays. The results are anticipated to provide a better understanding of how keratin filaments influence HeLa cell physiology beyond simply being a diagnostic measure of cervical cancer. Supported by the McNair Scholars Program (SP) and the COLSA Karabelas Fund (DHT).

**THE EFFECTS OF PHOSPHODIESTERASE (PDE) INHIBITORS ON CHEMOTAXIS
ALONG A SALT GRADIENT IN *C. ELEGANS***

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Plant parasitic nematodes cause an estimated 80-100 billion dollars in damage per year to American agriculture by infecting major commercial crops. Current methods of controlling nematodes are unsafe and ineffective; it is therefore important to discover new ways of minimizing damage caused by parasitic nematodes. One potential new target is a family of enzymes, phosphodiesterases (PDE). PDEs are present in all vertebrate and invertebrate species and are important for regulating many cell signaling pathways. PDE inhibitors have been developed with highly specific targets in humans. Since PDEs are absent in plants, using PDE inhibitors as nematicides would reduce adverse environmental effects. We have shown that treating a nematode commonly used in research, *C. elegans*, with PDE inhibitors caused a significant decrease in general motility. These effects were seen with inhibitor compounds that target three PDEs found in nematodes. We hypothesize that one or more of these PDE inhibitors will also disrupt chemosensation. Since plant parasitic nematodes find their host plants by responding to chemical signals given off by plant roots, disrupting this sensory pathway with PDE inhibitors may lead to development of specific compounds that would selectively disrupt chemotaxis in plant parasitic nematodes and protect crops from their damaging effects.

THE PRODUCTION OF DECAFFEINATED TEA PLANTS

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With the recent escalation in concern about the adverse effects of caffeine on human health, there is a market for decaffeinated tea. Current industrial techniques used to extract caffeine result in tea lacking in flavor and nutrients. By genetically modifying the synthesis of caffeine in the common tea plant, *Camellia sinensis*, caffeine production can be turned off (or reduced) and a naturally-decaffeinated product can be produced. Caffeine synthase (CS) is the primary enzyme responsible for caffeine biosynthesis in tea. The gene responsible for coding this enzyme has been previously cloned by the Minocha Lab at UNH. The CS gene has been further modified by an undergraduate student in the lab to make it ready for transfer into *Agrobacterium tumefaciens*. Moving forward, it is necessary to ensure the functionality of the gene by adding it to a bacterial expression vector. Once confirmed, an antisense version of the gene can be made. The transcript (RNA) of the antisense gene when combined with the wild type CS mRNA in the plant, will lead to the latter's degradation, thus inhibiting the production of caffeine in the cells. This antisense version of the gene will then be transferred into the plant cells, which will be grown into transgenic* plants that will later be tested for caffeine production.

EVALUATING DNA EXTRACTION FROM ARCHAEOLOGICAL ATLANTIC COD BONE

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Atlantic cod populations in the Gulf of Maine are at an all-time low and not rebounding despite drastic quota reductions. Fishery management applies a two-stock model to Atlantic cod. Biological evidence, however, exists for a minimum of three distinct cod populations. It is also hypothesized that additional distinct populations were lost from the Eastern Gulf of Maine, which at present has no spawning cod. The loss of these locally adapted populations may have implications for their reduced recovery potential. In this study, I used modern cod bones to validate a methodological approach to extract and amplify DNA from bone. Bone was ground into a fine powder with a cryogenic grinding mill and extractions were performed in a separate, dedicated "ancient DNA" lab using quality control procedures. This is necessary because DNA in ancient samples is low quality and is also very prone to contamination. Amplifications were performed using PanI, (a nuclear gene) and cytochrome B (a mitochondrial gene). After validation, these methods are being applied on archaeological cod bones collected from four sites in New Hampshire and Maine spanning the time period from 5,000 years ago to the mid 1800's. The DNA sequence data will be used to reconstruct the Atlantic cod populations in the past. These findings will then be applied to modern Atlantic cod in order to better manage current populations.

