State House Undergraduate Research Day

A poster session to showcase undergraduate research in the University of Maine System

March 23, 2012

The Hall of Flags
Maine State House
March 23, 2012

Dear Governor LePage, Legislators, and Guests,

We are proud to present the second annual State House Undergraduate Research Day, which highlights the wide-ranging work conducted by our students. Thirty-two students from across the System and many of their faculty advisors, representing all seven of our universities, are at this event. The projects displayed here show the many opportunities for engaged learning at Maine’s public universities.

Projects featured today include research on Maine’s commercial forest and agricultural land, the development of a leak detection system for NASA’s inflatable lunar habitats, and work examining ways to protect and preserve the state’s aquaculture. All across our System, thousands of students are engaged in research to improve Maine’s economy and quality of life; and expand scientific knowledge, which leads to new patents, innovations and intellectual property.

Thank you for visiting us today. I encourage you to meet the students who are here to display their work and answer your questions. We hope you enjoy learning about the many research projects presented by our undergraduate students.

Sincerely,

[Signature]

James H. Breece
Vice Chancellor for Academic Affairs
STUDENT PRESENTERS

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THOMAS JAMES ANDERSON
Patten, Maine
Environmental Studies
Senior, University of Maine at Fort Kent

Determining Black Bear Density in Aroostook County, Maine Using Game Cameras

This study had two objectives. First, to assess the density of black bears in Northern Aroostook County using game cameras. The second objective was to evaluate the reliability of game cameras as a method of estimating population structures in lieu of using harvest returns. The results of the study suggested that the bear density in Northern Aroostook County is 2-3 bears per square mile, which matched the density found by the state in 1998. The camera results appeared to be a more reliable source to estimate age structure and density because of its potential to use a larger population sample.

Faculty Advisor: Steve Hansen, Assistant Professor of Biology and Environmental Studies

DOVEY BALSAM
Industry, Maine
Interdisciplinary Studies: Sociology/Anthropology
Senior, University of Maine at Farmington

Combat Trauma and Religious/Spiritual Beliefs: Paradigm Shifts in Combat Veterans of the US Military

The purpose of this study is to examine some of the spiritual challenges presented to US service members after serving in a war zone. Often, when confronting the traumatic aftermath of battle, there is a shift in religious and spiritual paradigms that occur during the process of reconciling the reality of combat and prior belief systems. Through the use of personal interviews with veterans, this research project explores how the shifts in paradigm affect the lives of veterans.

Faculty Advisor: Gaelyn Aguilar, Assistant Professor of Anthropology
MIGUEL BARAJAS  
Lewiston, Maine  
Environmental Studies  
Senior, University of Southern Maine

Bioenergetics Modeling of Atlantic Cod in the Kennebec-Androscoggin Marine System

This research involves modeling feedbacks between groundfish and river herring populations to understand their roles in the Kennebec-Androscoggin marine system. Through conducting diet studies of groundfish, diet composition data was developed and used to create different scenarios of prey abundance. These different scenarios of prey abundance will be used to model growth rate changes of groundfish, as well as changes in their overall population and age structure within the Gulf of Maine. The outcomes of these different bioenergetics models will be incorporated into bioeconomic models being developed with collaborators at Bowdoin and Bates colleges to identify social and ecological constraints on marine system recovery and to estimate the potential economic benefits that might emerge from increased river herring and nearshore groundfish stocks in the Kennebec-Androscoggin River system.

Faculty Advisor: Karen Wilson, Assistant Research Professor of Environmental Science and Aquatic Systems

JESSICA BARILONE  
Cornish, Maine  
Chemistry and Environmental Sciences  
Senior, University of Southern Maine

Levels and Trends of Mercury in Street Dust and Sediment Cores of Portland and South Portland, ME

This study focuses on identifying levels of mercury in street dust and looking at the transfer of mercury to stream sediment. Mercury is a metal of concern because it is detrimental to human health and wildlife. It is a metal that bioaccumulates in fish and is therefore a health risk to humans via consumption. Humans are also at risk of exposure to mercury via inhalation of small particulate matter to which it is bound. Samples were analyzed for mercury using direct mercury analysis (DMA-80, Milestone). Concentrations of mercury in Portland and South Portland street dusts ranged from 3.83 to 1139.96 ppb, and 6.24 to 146.30 ppb, respectively.

