Summer Undergraduate Research Experience Symposium

October 18, 2014 | 8:30 am - 12:30 pm

Join us in celebrating the hard work done by our summer undergraduate research students. Learn more about the benefits of working with a faculty member on scholarship and creative arts and celebrate the accomplishments of some of our research students. This event will feature posters and talks by students from the Summer Undergraduate Research Experience (SURE) Program.

8:30am-10:00am	Open House: Poster Presentations *Alfond Science Center, 2nd and 3rd Floors*
10:30am-12:00pm	Oral Presentations *Alfond Science Center, Room 106*
12:30am-1:30pm	SURE Lunch for Students and Families *Refreshments available on the 3rd floor of Alfond Science Center*

Presentation schedule enclosed in program

Poster Presentations

8:30am-10:00am

Summer Undergraduate Research Experience Symposium

POSTER 1

Methanol Extracts of *Ulva lactuca* Harvested from Biddeford Pool Inhibit the Growth of Clinically Relevant MRSA Strains

Presenter: Clay Bolduc

Advisor: Amy M. Deveau

Major: Medical Biology

The macroalgae *Ulva lactuca* is of interest worldwide for its nutrient profile and medicinal potential. Two physically unique macroalgae strains that are believed to be different phenotypes of *Ulva lactuca* were harvested from Biddeford pool in sync with four lunar phases. A comparative extraction strategy showed that methanol fractions, but not KOH/MeOH fractions, exhibit the greatest antimicrobial effect against *Methicillin-resistant Staphylococcus aureus*. Minimum inhibitory concentrations (MICs) of the extracts were assessed when significant inhibition was present. The MICs of the crude extracts against *mrsa* SH1000, *mrsa* USA300, *mrsa* COL, and *s. aureus* newman were comparable to positive antibiotic controls. Pilot data from our study suggest that *Ulva lactuca* from the coast of Maine is a novel source of compounds with interesting antimicrobial profiles that may block robust human *mrsa* strains. Future efforts will be aimed at genetic analysis of the *Ulva* to confirm speciation. Chemical analysis by GC-MS and LC-MS toward the isolation and structural identification of the compound or compounds with antimicrobial activity is also ongoing.

POSTER 2

Effect of Sea-level Rise on Coastal Salt Marshes Mediated by Plant Herbivore Interactions: Spartina Alterniflora and its susceptibility to Littorina Littorea.

Presenter: Rebecca Buchanann

Advisor: Steven Travis

Major: Marine Science

Salt marshes are the most ecologically and economically important ecosystems on the eastern U.S. shore. The dominant plant species found in the low intertidal zone of East Coast salt marshes is Spartina alterniflora, or smooth cordgrass. Due to global climate change, sea-level rise has become a concern regarding the prosperity of salt marshes. To protect these fragile environments, the factors that affect marsh structure, especially anthropogenic factors, must be understood. The gastropod, Littorina littorea, is an invasive snail known to graze on Spartina alterniflora. Recent studies have shown that grazing has an intensified effect when Spartina alterniflora is under stress. This project investigates three stressors: sea level rise, varying input of nutrients, and varying density of the grazer Littorina littorea. Samples of Spartina alterniflora were collected from the Wells National Estuarine Research Reserve, and transported to a lab setting in order to manipulate the three stressors. Data was gathered by measuring the plant heights throughout the growing season, collecting the dead biomass, and assessing damage by grazing. The growing season of Spartina

alterniflora typically ends in October. By analyzing the results, our understanding of the impact of sea level rise, varying nutrient input, and predation on salt marsh persistence will be improved.

POSTER 3

The Impact of Unequal Strand Length on DNA Hybridization in a Model Microarray System via Molecular Simulation

Presenter: Sarah Cooper

Advisor: John Stubbs

Major: Biochemistry

DNA microarrays are systems consisting of single stranded DNA that is bound to a surface, the probe strand, which hybridizes with its complement that is free to move in solution, the target strand. For this work a Monte Carlo molecular simulation study was done to look at the effects of target and probe length as well as sequence on hybridization of DNA microarrays for a 25-base strand with a complementary 10-base strand. Four different surface conditions were in place that tethered the probe to the surface from the 5' end of the long strand, the 3' end of the long strand, the 5' end of the short strand, or the 3' end of the short strand. This project showed that when the probe strand was short and its complementary target had a dangling end away from the surface or when the probe was long and the target was complementary at the end away from the surface, hybridization was enhanced when compared to solution based hybridization. When the probe strand was short and the target was long with a dangling end towards the surface and when the probe strand was long and the target was short and complementary at the bases of the probe near the surface bound end of the probe, hybridization was destabilized when compared to solution data.

POSTER 4

Synthesis of Inducible Compounds in Macroalgae and Their Effect on Human Pathogens

Presenter: Jenna DaCosta

Advisor: Ursula Roese

Major: Medical Biology

Brown algae, *Fucus vesiculosus*, were collected and placed in filtered sea water with supplemental air flow and light while being exposed to one of three treatments. Isopod treated algae underwent herbivory by 11 isopods, *Idotea baltica,* snail treated algae underwent herbivory by 10 *Littorina littorea* snails and controls lacked any visible herbivores. After being treated for 6 days, volatiles were collected from algae for three hours. Algae samples were then frozen, ground up, and extracted. Volatiles and extractions were run by the GC-FID and GC-MS for separation and identification. In field experiments in Biddeford Pool, the algae were exposed to one of three treatments: Methyl jasmonate (MeJA), artificial damage (ART), or control (CTRL). MeJA treated algae were exposed to methyl jasmonate for two hours and the ART treated algae were inflicted with cuts along the algae thallus and compared to uninjured CTRL. Samples were collected from the field after 6 days. Samples were frozen and extracted using methanol and pentane, and extracted solutions were pipetted onto a sterile disk. Bacteria was swabbed onto an agar plate and five disks containing either algae extract in methanol or pentane, pure methanol or pentane, and one of two antibiotics, Chloramphenicol or Ampicillin, were added onto the plate. Plates were incubated overnight and the zone of inhibition was measured.