WHAT DOES AN OIL-SPILL FROM THE MONTREAL TO PORTLAND PIPELINE MEAN FOR WATER QUALITY IN NEW ENGLAND'S RIVERS?

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Plans are underway for tar sands to flow through the Portland-Montreal Pipeline (PMPL). A tar sands spill will negatively impact the services provided by the ecosystems it contaminates. This research focuses on identifying and valuing at risk freshwater and agriculture in New Hampshire. Our analysis shows a total ecosystem services value of approximately \$15 million. This represents a minimum value of the services. Cultural importance, drinking water and recreation are among the undervalued services. There are also unaccounted for downstream ecosystems in Maine and Vermont. As next steps, our research expands this model along the rest of the pipeline. The broader research is shared with communities along the pipeline for feedback and to raise awareness about the importance of the ecosystems at risk.

EVALUATING THE PLASMA FREE AMINO ACID DOSE-RESPONSE METHOD TO DETERMINE THE CONTENT OF METABOLIZABLE METHIONINE IN A RUMEN-PROTECTED METHIONINE SUPPLEMENT

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The primary objective of this experiment was to confirm linearity in plasma Met response with up to 24 g/d of supplemental MP-Met by abomasal infusion or feeding a RP-Met product. A secondary objective was to determine if technique precision could be improved by including the other plasma sulfur AA with Met (total sulfur AA) as an indicator of Met absorption. Five rumen-cannulated lactating Holstein cows, fed a Met-deficient diet, were assigned to a 5 x 5 Latin square with 7-d experimental periods. Treatments were 0 g/d Met (negative control), 12 and 24 g/d abomasally infused Met, and 12 and 24 g/d of assumed MP-Met from a RP-Met supplement. Blood samples were taken from the tail vein every 2 h, 4 times daily, the last 3 d of each period, centrifuged, deproteinized, and composited into 1 daily sample/cow. The basal diet was confirmed to be Met-deficient by observed increases in milk protein concentration with the first level of both infused and fed Met. All plasma sulfur AA responded in a significant linear fashion to both infused and fed Met. Estimates of the MP-Met content of the RP-Met supplement were the same using either plasma Met or plasma total sulfur AA. The plasma free AA dose-response method is applicable for determining the MP-Met content of RP-Met supplements.

FECAL STEROID ANALYSIS FOR MONITORING REPRODUCTIVE STATUS IN CAPTIVE ANIMALS

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New England wildlife populations are facing various anthropogenic threats including habitat loss and over-hunting. A better understanding of critical life history traits, including reproductive status, in captive animals will facilitate federal reestablish efforts within feral conspecifics. Traditionally, blood, saliva, and urine samples are used to monitor health and reproductive status. However, obtaining these samples from large-bodied animals is often impractical, stressful, and dangerous to the animals and handlers. Thus, a noninvasive method such as measuring reproductive hormones in feces is a potentially safer and more feasible alternative. The current study will assess if the major reproductive hormones, progesterone, estradiol and testosterone, are detectable within feces of captive male and female bobcat (*Lynx rufus*; n=3) and American black bear (*Ursus americanus*; n=3) housed at Squam Lake Science Center. Following collection, fecal samples were freeze-dried and steroid hormones were quantified by radioimmunoassay. Preliminary results suggest that fecal progesterone concentrations ranged from 116-400 pg/g and 69-430 pg/g in the bobcat and black bear, respectively. Currently, samples are being analyzed for the other two steroids. We hope that the profiles of these steroid hormones are reflective of the reproductive status of these animals. (Supported by a McNair Fellowship)