Faculty Advisor: Lucille Benedict, Assistant Professor of Chemistry
KIMBERLY BASTILLE
Saco, Maine
Biology, Fisheries Concentration
Sophomore, University of Maine at Machias

**Bacteriophage as Potential Treatment for the Prevention of Flavobacterium Infection in Atlantic Salmon (Salmo salar) parr**

The goal of this project is to find a bacteriophage (virus that kills bacteria) that will kill a bacterium that is killing salmon parr in a local hatchery. A Flavobacterium that causes Bacterial Gill Disease was found in the East Machias Hatchery. The project wanted to isolate the Flavobacterium from the dead salmon sampled from the hatchery and find a bacteriophage to rid the hatchery of the disease.

*Faculty Advisors: Sherrie Sprangers, Associate Professor of Biology
Gerard Zegers, Assistant Research Professor*

AMANDA BEAN
Augusta, Maine
Liberal Studies, Biology
Senior, University of Maine at Augusta

AMANDA COUTURE
Oakland, Maine
Liberal Arts, Biology
Junior, University of Maine at Augusta

HEATHER DYER
Augusta, Maine
Biology
Senior, University of Maine at Augusta

KAREN THEBERGE
Winthrop, Maine
Biology
Senior, University of Maine at Augusta

**Evaluating Interactions Between Wild Turkeys and Maine Agriculture**

This research involves four separate components: (1) an agricultural survey, (2) population genetic analysis of Maine turkeys across the state, (3) pathogen and microbiological screening of Maine turkeys across the state, & (4) tagging and GIS analysis of select turkeys. All analyses are strategic components of an interdisciplinary STEM-based approach to evaluate the impact reintroduced birds have on the agricultural and recreational landscape in Maine.

*Faculty Advisor: Peter Milligan, Assistant Professor of Biology*
SCOTT BELAIR
Bridgewater, Maine
Environmental Studies
Junior, University of Maine at Presque Isle

Research on two Ecologically and Economically Important Northern Maine Landscapes: Commercial Forests and Underutilized Agricultural Land

One research project has focused on the ecology of four forest types that are important not only to the forest industry but to the wildlife and quality of place features that make Maine’s forest such a valuable resource. The second research project is assessing the potential for underutilized agricultural lands to be used to produce grass biomass in a sustainable way that may also benefit the local economy. This research is funded by the National Science Foundation, through the University of Maine and is being conducted in collaboration with UM Cooperative Extension. While both research projects will contribute to improving basic knowledge, a major component is collaboration with practitioners and local organizations such as 7 Islands Land Management Company, Northern Maine Development Commission, many local municipalities, local farmers, and a variety of state and federal agencies.

Faculty Advisor: Jason Johnston, Assistant Professor of Wildlife Ecology

PETER BROOKS
Bremen, Maine
Psychology and Spanish
Senior, University of Maine

CHRISTIE EDWARDS
Scarborough, Maine
Biology
Sophomore, University of Maine

Exploring the Alcohol Deprivation Effect in Withdrawal-Seizure Prone and Withdrawal-Seizure Resistant Mice

The study explored the alcohol deprivation effect (ADE) in mice selectively bred for high and low severity of alcohol-withdrawal seizures: withdrawal-seizure prone (WSP) and withdrawal-seizure resistant (WSR) mice. The study consisted of providing the mice with continuous access to food and water and observing the changes in alcohol intake and preference as a result of intermittent alcohol availability. The ADE is an animal model of human relapse drinking, in which multiple genotypes of rats and mice have repeatedly shown an innate tendency to increase free-choice, voluntary alcohol drinking following alcohol deprivation. The increase in drinking as a result of intermittent access among various genotypes suggest that binge-like relapse drinking in humans is dependent on multiple interacting genetic factors, and in the present study, WSP and WSR mice showed a similar ADE, which supports the generality of this effect and shows that the genetic mechanisms underlying escalated intermittent drinking are separate from the genetic mechanisms underlying withdrawal severity.