POSTER 5

"Optimizing the Parameters for Photolysis of Naphthyl Benzoate and Naphthyl Pivalate"

Presenters: Andrew Diorio and Colbey Bowen

Advisor: Amy Keirstead

Major: Chemistry

The photo-Fries reaction is a system that can be used to study the cage effects of various media. Cage effects are a measure of restriction for molecules and can dramatically influence the outcome of a chemical reaction or the efficiency of a device like a switch or sensor. In our research group, we are interested in studying the cage effects of ionic liquids, which are thought to be good for applications such as molecular electronics and dye sensitized solar cells. However, before the cage effects can be studied in these media, the reaction must be carried out and the parameters optimized in traditional solvents for direct comparison. In this research project, two naphthyl esters (naphthyl benzoate and naphthyl pivalate) were dissolved in hexanes and subjected to photolysis using UVC light to initiate the photo-Fries reaction. The product mixture (photoproduct distribution) was analyzed by gas chromatography-mass spectrometry (GC-MS), and variables for the optimization process included concentration, irradiation times and method development for the GC-MS. The photophysical parameters (absorption spectrum and extinction coefficient) were also measured for the two esters. These results can be used to design experiments that employ these naphthyl esters and that measure the cage effects of ionic liquids.

POSTER 6

Lactic Acid "Probiotic" Bacteria Reduce Host Cell Cytotoxicity Induced by the Bacterial Pathogen Salmonella enterica Javiana

Presenter: Dylan Fletcher

Advisor: Kristin Burkholder

Major:Neuroscience

Salmonella enterica is a foodborne bacterial pathogen that causes the intestinal disease Salmonellosis in humans. Recently, a previously rare strain of Salmonella enterica, S. enterica Javiana, has emerged as a leading cause of deadly Salmonellosis in the United States. However, since S. Javiana is a recently-discovered agent of human disease, little is known of its mechanisms of pathogenesis or of potential ways to limit infection. Because S. Javiana possesses toxin genes not found in other strains of S. enterica, we sought to evaluate the pathogen's potential cytotoxic effect on human intestinal epithelial cells by comparing its cytotoxicity with that of other common strains of S. enterica, such as S. Typhimurium. We also evaluated the potential inhibitory effect of lactic acid bacteria (LAB), including Lactobacillus acidophilus, Lactobacillus plantarum, Lactobacillus rhamnosus, Lactobacillus casei and Lactobacillus mesenteroides, on S. Javiana-induced cytotoxicity. Cytotoxicity assays, which measured lactate dehydrogenase release from the mucus-secreting intestinal epithelial cell line HT29-MTX, revealed that S. Javiana induces greater damage to host cells than either strain of S. Typhimurium tested. Further, S. Javiana-induced cytotoxicity was reduced by pre-treating HT29-MTX cells with L. rhamnosus, L. acidophilus or L. mesenteroides prior to infection with S. Javiana. Data suggest that certain species of LAB may be useful as probiotics if taken to reduce incidence or severity of S. Javiana Salmonellosis. Ongoing studies aim to further characterize the strategies used by S. Javiana to damage or infect host cells, as well as mechanisms by which lactic acid bacteria prevent S. Javiana-induced cytotoxicity.

POSTER 7

Assessing Reproductive Steroid Hormone Concentrations in Shark Species Captured off the Coast of Southern Florida

Presenter: Michelle Furbeck and Erin Mohr

Advisor: James Sulikowski

Major: Marine Science

Worldwide, shark species are experiencing a decline in population due to various human activities such as: loss of habitat, overfishing, and incidental bycatch. As K-selected species, sharks display slow growth, late maturation, long gestation, and low fecundity. Due to a lack of knowledge of these characteristics, specifically reproduction and its associated hormones, it has become crucial to expand our understanding for conservational purposes. Typically, lethal sampling is used to collect reproductive data, but with recent declines in shark populations, non-lethal methods such as circulating plasma steroid hormones are favored. Therefore, this research being conducted involves using steroid hormone analysis by radioimmunoassay to determine the amount of estradiol, progesterone, and testosterone present in the plasma of five different shark species found off the southeast coast of the United States. The values obtained will be used to predict the sexual maturity or reproductive state of these shark species, which include bull, lemon, blacktip, sandbar, and hammerhead sharks. This data will then be combined with other research techniques such satellite telemetry for aid in conservation purposes.