FACTORS INFLUENCING PROGRAMMED CELL DEATH (*APOPTOSIS*) OF HUMAN OVARIAN GRANULOSA TUMOR CELLS

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Ovarian failure is a cause of infertility often attributed to programmed cell death, or apoptosis, of granulosa cells and follicular atresia. The mechanisms by which granulosa cells remain resistant or become sensitive to apoptosis, however, are unclear. Here, the hypothesis that apoptosis occurs via the death receptor Fas, and that keratin 8/18 (K8/18) filaments comprising the cytoskeleton provide resistance to Fas-induced apoptosis, was tested. Experiments using KGN cells (a human granulosa tumor cell line) indicated that these cells are resistant to Fas-induced apoptosis, yet become sensitized (a 10-fold increase in cell death, $P < 0.05$) by cycloheximide, a protein synthesis inhibitor ($n = 6$ expts). Genetic silencing of K8/18 filaments in KGN cells via siRNA reduced K8/18 expression ~63% and enhanced Fas-induced apoptosis (a 3-fold increase in cell death, $P < 0.05$) compared to Lipofectamine and scrambler siRNA controls ($n = 4$ expts.). Most recently, a preliminary examination of KGN cells by flow cytometric analysis hinted that siRNA knockdown of K8/18 filaments also enhanced the expression of Fas on the cell surface. Thus, the results suggest labile protein(s) and K8/18 filaments provide resistance to Fas-induced apoptosis, possibly by impairing the expression of Fas receptor on the cell surface. Supported by USDA grant 2007-35203-18074.

A COMPARISON BETWEEN THE SULFUR HEXAFLUORIDE TRACER TECHNIQUE AND THE PORTABLE AUTOMATED HEAD CHAMBER SYSTEM FOR MEASUREMENT OF ENTERIC METHANE EMISSIONS FROM MID-LACTATION HOLSTEIN COWS

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The sulfur hexafluoride tracer technique (SF_6) is the most commonly used method for measurement of methane emissions from dairy cattle. This technique is known to be laborious and yield variable results. The portable automated head chamber system (GF) is a less laborious method, but has not been compared to methods that are already in place. The objective of this study was to evaluate the concordance correlation coefficient (CCC) and variability (CV) between the SF_6 and GF methods. Sixteen lactating Holstein cows housed in a tie-stall barn at the UNH Fairchild Dairy Teaching and Research Center were blocked by feed intake as a percentage of body weight into two treatments: restricted intake (90% of feed intake) or free choice intake according to a crossover design. Experimental periods lasted 22 days, with 14 days for treatment adaptation and 8 days for data collection. Two 5-minute measurements spanned 12 hours apart were taken from all animals using the GF method. A circadian methane emission profile was achieved through advancing gas sampling by 2 hours from one day to another, yielding a total of 14 methane measurements/cow. Data collection for the SF_6 technique was done twice daily before milking for each cow. Between treatments, there was no significant difference in methane emissions. Results were more variable using the SF_6 technique versus the GF method. When compared, the two methods had low concordance, suggesting that further investigations are required.

EXPLORING NOVEL GENETIC TOOLS FOR *GEODERMATOPHILACEAE*

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The development of genetic tools is useful for understanding physiology and regulation mechanisms behind genes. Currently, there are no genetics tools available for *Blastococcus saxobidens* and *Modestobacter multiseptatus*, members of the family Geodermatophilaceae. These stone-dwelling actinobacteria damage many historically important monuments and are known to inhabit a spectrum of environments including arid deserts and tundras. Despite their diverse growth conditions, their physiology and genetic background have not been explored in detail. Recently, sequenced genomes for *B. saxobidens* and *M. multiseptatus* provide the necessary foundation for identifying a novel genetic approach. Transposon-based vectors that were successfully used in closely related actinobacteria *Mycobacterium*, *Nocardia*, and *Rhodococcus* were explored to establish a potential methodology. As an alternative approach, a suicide- transposon-based vector was also tested. Unfortunately, these techniques did not allow for plasmid uptake or integration of the transposon into the *B. saxobidens* or *M. multiseptatus* genome. Further optimization is required to establish a successful genetic approach for studying these organisms.