Faculty Advisor: Alan Rosenwasser, Professor of Psychology
Salinity Tolerance of the Oyster Mudworm Polydora Websterti

Polydora websterti is a marine polychaete that burrows into the shells of oysters where mud subsequently accumulates. Although the oyster secretes new shell material over the burrows, the resulting blisters are unsightly and decrease the market value of the oyster. Proposed methods used to eradicate the worm can be expensive, toxic, or unreliable. I investigated the salinity tolerance of P. websterti outside the oyster shell and the efficacy of salinity-based treatments for the worm inside the shell. My results indicate that P. websterti is intolerant to freshwater and when a freshwater soak is combined with dry cold storage, 100% of worms die within 10 days with little oyster mortality.

Faculty Advisor: Paul Rawson, Associate Professor of Marine Sciences

Winter Harvesting in a Northern Climate

This study looks at season extension gardening in an unheated hoop house in Fort Kent, Maine. This was achieved through the observation of the progress of cold-hardy plants from seed to maturity, using succession planting for 5 weeks. Spinach, salad mix, and carrots were planted on September 1st, 2011, and then weekly in different beds until September 30th. Upon reaching maturity, each bed was harvested and dated, calculating maturity and mass. Throughout the experiment, several layers of cold protection were used. The differences in temperature were recorded for each experiment. The results demonstrated that spinach and the mix had no trouble reaching maturity, allowing 4 additional harvests throughout the mild fall. One bed of carrots reached maturity by the end of the experiment, but the other four beds of carrots did not. This experiment provided information on techniques for season extension, and served as a comparison to other similar studies in Maine.

Faculty Advisor: Kimberly Borges-Therien, Associate Professor of Environmental Studies
DONNA DELONG
Westfield, Maine
English
Senior, University of Maine at Presque Isle

I’m all Ears: The Art of Asking and Listening

In the Fall of 2010, a group of students began a journey. These students learned how to have focused conversations to gain specific information. Over the next one and a half years, they honed their skills in this area. They worked at local, state and, ultimately, national levels as professional consultants. Thanks to technology, they are poised to take their talents global. This presentation will focus on the results of this process and where how successful these students were in their efforts.

Faculty Advisor: Jacquelyn Lowman, Assistant Professor of Journalism and Mass Communications

SHARON FOSS
Machias, Maine
Business, Environmental Studies
Junior, University of Maine at Machias

A Winning Partnership

The Washington County Education and Employment Through Sustainable Broadband Adoption (WCEESBA) project takes advantage of wireless broadband technology, provides computer equipment, and offers computer training and applications to support blueberry farming, lobster fishing, and health care in Washington County. In this program, Business Majors at the University of Maine at Machias partner with Axiom Technologies and Washington County's small businesses. Axiom is building infrastructure for the use of broadband and WI-FI in Washington County's working waterfront and traditional farming communities. Students apply what they have learned, as they work with farmers, fisherman, and other local business.

Faculty Advisor: Kevin Athearn, Associate Professor of Environmental and Community Economics
Rachel M. Henderson
Weare, New Hampshire
Mass Communication and Animal Science
Senior, University of Maine

Lauren Thornbrough
San Diego, California
Communication
Senior, University of Maine

Female College Students’ Perceptions of Body Image: Sociocultural Factors and Self-Esteem

Internalization of societal standards of attractiveness and feelings of self-esteem play major roles in the development of poor body image. Research indicates that there are discrepancies between how one looks and how women think they should look, resulting in appearance concerns and health problems. This study examines the relationships between self-esteem and sociocultural factors on female college students perceptions of their body image. An online survey will be conducted on approximately 150 female college students using surveymonkey.com. Implications of these findings will be discussed including work with campus organizations to inform body image program development.

Faculty Advisor: Claire Sullivan, Associate Professor of Communications and Journalism

Thomas Leeuw
Lincoln, Vermont
Marine Science
Senior, University of Maine

In-situ Measurements of Phytoplankton Fluorescence Using Low Cost Electronics

Chlorophyll, a fluorometry, has long been used as a method to study phytoplankton in the ocean. In-situ fluorometers are used frequently in oceanography to provide depth resolved estimates of phytoplankton biomass. However, the high prices of commercially available in-situ fluorometers can make them unavailable to individuals or institutions. Presented here is an investigation into building an in-situ fluorometer using low cost electronics. The goal was to construct an easily reproducible in-situ fluorometer from simple and widely available electronics. The simplicity and modest cost of the sensor makes it valuable to students and professionals alike. Open source sharing of architecture and software will allow students to reconstruct and customize the sensor on a small budget. Research applications that require numerous in-situ fluorometers or expendable fluorometers can also benefit from this study. The sensor uses a blue LED to excite chlorophyll a and measures fluorescence using a photodiode. The sensor is controlled by an Arduino microcontroller that also serves as a data logger.