POSTER 8

Diet Composition of Grey Seals (Halichoerus grypus) in the New England Area from Fecal Analysis

Presenter: Katelyn Gilbert

Advisor: Kathryn Ono

Major: Marine Science

New England Grey Seal (Halichoerus grypus) diet composition can be determined from collecting Grey seal scat samples and conducting a hard-part analysis of fish otoliths (fish ear bones) and cephalopod beaks. Four samples from Mount Desert Rock, ME (MDR) collected during the winter 2014 breeding season and 16 samples from Cape Cod, MA collected in the winter of 2012 and 2013, and summer 2014 were analyzed. Hard-part analysis included identifying the species of fish from the otoliths collected based on shape and pattern viewed under a microscope. Count data for each identified species and hard-part found were recorded for future statistical analysis. Preliminary data shows that Grey seal diet in New England is variable. Samples from MDR contained mainly Horseshoe crabs (Limulus polyphemus), Silver Hake (Merluccius bilinearis), and Redfish (Sciaenops ocellatus) while samples from Cape Cod contained large amounts of sand, plant matter, worms, various crab species, Red Hake (Urophycis chuss), and White Hake (Urophycis tenuis). In addition, 32 very degraded otoliths remain to be identified with the help of experts at Woods Hole Oceanographic Institution (WHOI). Future statistical evaluation of scat samples will include Relative Abundance (RA) and Percent Biomass (PB) to help describe the overall diet and percent of the species in the diet consumed and represented. I am also working on the articulation of an adult male Grey seal skeleton. From reconstructing this skeleton, a better understanding of the anatomy and evolution of this species can be obtained.

POSTER 9

Glass Bottom Boat (*gbb)* is Necessary in the Pain Sensitization Pathway in *Drosophila*

Presenter: Kayla Gjelsvik

Advisor: Geoffrey Ganter

Major: Medical Biology

The purpose of this research was to characterize how nociception is modulated and to identify target molecules involved in pain response pathways using *Drosophila melanogaster,* the common fruit fly, as a genetic model. The ultimate goal is the development of better drugs to treat acute and chronic pain in humans. My project tested a candidate molecule believed to be required for pain sensitization. My hypothesis was that when flies are deprived of the candidate molecule*, gbb*, through the RNAi knock-down approach, those mutant flies will not sensitize when treated with UV light compared to their parental controls. If my hypothesis is supported, then drugs can be identified that block the activity of this candidate molecule, thereby blocking the sensitized pain state. The approach used genetically manipulated flies and RNA interference to knock down *gbb* gene expression. Sensitization was then induced using UV light to damage the epidermis of the flies, followed by touching the damaged area with a normally non-noxious thermal stimulus. The flies were thus tested for the production of sensitized pain states such as allodynia, or a pain response to a normally non-noxious stimulus. The results were analyzed using Fisher's Exact Test and the hypothesis was supported such that the *gbb* mutants did not sensitize following UV treatment.

POSTER 10

Incidental Finfish Bycatch in the Gulf of Maine Commercial American Lobster (*Homarus americanus*) Fishery

Presenter: Blaise Jenner

Advisor: James Sulikowski

Major: Marine Biology

The commercial American lobster (*Homarus americanus*) fishery is economically the largest fishery in the State of Maine with commercial landings in 2010 worth an estimated $318 million and resulting in 2.95 million trap tags. The bycatch of fin fish, including commercially in this fishery is not considered in management assessments because of low observed bycatch important species such as Atlantic cod (*Gadus morhua*). However, observations with a local lobsterman described that bycatch data may be underrepresenting actual bycatch in the American lobster fishery. Through collaboration with the local lobsterman, bycatch data has been collected on 41 routine trips during the summer of 2014, displaying that over twice the expected number of Atlantic cod were caught as bycatch in lobster pots. The higher than expected Atlantic cod bycatch may be potentially detrimental to the rebuilding of cod populations in the Gulf of Maine. Recent management plans have reduced Atlantic cod annual commercial harvest dramatically with no sign of the population recovering. This trend indicates that other factors such as bycatch mortality in the lobster fishery may be contributing to the declining cod population. However, more research is needed to definitively assess whether bycatch mortality in other gear types may be having an impact on Atlantic cod populations.

POSTER 11

Protagonist Goal Monitoring in Participants with Mild Cognitive Impairment and Normal Cognitive Functioning

Presenter: Benjamin Katz

Advisor: Jennifer Stiegler-Balfour

Major: Psychology

For successful comprehension, readers must be able to detect and monitor the goals of a protagonist. In this current study, we examined whether decline in cognitive functioning (as measured by scores on the Montreal Cognitive Assessment (MoCA)) in elderly participants would influence their ability to monitor the goals and actions of a protagonist. Based on data collected thus far, individuals with lower scores on the MoCA tend to be less sensitive to subtle nuances of written text such as detecting small inconsistencies. Further analyses determined that the attention and language sub-scales of the MoCA are most predictive of losing the ability to comprehend text effectively.

POSTER 12

Temperature Effect on Behavior and Neurological Development of the Little Skate (Leucoraja erinacea)

Presenter: Melanie Kolacy

Advisor: James Sulikowski

Major: Marine Biology

Previous research suggests that in the Gulf of Maine the sea surface temperature has increased around 2 ˚C over the past 45 years and is estimated to increase approximately another 2 ˚C in the next 70 years. Oviparous (egg-laying) elasmobranchs (skates, rays, and sharks) are poikilothermic , where their body temperatures fluctuate along with their external environment. Recent research has concluded that little skate eggs deposited and raised in warmer temperatures have shorter gestations and higher mortality rates. My project uses the little skate to investigate possible connections between increasing SST to behavioral and neurological development in elasmobranchs and how this relates back to survivability. Oviposited eggs from a captive breeding stock are equally divided into two separate conditions in lab. One group of egg cases is held at ambient temperature conditions with flow-through seawater from the Saco Bay, while the second condition simulates an elevated temperature condition of 5 ˚C above the ambient temperature. After hatching in these conditions, each little skate is tagged and measured. Differences in behavior are assessed using four assays; foraging, tap-startle reflexes, space use, and activity levels. Their behavior is tested in group and individual settings. Once the behavioral experiments finish, the brains of the specimen used in these trials are dissected and histologically processed to identify any morphological differences. If current temperature trends continue, the resulting effect from neurological differences could potentially result in overall lower survivability for oviparous elasmobranchs in the GOM and worldwide.