DIABETIC CONDITIONS AND ATHEROGENIC CELLULAR EVENTS *IN VITRO*Chijioke Okereke¹ and Thomas Foxall²¹Department of Molecular, Cellular, & Biomedical Sciences, UNH²Department of Biological Sciences, UNH

This study investigated the effects on the expression of an adhesion molecule, an initial event in inflammation, by aortic endothelial cells when exposed to diabetic conditions *in vitro*. Atherosclerosis, an inflammatory disease of the arteries, is the basis for cardiovascular disease (CVD) which is the primary cause of morbidity and mortality in developed countries. Diabetes greatly accelerates atherogenesis. With increased levels of obesity, causing increased rates of type II diabetes, there will be increased levels of atherosclerosis. Porcine aortic endothelial cells (PAEC) were cultured to confluent monolayers in multi-well plates and exposed for 24 and 48 hours to two diabetic conditions: hyperglycemia (200 mg/dL), dyslipidemia and both together. Culture medium and cell lysates were collected and assayed by ELISA for VCAM-1 adhesion molecules expressed by injured or dysfunctional PAEC. Controls were normal culture medium alone and with pro-inflammatory TNF-alpha. Comparisons were made between treatments within each time point and between time points. While an increased amount of proteins were expressed by cells treated with hyperglycemic conditions, dyslipidemic conditions had a more significant impact on the expression of VCAM-1.

DRUG METABOLIZING ENZYMES IN RAT LIVER AND THEIR ROLE IN VITAMIN D INACTIVATION

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Synthetic chemicals, including the flame-retardant chemicals polybrominated diphenyl ethers (PBDEs), migrate from the environment into the human body. Once in the body, PBDEs increase the activity of liver drug metabolizing enzymes, including those belonging to the Cytochrome P450-3A (CYP3A) family. CYP3A metabolizes PBDE, but can also inactivate Vitamin D. It is unknown if PBDEs promote Vitamin D deficiency. My research project tested the hypothesis that rats exposed to PBDEs would have increased liver CYP 3A activity and Vitamin D inactivation, compared to control. Eight male, Wistar rats weighing 50-75 grams were orally administered 14 mg/kg/day PBDEs; 8 rats served as controls. After 28 days rats were euthanized, livers removed, and membranes containing CYP3A activity (microsomes) prepared. At the end of the 28 day period the rats ranged in weight from 281.5 g to 369 g. The livers ranged in weight from 10.8 g to 16.3g. CYP3A activity in liver microsomes from PBDE-treated rats was 28-fold greater than that from control rats. Experiments to measure inactivation of Vitamin D by microsomes from PBDE-treated rats vs. controls are in progress. This project should add to our understanding of the ways in which environmental chemicals such as PBDEs can affect nutritional status.

THE GLOBAL SYMBIOSIS REGULATOR, GACA, REGULATES THE NITROGEN ASSIMILATION REGULATOR GlnD AND IRON UPTAKE IN *VIBRIO FISCHERI*

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The bacterium *Vibrio fischeri* enters into an exclusive symbiosis in the light organ of the Hawaiian Bobtail squid using global regulation to coordinate many functions necessary for growth in this iron limited environment. Iron uptake has been implicated as a factor necessary for persistence in the light organ, and evidence suggests that the global nitrogen assimilation regulator *glnD* regulates iron uptake and is defective in siderophore, a secondary metabolite involved in iron acquisition. There are multiple lines of evidence including quantitative PCR data that suggest that *glnD* is under the positive control of the global symbiosis regulator GacA and therefore we hypothesized that a GlnD deficiency explains the siderophore defect of a *gacA* mutant. Contrary to our expectations based on this model of regulation, expression of *glnD* through its own promoter did not restore siderophore production to the *gacA* mutant. The GacA protein regulates all traits in its cascade by inhibiting the post-transcriptional repressor RNA *csrA*, which would otherwise block translation of genes involved in *V. fischeri* symbiosis. Analysis of the *glnD* sequence revealed a potential *csrA* binding site that could block its translation and would explain our unexpected result. Ongoing research is examining the function of the putative *csrA*-binding site in regulation of *glnD* expression by GacA and *csrA*, and determining whether GacA regulates siderophore production through the downstream regulator GlnD.