Faculty Advisor: Emmanuel Boss, Professor of Marine Sciences
ABRAHAM LORRAIN
Kennebunk, Maine
Biology
Senior, University of Southern Maine

The Effects of Temperature on the Growth Rate of Various Prochlorococcus Strains

Over the past year and a half this research has focused on studying the effects of temperature variances on the growth rates of Prochlorococcus. Different strains of Prochlorococcus will grow better at certain optimal temperatures. By growing each strain in a wide range of cold to warmer temperatures one can pinpoint these optimal temperature ranges. This data contributes to the phenomic characterization of the different phylotypes that might help with understanding the evolution of the different phylotypes. In addition, understanding temperature physiology may allow for prediction of where in the water column each Prochlorococcus strain would prefer to live, how global warming of the oceans might affect Prochlorococcus, and how these strains deal with cold or hot temperature stressors, i.e. do they go dormant or just die off?

Faculty Advisor: Lisa Moore, Associate Professor of Biology

EMMA MORRISON
Saco, Maine
Mathematics
Senior, University of Maine at Farmington

Does CABG Improve Functional Status and Survival?

This biostatistics research project used data from the Mediators of Social Support (MOSS) study to assess the effectiveness of coronary artery bypass grafts (CABG) in improving patient outcomes. By completing appropriate statistical tests through SAS computer software, data was analyzed in order to answer questions about the effectiveness of this medical procedure in improving functional status and survival rates.

Faculty Advisor: Lori Koban, Associate Professor of Mathematics
Rural Heating: Culture of Convenience, Socio-Demographic Factors and Low Ecological Awareness

In this study, ten women who were former urban dwellers that owned homes in the St. John Valley, but were not originally from the state of Maine were asked questions about their heating preferences. The study concluded that women with higher incomes preferred oil as their primary heating source and many did not want to use wood because of the mess associated with it. Despite these women having high educational levels; this did not impact their attitudes and behaviors towards sustainable heating practices.

Rural Heating and Alternative Sources: Local Women of Fort Kent

In this study, ten women who were home owners and from the St. John Valley were interviewed. Based on the data collected, most women used a combination of wood and oil. Of all of the alternative fuels, most women preferred pellet stoves. Cost and affordability was a recurrent theme. In conclusion, this study reinforced that socio-demographic considerations are more likely to motivate change then altruistic devices. Most of the women interviewed were in the middle to low income range. Many of these women were already using wood to heat their homes. Yet, an alternative explanation could be that many of these women grew up using wood as a secondary source; thus, cultural conditioning must also be considered.

Socio-Economic Status: A Comparison Study

Most people in the St. John Valley spend enormous amounts of energy to heat their homes because of its long, cold winters. The average home uses about 600 to 650 gallons of oil a year, which at current prices uses $2,000 to $2,500 dollars of a family’s annual budget. The high cost of oil is especially burdensome to the residents, which reside in Aroostook County, one of the poorest in Maine, with an average household income of $34,868, which is $10,000 below the state average and $15,000 below the national average (Johnston and Cardenas 2012). Though an existing population has a history of adapting to their environment, immigrating members of the community, who often come to the area to work at the hospital or university, two of the largest employers next to small businesses and logging, may not have the same attitudes, beliefs and behaviors of local members. This study compares two groups of local residents heating practices, those originally from the community or with strong familial ties and those not from the state of Maine who have lived in urban settings.