POSTER 13

Evaluating the Management Implications of Discard Mortality in the Gulf of Maine Recreational Atlantic cod (Gadus morhua) Fishery

Presenter: Joseph Langan

Advisors: James Sulikowski, James Quinlan, Michael Arciero

Major: Marine Science

Increased fishing-induced mortality during the late 20th century has led to the severe decline of Atlantic cod (Gadus morhua) populations throughout the Gulf of Maine (GOM). Despite the common supposition that commercial fishing is the foremost factor influencing cod stocks, recent reductions in annual commercial harvests have not allowed the fishery to recover as expected. This trend suggests that other factors, such as the growing GOM recreational fishery, may be significant drivers of cod populations. In addition to the mortality attributed to harvest, Atlantic cod are known to experience increased mortality after being discarded by recreational fishermen. However, the mortality of cod in response to such recreational fishing activity is not clearly understood. This study aims to evaluate the impacts of this discard mortality on GOM cod stocks and its implications for fishery management. As part of a larger investigation, 130 specimens were captured using standard recreational fishing practices during the summer of 2013. After release, these cod were tracked using acoustic telemetry in order to assess their movements for evidence of mortality. Total length and environmental parameters were recorded for each individual to determine the influence of these factors on recreational discard mortality. These data are currently being utilized in a Leslie-form matrix model to investigate the effects of varying fishing regulations. Ultimately, this model will serve as a decision tool for fishery managers to project the potential implications and relative efficacy of policy options for the GOM recreational cod fishery.

POSTER 14

Developing Burrowing as a Non-Evoked ReadOut Assessment for Use with Novel Analgesic Drugs

Presenter: Kayla Lindros

Advisor: Edward Bilsky

Major: Neuroscience

Chronic pain is a major health, economic, and social problem that continues to be prevalent throughout the United States and the World. Historically, drug development efforts for new analgesics relied heavily on pain-evoked assays in which a stimulus is applied to the injured area of the animal. These tests can yield false positive results that confound the assessment of the test drug. Clinically, pain reduces many types of normal behaviors (exercise, social interaction, etc.). Novel drug treatments can be assessed for efficacy by evaluating if the treatment can restore a pain-suppressed behavior back to normal levels. Burrowing is one such activity in rodents that occurs naturally and could be helpful in evaluating novel analgesics. We used a modified two-week protocol in which rats' baseline level of burrowing behavior was assessed. Continuation of testing variables such as sex, flooring, habituation and test length, and new ways of assessing behavior using HD webcams, have been tested in order to optimize this assay. We have also begun to look at this in a model of post surgical pain. Preliminary results have shown that post surgical pain reduces baseline-burrowing levels. Further testing is needed in order to determine if this will be useful in testing novel analgesic drugs in a laboratory setting.

POSTER 15

Defining Effects and Response Curves of Cannabinoid receptor Agonist compounds on Breast Cancer Cells In-vitro

Presenters: Taylor Littlefield and Taxia Arabatzis

Advisor: Katherine Hanlon

Major: Medical Biology

Three cannabinoid receptor agonist compounds, JWH-015, GP1a, and CM-39-156 were used in various drug trials on E0771 cells (murine breast cancer line) and MCF7 cells (human breast cancer line) to determine cell toxicity and response curves at various concentrations and treatment doses.

POSTER 16

The Effects of NGF and Artemin as Possible Treatments for Chronic Dry Eye Syndrome on Temperature Sensitivity

Presenter: Alison McMahon

Advisor: Ian Meng

Major: Medical Biology

Chronic Dry Eye Syndrome (DES) is a condition in which the amount of tears produced is inadequate to sufficiently coat the corneal surface; this results in a feeling of dryness and irritation. DES is a fairly common clinical problem in the U.S., affecting 38% of the population over 50. It is becoming evident that the application of artificial tears alone is not sufficient to treat this condition, and other options are being explored. One of these options in clinical trials is Nerve Growth Factor (NGF). Another trophic factor just emerging in preliminary trials is Artemin. My work looked at both of these separately as well as in a combined treatment. For all 3 possible treatments, the following effects were examined: effect on spontaneous blinks and tears, effect on cold-sensing TRPM8 channel sensitivity via menthol application to the treated eye, and effect on heat-sensing TRPV1 channel sensitivity via capsaicin application to the treated eye. By doing this, the goal is to be able to find if there is a significant effect on any of the above, and if so which of the 3 options explored is the most effective yet least detrimental choice as a treatment for DES.

POSTER 17

Observations on Diet and Prey Availability of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Saco River Estuary

Presenter: Ashleigh Novak

Advisor: James Sulikowski

Major: Marine Science

Atlantic sturgeon (Acipenser oxyrinchus) are a highly migratory anadromous fish species, ranging from Labrador, Canada to Florida. Populations of this large and late maturing species decreased significantly along the coast in the early 20th century due to overharvest, development of dams, and pollution. As a result, this species of sturgeon was extirpated from many river systems, including the Saco River, Maine, by the 1950s and is currently considered a threatened species in this ecosystem. To investigate the reappearance of this species to the watershed, a comprehensive study of the distribution and movement patterns by means of acoustic telemetry, and diet analysis was established in 2008. A total of 51 sturgeon collected using gill nets were measured, fixed with external and internal tags, including surgically implanted acoustic transmitters. Preliminary observations from the acoustic array in the Saco River have shown that sturgeon preferred to stay within the first few river kilometers of the estuary. Analysis of stomach contents, obtained through gastric lavage, revealed that American sand lance (Ammodytes americanus), which school at the mouth of the river,

are the most common prey item retrieved. In addition, the preliminary results of benthic grabs, beam trawls and beach seines conducted within the Saco river, suggest that the distribution of prey items found in the stomach contents, were correlated with the acoustic data. Further research on diet and prey availability for Atlantic sturgeon in the Saco River is needed to better understand the role this habitat plays in their recovery.