**THE EFFECTS OF DIET ON THE GROWTH AND SURVIVAL OF JUVENILE CHANNELED
WHELKS (*BUSYCOTYPUS CANALICULATUS*)**

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Channeled whelks (*Busycotypus canaliculatus*) are predatory marine gastropods, targeted in a Massachusetts commercial fishery. With increasing dealer prices and increasing fishing pressure, there is potential for this species to be fished to the point of concern in regards to their population. Little is known of the biological parameters of channeled whelk. This experiment studied the effects of three different diets (green crab, fish meat, and blue mussel) on juvenile whelk growth and survival in a laboratory setting. Statistical analysis of whelk length, width, weight, and survival was used to determine which of these diets provided optimal growth and survival. After eight weeks of study, whelks fed green crab had superior growth and survival. This information will assist in developing techniques for culturing whelks on a large scale, with the possibility of using stock enhancement as a mode of sustaining wild populations.

ECOLOGY, NOT HYPERMUTATION, DRIVES UNPREDICTABLE FLUCTUATIONS IN EXPERIMENTAL *PSEUDOMONAS* BIOFILMS

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Thousands of Cystic Fibrosis (CF) patients are chronically infected with *Pseudomonas aeruginosa* every year. These infections are characterized by extensive genotypic and phenotypic diversity that contribute to fluctuations in medically important traits, and unpredictable infections that are difficult to target and treat. To determine the relative importance of genetic variation on this unpredictability, we compared experimental biofilm populations consisting of strains with an elevated mutation rate called mutators or non-mutators. Previous work in our lab has shown that disrupting ecological interactions in populations of mutators can recreate rapid shifts in community composition. To determine if this pattern depends on hypermutation, we examined the effect of disrupting ecological interactions on the community composition in a diverse population of non-mutators. Manipulating cyclic-di-GMP levels in isolates in the third replicate population (B3) show the effects of ecology alone, and this change in isolate function displayed unpredictable reshaping of the community. To summarize, these findings suggest that the structure of a community is built on symbiotic relationships between varying isolates, which drives adaptation, and changes in medically significant traits.

**THE PLEIOTROPIC EFFECTS OF BENEFICIAL MUTATIONS IN ADAPTED
ESCHERICHIA COLI POPULATIONS**

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Mutations that improve fitness in one environment can often be beneficial, deleterious, or neutral in alternative environments. When a single mutation effects fitness in multiple environments, it is said to be a pleiotropic, which can have important consequences for niche specialization, niche expansion, speciation, and even extinction in the face of environmental change. While previous studies have revealed that pleiotropy is nearly universal, the role of adaptive history in the spectrum of pleiotropic effects has yet to undergo detailed experimental observation. Combining the elements of chance and history to gain insight into the pattern of adaptation becomes the focus of this inquiry. By using experimental evolutionary methods to gather beneficial mutations in a marked strain of sex and conjugation-incapable *E. coli* growing in a common substrate over hundreds of generations, the effects of these mutations were tested in multiple sugar environments and compared to the ancestor. It is our hypothesis that the magnitude of the effects will correlate positively with the similarity of resources to glucose, indicating that selective history has an influence in the distribution of beneficial mutations. More broadly, this inquiry may provide answers in to how evolution in a constant environment influences ecological niche formation and constraint.

MARGINAL EFFECTS OF LAND TENURE ON SMALLHOLDER FARMS IN RURAL KENYA

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There has been much research in agricultural economics concerned with factors affecting productivity. Research that has incorporated the qualitative factors of land tenure has found inconclusive evidence of its impact on productivity. This research shows that land tenure may have a positive relationship with production output. Farmers that have legal rights to the land may be more productive. The difference seems to be driven from deeded farmers' greater ability and willingness to take risks and make investments in their operation. Understanding how various land tenure systems impact production is important in developing policies aimed at balancing economic development and food securing in rural agrarian societies.