Faculty Advisor: Soraya Cardenas, Associate Professor of Sociology and Environmental Studies
**Cecelia Palow**  
*Southwest Harbor, Maine*  
*Psychology*  
*Junior, University of Maine at Farmington*

**Testing Brain Gym’s Pseudoscience**

Brain Gym claims to improve cognitive ability through simple stretches and movements which are said to change the physiological function of the brain. The current study tested the effects of Brain Gym on reading comprehension using subsections of a PRAXIS practice test. The study found no basis for claims of short term benefits from either Brain Gym exercises or from the other forms of exercise tested. Results were analyzed in a 5 X 2, between and within groups analysis of variance; no significant comprehension improvements were found (p=.375), thus disputing Brain Gym’s assertions. Nonetheless, the program continues to be used and adopted by schools both here and abroad by those who buy into the pseudoscience.

*Faculty Advisor: Marilyn Shea, Professor of Psychology*

**Adam Pinette**  
*Mars Hill, Maine*  
*Criminal Justice*  
*Senior, University of Maine at Presque Isle*

**Theft from Motor Vehicles: A Case Study in Presque Isle, Maine**

A class research project in conjunction with the Police Chief and Deputy Police Chief to examine the phenomena of incidence of theft from motor vehicles in Presque Isle, Maine. A nine member team of students researched prior incidents as well as current methods for preventing theft from motor vehicles, built a survey to gather information on rate of incidence in the Presque Isle area, correlated data and drafted a final document that was presented to the Chief in December by three team members and the project adviser.

*Faculty Advisors: Charles Johnson, Assistant Professor of Criminal Justice  
Lisa Leduc, Associate Professor of Criminal Justice*
JOSEPH RANKIN  
*Durham, New Hampshire*  
*Marine Science*  
*Junior, University of Maine*

**Experimental Analysis of Bacterial Isolates from Porphyra umbilicalis Kützing (P.um.1) on Growth and Morphology of Blade Callus**

The growth and morphology of some marine macroalgae are affected by associated bacteria. In this study, bacteria were isolated from laboratory P.um.1 (UTEX 2951) cultures on marine LB agar plates, and DNA was isolated from subcultures of bacterial isolates. PCR and sequencing to the genus level using both variable 16S and full 16S rDNA primers identified two species of Pseudomonas (Gammaproteobacteria, Pseudomonadales) and a single species of Maribacter (Bacteroidetes, Flavobacteriales). Bladeless callus tissue was grown in a common garden and treated with antibiotics for one week. Bacterial isolates were inoculated at 12°C under white fluorescent lamps to assess the effect of bacterial isolates on growth and/or morphology of P.um.1. On each plate were two positive controls (without antibiotics or bacteria) and two negative controls (without bacteria). By four weeks, spores were released from callus tissue across all treatments, and blades began to develop on cultures. It is unclear what proportion of blade development was from spores settling on callus surfaces versus direct differentiation from callus tissue. To date, bacterial addition does not appear to have produced differences in growth or morphology of P.um.1 compared to controls.

*Faculty Advisor: Susan Brawley, Professor of Marine Sciences*

ALEC ROSE  
*Orono, Maine*  
*Geosciences*  
*Senior, University of Southern Maine*

**Landscape Reconstruction at the Isles of Shoals: Sedimentology, Geochemistry and Topography**

A well-preserved mid to late Holocene archaeological site situated on Smuttynose Island, Isles of Shoals, Maine provides evidence of a culturally constructed anthropogenic deposit. The Smuttynose site is well stratified site with well documented Archaic, Ceramic, and Historic period components. The historic period deposits generally range between 50 and 90 centimeters in depth. Systematically selected column samples of sediment were utilized for organic context, grain size, x-ray diffraction and x-ray fluorescence analysis. The results are utilized in conjunction with a one meter interval topographic mapping to generate a 3D landscape of surface and subsurface deposits and their geological characteristics. The x-ray fluorescence analysis of sediment revealed clear stratigraphic variation in elements such as lead, arsenic, tin, potassium, and calcium. The variation allows us to define occupational activities manufacture, use, and disposal over time during the historic period. Lead amounts above 2,000 ppm reflect activities of bullet and fishing weight manufacture. The geological investigations in conjunction with cultural material provide a rich opportunity to develop models of landscape evolution in culturally occupied areas around the Gulf of Maine.