POSTER 18

Stress Tolerance in the Green Crab, Carcinus maenas, Exposed to Waste Water Treatment Plant Effluent

Presenter: Gwendolyn Pelletier

Advisor: Markus Frederich

Major: Marine Science

Wastewater treatment plant effluent (WTPE) is commonly discharged into marine environments. We investigated the effect of WTPE on the stress tolerance of the green crab, Carcinus maenas. Crabs were placed in 20-25% of WTPE and incubated for 4 days. Individuals underwent an anoxia challenge for 1 hour. Initially the incubation also included a temperature stress (21ºC). WTPE-exposed crabs showed decreased treadmill running endurance (145 and 316 sec, respectively) and righting response (8.9 and 3.5 sec). Oxygen consumption (0.06 and 0.08 µmol/g/min) remained unchanged. In a second experiment that omitted the heat stress no differences in whole animal performance were seen. GST activity was evaluated for animals kept in 20% WTPE for 4 days and anoxia for an hour (2.25 and 0.9 units/mg protein). Gene expression assessed by qPCR revealed only a 1.5 fold increase in AMPK and a 1.3 fold increase in HSP70 for the WTPE treated animals. Overall, there was very little change in the selected stress parameters after exposure to WTPE, paired with anoxia. This is different than observed in a parallel study using the blue mussel, Mytilus edulis, which showed diminished performance at the whole animal and cellular level after exposure to WTPE. Our data indicates that WTPE does not diminish the performance of the green crab, but that of other species. Therefore, WTPE might aid in the success of the invasive green crab in dominating new environments. Further studies will continue to explore this.

POSTER 19

The Effects of Global Warming, Snail Herbivory, and Nutrient Addition on Salt Marsh Plant Production and Microbial Decomposition

Presenter: Sydnie Racine

Advisors: Steven Travis and Gregory Zogg

Major: Biology

Salt marshes are important ecosystems that act as a transitional habitat between land and sea. They provide protection from storms and erosion, regulate pollutants, accumulate carbon, and also act as a nursery for mammals, fish, and invertebrates. Salt marshes are threatened by high-yielding agriculture practices, development, recreation, and climate change. To study the effects of global warming, nutrient addition, and non-native snail herbivory, net primary production and decomposition of the salt marsh (Wells Reserve, Maine) was determined by using the low-marsh dominant plant, smooth cordgrass (*Spartina alterniflora*). Plant production was determined by measuring stem heights over the summer months of 2014 and a final oven-dried mass of the grass. Litterbags were used to determine plant mass loss due to microbial decomposition. Field data has not been completely analyzed because the experiment will continue into the fall, when the plants begin to senesce. The results will help to understand how rising temperatures, stem damage by snails, and eutrophication will affect the surface elevation of the marsh. Depending on the rate of primary

production (marsh growth) versus microbial decomposition (marsh decay), the marsh may be able to keep pace with another threatening aspect of climate change, sea level rise.

POSTER 20

Scavenging and the Ecology of Fear: Does carrion have indirect effects on the landscape? Connected

Presenter: Xiomarah Ramos

Advisor: Zachary Olson

Major: Animal Behavior

Objective of this research was to determine if the presence of carrion, and therefore the presence of scavengers, affects the perception of predation risk (i.e., fear) by small mammals.

POSTER 21

Estimating Size Classes, Spawning Periods, and Residence Times of Teleosts in the Saco River Estuary System Based on Total Lengths

Presenter: Julia Reynolds

Advisor: James Sulikowski

Major: Marine Science

Coastal estuaries serve as vital nursery grounds for many commercially valuable fish species despite the variability in abiotic conditions. Within the Gulf of Maine (GOM) and in comparison to other larger estuarine regions, the Saco River estuary has shown significant species diversity in its fish assemblage. From 2007, ongoing fish surveys have been conducted in order to better understand the diversity, abundance, and distribution of larval fish within the Saco River estuary. To further reveal and understand the ecological value of this watershed, it is essential to define the size classes, spawning phases, and residence times of these important fishery species utilizing the estuary system. Thus far, a total of 61 fish species have been identified including the commercially important Atlantic herring (Clupea harengus) and Atlantic cod (Gadus morhua) as well as the NOAA species of concern cusk (Brosme brosme). This high species diversity indicates the system serves a vital role in the GOM. Preliminary analyses confirms this significance through increasing growth trends in larval and juvenile fish, evidence of larger class sizes of fish settling out, and spawning events. This research is essential in further investigating the importance of the Saco River estuary and working to clarify the ecological characteristics of its valuable inhabitants.