ROLE OF THE MOLECULAR MOTOR DYNEIN IN TRANSLOCATION OF P53 PROTEIN TO THE NUCLEUS IN THE IMR-32 NEUROBLASTOMA CELL LINE

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It has been widely accepted that the AAA+ ATPase dynein is responsible for translocating the transcription factor p53 to the nuclear membrane, ultimately leading to its nuclear import and apoptosis of the cell. Until now the ability to test this idea has been difficult without a specific cell-permeable, inhibitor of dynein. Recently ciliobrevin has been used successfully to permeate cancer cells and inhibit AAA+ ATPase function. In this study, the function of dynein in translocating p53 protein to the nucleus of human neuroblastoma cells (IMR-32 cell line) will be investigated. Here we will employ IMR-32 cells and inhibit dynein with the specific ciliobrevin analog, ciliobrevin D, followed by treatment with etoposide (a topoisomerase II poison) to induce severe genotoxic stress. Results will be assessed via immunocytochemistry, the TUNEL assay for apoptosis and transmission electron microscopy for both control and treated IMR-32 cells. Although the expected result is that inhibition of dynein will in turn inhibit translocation of p53 to the nuclear membrane and thus inhibit apoptosis, it is possible that apoptosis will occur indicating the presence of another mechanism governing this process. Further studies would be designed to address both of these outcomes. Support from NCI R15 (1R15CA182761-01) to CWW.

EFFECTS OF ROAD CONSTRUCTION ON NEARBY TREES

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Road construction has a clear impact on the surrounding environment that decreases the net urban tree loss. However, what is not known is to what extent construction affects nearby trees, and how exactly the damage occurs (Hauer *et al.* 1994). This experiment studies the extent of damage on trees, specifically Basswoods, due to road construction. Four Basswoods were studied, two Basswoods (1,2) directly next to recent road construction, and two Basswoods (3,4) set back from the road construction. By use of a VIRIS scan, dendrochronology and scanning electron microscope images, all areas of the Basswoods were analyzed. It was found that Basswoods 1 and 2 were extremely water stressed when compared to Basswoods 3 and 4 as a result of the heavy construction vehicles constantly driving over the root systems.

FITNESS ASSOCIATED WITH ADAPTATION TO A NOVEL ENVIRONMENT

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Adaptation to a novel environment is typically expected to come at some cost to the organism. *Burkholderia cenocepacia* is a species of bacteria found in soil, and is an opportunistic pathogen of the lungs of cystic fibrosis patients. To examine the magnitude and extent of these trade-offs, we carried out an experimental evolution experiment using a previously adapted strain of *Burkholderia cenocepacia* to the biofilm lifestyle that has accumulated 7 beneficial mutations. 17 populations were founded by this strain and forced to adapt to a new environment that favors free-swimming. After 20 days of adaptation, 15 out of the 17 populations saw an increase in fitness relative to their ancestor when competed in the environment they evolved in and in entirely new environments. In summary, we did not identify fitness tradeoffs in the environments tested so far. As it currently stands it does not appear that an organism well adapted to its environment has to give up traits when it is adapting to a new environment.

INVESTIGATIONS INTO ALDEFLUOR AS A NOVEL METHOD FOR IDENTIFYING LEUKEMIA IN SOFT-SHELL CLAMS

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The clam species *Mya arenaria* is a common model organism in leukemia research. Currently, the typical method for classifying leukemic from non-leukemic individuals is based on visualization of cell concentration and morphology through light microscopy. This approach is highly qualitative, which makes identification of pre-leukemic and semi-leukemic individuals difficult. A quantitative approach uses flow cytometry to measure levels of aldehyde dehydrogenase (ALDH) expression. In certain human tissues, such as breast tissue, high ALDH expression is a marker for identifying cancer stem cells. The enzyme assay ALDEFLUOR® can actively measure aldehyde dehydrogenase expression in viable cells, but the effectiveness of certain protocol conditions is dependent upon the cell type. This project finds the ideal protocol conditions for the ALDEFLUOR® enzyme assay as an alternative method for classifying *M. arenaria* specimens. It also examines the advantages and disadvantages of both methods, and compares each of them for use in leukemia research, and as an assay for leukemia from field samples. Supported by the UNH Hatch and the National Cancer Institute to C.W.Walker.