*Faculty Advisors: Nathan Hamilton, Associate Professor of Archaeology  
Stephen Pollock, Professor of Geosciences*
MICHAEL SCHELL  
North Waterboro, Maine  
Electrical Engineering  
Senior, University of Southern Maine

**Development of a MEMS-based Acceleration Sensor Network using Wireless XBee RF Modules in LabVIEW 2010**

The purpose of this design project was the development of an XBee-based wireless acceleration sensor network in LabVIEW 2010. This system is to be used in conjunction with a centrifuge test platform designed for the testing of micro-electro-mechanical-system (MEMS) acceleration sensors developed by Dr. Mustafa Guvench and the project’s author at the University of Southern Maine. These sensors were developed as part of a joint project with the University of Maine to investigate effective low-power, wireless, ultrasonic leak detection technologies for use on NASA inflatable lunar habitats. Funding for this project was provided in part by the Maine Space Grant Consortium. National Instrument’s LabVIEW 2010 was used to build the network control and sensor measurement applications used with the accelerometer test bed. Because LabVIEW provides no libraries for working with the XBee wireless communication standard chosen for this project, the task of creating a generic LabVIEW based XBee communication library was also incorporated into the project. Testing and debugging of the wireless sensor network software was done using two sensor module prototypes developed specifically for this application. Each of these hardware modules was built around an Arduino Uno microcontroller board connected to XBee RF modules and commercially available accelerometers.

*Faculty Advisor: Mustafa G. Guvench, Professor of Electrical Engineering*

ERIC BRYAN P. TAN  
Mandaue City, Cebu, Philippines  
Marine Biology  
Senior, University of Maine at Machias

**Interactions Between the Invasive European Green Crab, Carcinus maenas, and the Soft-Shell Clam, Mya arenaria, in Downeast Maine: The Effect of Predator Deterrent on Survival**

The study focused on the enhancement of survival in hatchery-reared soft-shell clams, through the use of different types of netting and different types of enclosure, after they are planted in the field. A field experiment (Duck Brook Flat in Holmes Bay, Cutler, Maine) was done to test these different netting and enclosure types and two laboratory experiments (Downeast Institute for Applied Marine Research and Education, and University of Maine at Machias) were conducted to help explain some of the results obtained from the field.

*Faculty Advisor: Brian F. Beal, Professor of Marine Ecology*
LINDSEY THERIAULT  
Gorham, New Hampshire  
Psychology  
Senior, University of Southern Maine

PETER MORNEAU  
Portland, Maine  
Psychology  
Junior, University of Southern Maine

An Investigation of Home Disadvantage in Fed Cup Tennis

Occurrence of the home disadvantage in Fed Cup tennis matches was examined by analyzing the outcome of Fed Cup finals matches from 1995 to 2010. There was no significant home disadvantage when Matches 1 and 2 were compared with Matches 4 and 5. However, there was a significant home disadvantage when Matches 1 and 2 were compared with Match 5. These findings are compared with those from a study examining the home team disadvantage in men’s professional tennis.

Faculty Advisor: William Gayton, Professor of Psychology

JEFFREY THOMPSON

Bridgton, Maine  
Computer Science  
Sophomore, University of Southern Maine

Searching for Functional Elements in Noncoding DNA

Three to five percent of the human genome codes for genes; the rest was once considered “junk.” Recent research has shown that the noncoding regions contain functional elements that regulate the expression of genes. Identifying functional elements in the noncoding portion of the human genome could provide insight into disease research and toxicology, but there are too many candidates in the DNA to search through by laboratory testing. Since such functional elements are likely to have been conserved by evolution, they are likely to appear in a variety of diverse species, forming a genetic motif. Genetic algorithms provide a novel computational method for finding motifs conserved across evolutionary time. The genetic algorithms for motif inference (GAMI) approach is a promising tool for identifying candidate functional elements that appear in all of the species studied. However, sometimes candidate elements appear in only some of the species. For example, the element may be shared only by some of the more closely related species. This project involves modifying GAMI to better identify such elements.

Faculty Advisor: Clare Bates Congdon, Associate Professor of Computer Science
Established in 1968, the University of Maine System is the state’s largest educational enterprise. It has an annual enrollment of more than 42,000 students and serves over 500,000 individuals annually through educational and cultural offerings. Two-thirds of its alumni—approximately 120,000 people—live in Maine. The University of Maine System features seven universities—some with multiple campuses—located across the state, as well as nine University College outreach centers, a law school, and an additional 75 interactive distance learning sites. For more information, visit www.maine.edu.

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