POSTER 22

Abiotic Influences on the Juvenile Fish Assemblage of the Saco River Estuary, ME

Presenter: Brenda Rudnicky

Advisor: James Sulikowski

Major: Marine Science

Considered among the most productive marine environments within the Gulf of Maine (GOM), estuaries are known to provide habitat, resources, and shelter for diverse fish communities. These complex coastal ecosystems are physiologically challenging habitats due to large variations in abiotic parameters, such as temperature, salinity, dissolved oxygen, and pH. The Saco River Estuary (SRE) is an established nursery ground and habitat for 60 marine, diadromous, and freshwater fish species, including many that are considered threatened or of commercial and recreational importance in the GOM. Although the fish community has been well studied in the SRE, no study to date has attempted to correlate seasonal fluctuations in fish abundance to environmental factors. Preliminary information

on the abiotic characteristics of the SRE suggests that the estuary exhibits large fluctuations in relative salinity (0-30ppt) and surface water temperatures (13-31°C). In addition, preliminary data suggests that abundance and diversity of juvenile fish species in the SRE fluctuates on relatively short (month) and long (annual) temporal scales, with highest overall abundance and species diversity occurring in mesohaline water (5-18ppt). Furthermore, fresh and oligohaline (0-5ppt) sampling events yielded 61% freshwater, 33% estuarine, and 6% marine fish species while mesohaline sampling events yielded 14%, 33%, and 53%, respectively, suggesting that salinity has the most influence on fish abundance. When this knowledge is combined with the idea that current threats to this region (e.g. climate change, overfishing, and pollution) can affect recruitment, understanding the dynamics of the SRE fish community is crucial to proper conservation and management.

POSTER 23

Investigation of the Presence of MOR or DOR on TRPV1 Positive Neuronal Profiles in the Trigeminal Ganglion

Presenter: Sebastien Sannajust

Advisor: Tamara King

Major: Medical Biology

Temporomandibular Disorder (TMD) is a musculoskeletal orofacial disorder within the masticatory system. It is reported that as the disease progresses, over 10 million patients report ongoing pain, joint noises, and restricted jaw motion that cannot be mitigated by NSAID or surgical therapies, some of which have their own adverse effects – increasing hypersensitivity and chronic numbness. TMD is often viewed as a repetitive motion disorder of the masticatory structures. It has many similarities to musculoskeletal disorders of other parts of the body, and therapeutic approaches for other musculoskeletal disorders generally apply to this disorder as well (i.e. myofacial pain, temporomandibular joint (TMJ) inflammation). Symptoms of this disorder are reported to be burning mouth syndrome and atypical facial pain. Pain during function and/or at rest is the primary reason patients seek treatment, and reduction in pain is generally the primary goal of therapy. We tested the hypothesis that the pattern of expression of mu and delta opioid receptors on peptidergic nociceptive fibers within the trigeminal ganglion differ from patterns reported for dorsal root ganglion.Our hypothesis was assessed using immunohistochemical measures to characterize the pattern of expression of MOR and DOR on peptidergic fibers expressing the TRPV1 receptor. Pain fibers have been broadly characterized into 2 subpopulations, peptidergic fibers expressing TRPV1 receptors and non-peptidergic fibers expressing MOR and DOR receptors. In addition, characterization of the neurochemical properties of sensory fibers within the trigeminal ganglion was performed to delineate potential molecular targets on these distinctive populations that may be targeted for pain relief.

POSTER 24

A Modified Course-Grain DNA Model and its Application to Surface Density Effects on Hybridization

Presenter: Wyler Scamman

Advisor: John Stubbs

Major: Oceanography

Using DNA microarrays is a relatively cost effective and fast way of detecting certain sequences in given strands of DNA. The basic procedure of a DNA microarray consists of single strands of DNA that are attached to a flat solid surface and will bond to the sequence to be detected in the sample DNA. This project addresses an issue that was observed in previous work where when multiple strands were simulated in the model all DNA tended to lump together in a single aggregate. Since this

aggregation is not reflective of experimental behavior, the model was altered to correct it. This new model was then employed to study multiple DNA duplexes bound to a surface and their hydrogen bonding patterns.

POSTER 25

Role of the Perirhinal Cortex in the Ontogeny of Fear

Presenters: Emily Mitchell and Cassandra Simmons

Advisor: Michael Burman

Major: Animal Behavior

Fear conditioning involves the association of a previously neutral stimulus with a fear-inducing stimulus and is a common model of anxiety disorders such as specific phobias and post-traumatic stress disorder. Although the neural circuitry involved in fear conditioning in adult organisms is well understood, the development of these circuits is less well studied. The major research question underlying our work was whether perirhinal cortex lesions would disrupt fear conditioning early in life, postnatal day (PD) 18 or 25 in rats. We assessed two types of fear. Auditory fear resulted from the pairing of a tone with a mild footshock. Contextual fear occurred incidentally during auditory conditioning, as fear also develops to the experimental apparatus. Fear was measured by the percentage of time the rats exhibited freezing behavior either during replacement into the conditioning apparatus (contextual fear) or replay of the tone in a novel chamber. We believed lesions to the perirhinal cortex would disrupt much of the fear conditioning circuit by cutting off communication between the amygdala and hippocampus, identifying this as a key area of development. Our hypotheses were not supported. PD 25 rats had higher levels of contextual and auditory fear, compared to PD 18. However, there were no meaningful main effects or interactions caused by the lesion. We believe animals were using an alternative neural circuit (compensatory mechanism) which allows them to complete the task. To preclude this a new study is being carried out in which lesions are made after training

POSTER 26

The Effects of Post-Operative Pain on Motivation: Use of Progressive Ratio Operant Schedules as Behavioral Endpoints for Preclinical Pain Research