THE PRESENCE OF HEMOLYSIN GENES, BUT NOT NECESSARILY HEMOLYTIC ACTIVITY, CORRELATES WITH VIRULENCE POTENTIAL IN CLINICAL ISOLATES OF THE EMERGING ENVIRONMENTAL PATHOGEN *VIBRIO PARAHAEMOLYTICUS*

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Although most strains of the shellfish-associated bacterium *Vibrio parahaemolyticus* (Vp) are harmless, rare variants, typically harboring one or both hemolysin genes (*tdh* and *trh*), have the ability to instill severe gastroenteritis or wound infections in human hosts. In the past decade, the incidence of Vp outbreaks has greatly increased, notably in cold-water regions (where infections were previously rare), perhaps due to changing climate. Hemolysin genes are classically used to identify pathogenic Vp variants, and hemolysis is easily visualized without the use of molecular tools, yet the validity of these traits to define pathogenic potential is ostensible. We obtained clinical strains from Vp outbreaks that occurred in ME, NH, and MA over the last four years, and evaluated 1) the presence of hemolysin genes, and 2) hemolytic activity in order to examine whether these traits are conserved amongst pathogens in the region. While most strains contained hemolysin genes (consistent with previous studies), select clinical isolates containing one or both of these genes failed to lyse erythrocytes, which has not been previously reported. Taken together, this suggests that mere presence of hemolysin genes, rather than their associated phenotype, is related to the pathogenicity of clinical Vp strains. Future research will determine how these genes and associated DNA, and not the ensuing hemolytic function of the encoded protein, contributes to virulence in the species.

EVALUATING ATTRACTIVENESS OF BAIT IN THE AMERICAN LOBSTER (*HOMARUS AMERICANUS*)

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Bait is being explored as a potential factor of trap saturation. Bait efficacy in lobster traps is vital to the commercial fishing industry. We hypothesize that bait loses attractiveness over time resulting in less frequent trap entry. In a summer trap study bait quality was manipulated and its impacts on trap catch were evaluated. Lobster trap video (LTV) was used to measure entry rates in correlation to catch. As a result of our summer findings, we are currently quantifying degradation of bait in the lab. Using the LTV and lab data, we will evaluate the attractiveness of bait over time in the American lobster, *Homarus americanus*.

EFFECTS OF KERATIN FILAMENTS ON ERK SIGNALING DURING FAS-INDUCED DEATH OF CERVICAL CANCER (HELA) CELLS

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Survival of cancer cells is influenced by a variety of factors, including physical elements such as keratin filaments. We know HeLa cells containing or lacking keratin 8/18 intermediate filaments (K⁺ and K⁻ cells, respectively) are more sensitive to the death-inducing effects of Fas agonist compared to other cytokines such as tumor necrosis factor alpha (TNF- α) or TNF-related apoptosis-inducing ligand. Additionally, K⁻ cells are more sensitive to Fas-induced death than K⁺ cells (89% versus 71% cell death, $P < 0.05$, $n = 3$ expts.). In the current study we tested the hypothesis that keratin filaments associate with the mitogen activated protein kinase (MAPK) cascade to protect cells from Fas-induced death. To do this, K⁺ and K⁻ cells were exposed to Fas agonist and then to human epidermal growth factor (EGF), known to stimulate MAPK. Fas agonist down-regulated MAPK equally in both cell types, as evidenced by reduced phosphorylated ERK (pERK) expression (~32% less pERK compared to non-EGF-treated controls, $n = 3$ expts.). Conversely, EGF (50ng/ml) reversed this outcome, but again did so equally in K⁺ and K⁻ cells. Intriguingly, K⁻ cells were more responsive to EGF stimulation alone than K⁺ cells, regardless of EGF dose (pERK ~27% higher in K⁻ than K⁺ cells, $n = 3$ expts.). Thus, keratin 8/18 filaments do associate with MAPK to influence ERK phosphorylation and cell survival. Supported by the Hamel Center for Undergraduate Research (AB) and the COLSA Karabelas Fund (DHT).