Presenter: Emily Warner

Advisor: Glenn Stevenson

Major: Neuroscience

Recently, there has been a keen interest in developing preclinical assays that assess the effects of acute or chronic pain on motivation and/or cognition. The current set of experiments characterized the effects of incisional post-operative pain on an operant schedule that represents a simple model of motivation. Rats were trained to press a lever for food on a fixed-ratio 1 schedule of reinforcement. The ratio requirement was gradually increased to 5, and following stable responding rats were assigned to one of four progressive ratio schedules: PR2, PR5, Log1, Log2. Once responding stabilized, an incisional pain manipulation was completed on the left hind paw under brief anesthesia. The effects of reinforcer type (grain vs. sugar-based food pellets) limited hold duration (min), and ratio progression (logarithmic vs. arithmetic) were manipulated to develop a schedule with (1) low intra-animal variability in breakpoints, (2) high rates of responding, and (3) session lengths shorter than 60 min to facilitate future drug testing. Parallel studies examined the mechanical sensitivity to touch with von Frey monofilaments. The incisional pain manipulation produced robust reductions in mechanical thresholds but only subtle decreases in progressive ratio responding. The progressive ratio schedule may have utility as a preclinical behavioral endpoint for assessing pain-depressed behaviors and

pain/motivation interactions in rodents. The overall goal is develop a version of this operant procedure for future studies that will evaluate delta/mu opioid receptor interactions on analgesic endpoints. Parallel studies will assess the same delta/mu receptor interactions on bone joint pathology using in vivo imaging technology.

POSTER 27

Biological Control of Mosquitoes

Presenters: Christopher Watt and Shane Murphy

Advisor: Noah Perlut

Major: Biological Sciences

The Biological Control of Mosquitos project involved several methods for biologically controlling mosquitoes on UNE's Biddeford campus. The methods for accomplishing this involved establishing bird and bat boxes at three locations on campus: the riverfront surrounding Jordan Point, the Barbara Hazard soccer field, Sokokis Pond and the area bordering the trees near the Harold Alfond Forum parking lot. The purpose was to encourage local bird and bat species to UNE's Biddeford campus, all of which include mosquitoes as a significant dietary component. The bird species of focus were tree swallows, eastern bluebirds, and black-capped chickadees. Of the nine species of bats that reside in New England, our primary target to attract was the little brown bat, Myotis lucifugus.

The other style of managing the mosquito population was to use integrated pest management plants (IPM's) that took advantage of certain plants with natural mosquito repellant chemicals and fragrances. Several varieties of plants were utilized such as bee balm, mint, citronella, marigold, basil, rosemary, lavender and cherry tomatoes. The plants were placed across the campus; the Student Academic Success Center, the Alfond Center for Health Sciences, Decary Hall, the Gateway path, Sokokis Pond, the Harold Alfond Forum, Morgane/Marcil Hall parking lot, the Petts Health Center, the Welcome Cottage, the Bush Center/Windward parking lot, the Riverlot, Featherman Hall, Avila Hall, Padua Hall, the Quad Intersection, West Hall, East Hall, Champlain Hall, Frederick Hall, and the Campus Center all had mosquito repellant plants somewhere in the area.

POSTER 28

Methanol Extracts of *Ulva lactuca* Harvested from Biddeford Pool Inhibit the Growth of Clinically Relevant MRSA Strains

Presenter: Fallon Weiss

Advisors: Amy M. Deveau and Kristin Burkholder

Major: Medical Biology

The macroalgae *Ulva lactuca* is of interest worldwide for its nutrient profile and medicinal potential. Two physically distinct phenotypes that are believed to be the same strain of *Ulva lactuca* were tested for potential antimicrobial activity against the bacterial pathogen *methicillin*-resistant *Staphylococcus aureus* (MRSA). Both phenotypes were harvested from Biddeford Pool in sync with four lunar phases. A comparative extraction strategy was employed to separate surface-associate organics from those that were bound to internal cell structures.

Data indicate that methanol fractions, but not KOH/MeOH fractions, exhibit the greatest antimicrobial effect, suggesting that active compounds may be surface affiliated. Minimum inhibitory concentrations (MICs) of the extracts were assessed when significant inhibition was present. The MICs of the crude extracts against MRSA SH1000, MRSA USA300, MRSA Col, and *S. aureus* Newman were comparable to positive antibiotic controls. Pilot data from our study suggest that *Ulva lactuca* from the coast of Maine is a novel source of compounds with interesting

antimicrobial profiles that may block robust human MRSA strains. Future efforts will be aimed at genetic analysis of the *Ulva* to confirm speciation. Chemical analysis by GC-MS and LC-MS toward the isolation and structural identification of the compound or compounds with antimicrobial activity is also ongoing.

Summer Undergraduate Research Experience Symposium

Oral Presentations

October 18, 2014 | 10:30am-12:30pm

Oral Presentations

10:30am-12:00pm

Summer Undergraduate Research Experience Symposium

ALFOND SCIENCE CENTER ROOM 106 *Listed in order of appearance*

ORAL PRESENTATION **10:30 AM - 10:45 AM**

Steroid Signaling Modulates Nociception in Drosophila melanogaster

Presenter: Aidan McParland

Advisor: Geoffrey Ganter

Major: Medical Biology

Medicine has long sought to reduce pain, and the identification of novel drug targets is an important part of medical research. Study of the fruit fly Drosophila melanogaster has yielded a wealth of basic science information that has increased our knowledge of all organisms. We are testing the hypothesis that steroid hormones modulate nociception in the fly and we suggest that the study of its mechanisms may be relevant to humans. Steroids such as estrogen and testosterone are known to affect pain perception in humans and rodents. For example, castration or ovariectomy of rats produces resistance to opioid analgesia that can be restored by hormone replacement. While opioid modulation of nociception has not been observed in flies, they do possess one steroid hormone: ecdysone. Ecdysone signaling is necessary for the fly to pass important developmental milestones, and is neuroactive, but ecdysone signaling can be conditionally impaired by various genetic means. Here, we present the findings of baseline nociception in animals with reduced levels of steroid hormone receptor EcR both peripherally and pan-neuronally in response thermal, mechanical stimuli and chemical stimuli.