MILK PRODUCTION OF DAIRY COWS WITH ADDITION OF GRANULATED CANE SUGAR

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The addition of granulated cane sugar to a dairy cow's diet has the potential to alter milk yield and milk components. A total of 18 Holstein cows housed at the UNH Fairchild Dairy were separated into two treatment groups based on days in milk and lactation number. Group one received the control treatment of a total mixed ration diet. Group two was fed an alternative total mixed ration in which granulated cane sugar was incorporated at 2.6% of the daily diet. A period of 21 days was allowed for diet adaption. Milk yields and feed intake of cows were recorded daily. Milk components (protein and fat) were taken every 4 weeks using DHI information, which was obtained before the introduction of the sugar diet and during 5 weeks of the treatment. It is expected that feed intake and milk production would increase due to improved diet palatability. In addition, increases in protein are expected due to increased glucose content available to rumen bacteria. During the study, feed expenses were recorded to determine any effects of sugar supplementation on income over feed costs. Comparisons between alternative diet ingredients are beneficial to dairy producers, as inexpensive ingredients can be utilized to decrease costs while increasing or maintaining milk production. Alternative diets that reduce milk production and lower milk components are often more expensive. By examining the use of unconventional ingredients cost/benefit analysis can be more effectively carried out.

**THE EFFECTS OF GOLD AND SILICA NANOPARTICLES ON HORIZONTAL GENE
TRANSFER IN *ESCHERICHIA COLI***

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Currently nanoparticle research has been under specific investigation for its ability to be a drug carrier for cancer therapy. Nanoparticles, having dimensions of at least one or less than one hundred nanometers, have exhibited many properties much like biological molecules, thus have interested those to further test the dangers of using them. Although there are many benefits to the use of nanoparticles, the environmental and biological impacts are not fully understood. This area sparked our undergraduate research to help understand more about the effects nanoparticles can have on DNA transfer into bacteria and into plants. We are testing the hypothesis that nanoparticles could facilitate the transfer of DNA into bacteria and between bacteria, thus increasing the possibility of exchange of antibiotic resistance genes among bacteria. This could pose a problem at places like hospitals for the production of bacteria that are resistant to multiple antibiotics. We are using *Escherichia coli* and a plasmid, pGLO to study the effects of gold and silica nanoparticles. Our first challenge is to develop a reliable protocol for gene transfer using heat shock and electroporation to introduce DNA into bacteria. The different methods of gene transfer will be quantitatively measured by the presence of green fluoresce protein to mark the cells that have been transformed. The results would indicate either the safety or potential problems with the abundant use of nanoparticles in human health.

HUMMINGBIRD (TROCHILIDAE) SPECIES DIVERSITY AND HABITAT TRANSFORMATION IN NEOTROPICAL CLOUD FOREST

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Many tropical species and their interactions are affected by land transformation. Hummingbirds were studied in Lower Montane Wet Forest in Monteverde, Costa Rica at 1500 meters in three different habitats; open, edge, and interior. Small feeders were set up in each habitat for daily observations. There was no significant difference in the number of species (5, 7, and 7, respectively) or relative activity, as measured by nectar consumption (35.8-39.9 ml), between the three habitats. However, the diversity (H') was significantly greater in the edge ($H'=1.705$) and interior ($H'=1.677$) than the open ($H'=1.45$). Hummingbirds in this area do not seem to be greatly impacted by land transformation, at least very near forest, though two of seven species never left forest or edge. For plants that rely on pollination by strictly forest/edge species, habitat transformation could be important.

**INTEGRATING THE AQUACULTURE OF THE GREEN SEA URCHIN
STRONGYLOCENTROTUS DROEBACHIENSIS AND THE EUROPEAN OYSTER *OSTREA
EDULIS* IN THE GULF OF MAINE**

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A system for integrated culture of the green sea urchin *Stongylocentrotus drobachiensis* and European oyster *Ostrea edulis* was developed and tested at a field site in Little Harbor, a part of Portsmouth Harbor, New Hampshire. Juvenile urchins performed as an effective anti-fouling agent when cultured within oyster cages. System components were tested to determine scalability of this culture method. The solitary tunicate *Ciona intestinalis*, a major contributor to bio-fouling in bivalve aquaculture operations, was analyzed for nutrient composition, and considered as an alternative feed for finfish aquaculture.