ORAL PRESENTATION **10:45 AM - 11:00 AM**

Color Morph-Specific ion Regulation in the European Green Crab, Carcinus maenas, during Oscillating Salinity Stress

Presenter: Anthony Himes

Advisor: Markus Frederich

Major: Marine Science

Carcinus maenas occurs in two color morphs: green after molting, red after prolonged intermolt. Ion regulation is well documented in green morphs at low salinity, but few studies have focused on fluctuating salinity levels like in a natural tidal environment. We investigated how the ability to ion regulate differs between the two morphs, how oscillating salinity affects both morphs, and whether these changes vary with sex. Red and green morphs were exposed to constantly low salinity (12psu) for 72h or to oscillating salinity ranging from 12 to 32psu every 6h. Whole animal performance was measured by reaction time, treadmill running, and hemolymph osmolarity. Expression of key ion regulators was measured by western blots and qPCR. Results reveal green morphs as better ion regulators accomplished not by changing the ion transporters, but by enhancing the driving force for the transporters through increased mRNA expression of cytosolic and membrane bound carbonic anhydrase along with Na+K+ATPase. Exposure to constantly low salinity results in greater mRNA expression of these ion regulators demonstrating that constantly low salinity is more stressful than oscillating salinity. Little difference was noted between sexes. An analysis of the full transcriptome by Roche 454 RNA sequencing is currently ongoing. Our data show that the ion regulatory capabilities of C. maenas need to be viewed in a color morph specific context. Oscillating salinity

being less strenuous than constantly low salinity is in agreement with the conditions in the crabs' natural habitat as they are rarely exposed to constantly low salinity.

ORAL PRESENTATION **11:00 AM - 11:15 AM** **On**

On Sun Wu Kong and the Resolutions of a Trickster

Presenter: Justin Brewer

Advisor: Susan McHugh

Major: English

I love to see the potential and development of characters, and their choices as they proceed in their story. For this research project I chose Sun Wu Kong and his other contemporary character interpretations, from "Dragon Ball" and "One Piece", as the main focus. "Journey To The West", from which Sun Wu Kong hails is a novel I am intimately familiar with, and I recognize that Sun Wu Kong as a character works as a fantastic choice because his journey is one of maturing. As a trickster by nature Sun Wu Kong holds a distinct unpredictability to each choice he makes, and these choices fall into three archetypes, one is solving the problem quickly with violence, two is reasoning the problem out to achieve a peaceful resolution, and three falls to manipulating the variable around them to solve the problem through deceit. Characters in fiction tend to fall into one of these patterns based on their emotional state. The choices made are then perhaps the most important out of any, because whatever the outcome it will stick with both the character and audience. The path taken to reach the end goal reflects back onto the real world, and with other adaptations of Sun Wu Kong establish on how they deviate from the base character, to show how they serve as a catalyst for culture. The purpose then is to analyze and group these choices and what they say about our culture and the demographics that they reach out to.

ORAL PRESENTATION **11:15 AM - 11:30 AM**

Determining Sex Ratios and Sexual Maturity of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Saco River, Maine

Presenter: Carolyn Wheeler

Advisor: James Sulikowski

Major: Marine Sciences

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a long-lived, anadromous fish species ranging from Labrador, CA to Florida, USA. In the Saco River, located in the Gulf of Maine, Atlantic sturgeon were common in the 1920's, but were extirpated by the 1950's due to overfishing. However, after a 60 year absence, Atlantic sturgeon reappeared in the Saco River in 2007. Although the reason for the return of this species to this river system remains unknown, research on basic life history information is necessary to facilitate the conservation of this federally protected species. Understanding reproductive parameters such as sex ratios and sexual maturity are vital to effective management of any species. Unfortunately, this information is typically obtained by lethal, gross dissection, or stress inflicting endoscopy. Thus, in order to better understand these important life history parameters, three non-invasive techniques (steroid hormone analysis, ultrasonography, and external morphological features) are being utilized to non-lethally determine sex ratios, sexual maturity, and reproductive status for sturgeon captured within the Saco River watershed. Preliminary results suggest that the combination of these three techniques provides an accurate assessment of reproductive parameters in Atlantic sturgeon. This study will continue to couple these techniques in order to determine reproductive parameters of Atlantic sturgeon inhabiting the Saco River, which in the future can be applied to other sturgeon populations.

ORAL PRESENTATION **11:30 AM -11:45 AM**

Propaganda: Social Media and Partisan Political Information

Presenter: Ioana Panaitiu

Advisor: Brian Duff

Major: Political Science

Social media plays an ever growing role in every aspect of society. Yet, most scholarship focuses on its pro-democratic, liberating, grassroots activism aspects, while neglecting how social media, like any other form of public opinion, can be manipulated and controlled. With trust in government, institutions, and corporate media at a low, and the increasing power of word of mouth in American public opinion, Web 2.0 (social web) meets Web 1.0 (informational web). The result – simple, partisan, emotional messages – or propaganda.

ORAL PRESENTATION **11:45 AM - 12:00 PM**

The Work of History: War Letters from the Archives to Exhibition

Presenter: Shannon Cardinal

Advisors: Elizabeth DeWolfe and Cally Gurley

Major: History

Taking on the roles of Randall M. Cushing Collection Specialist and Archive Assistant, Teacher's Assistant, and Exhibition Designer, over the last six months I have engaged with the work of history from start to finish, from posing questions in the archive to designing an exhibit for public display. This talk will be on that work, my methods, findings and plans.