

Berea College

Journal of Undergraduate

Research Abstracts

2011

## INTRODUCTION

**Editors: Ronald B. Rosen {Professor of Biology}, Cecilia Albers {Senior Biology Major}, Katie Massana {Senior Biology Major}, and Helena Pett {Junior Biology Major}**

This sixth issue of the "Berea College Journal of Undergraduate Research Abstracts," though certainly not inclusive of all the undergraduate research conducted by Berea College students, contains 44 different abstracts representing majors from 12 different academic programs. The common theme to the research represented in these abstracts is that the: (1) original proposal was peer-reviewed and (2) work was subsequently presented by undergraduates at an on- and/or off campus meeting. These abstracts represent research completed on-campus with funds provided by Berea College's Undergraduate Research and Creative Projects Program (URCCP 15 projects reporting), the Anne Ray Charitable Trust Internships (ARCT) and non-funded class or independent projects. Off-campus projects were funded by the Kentucky Biomedical Research Infrastructure Network (KBRIN) at the University of Kentucky, and by various universities throughout the country. Much of this collaborative work was presented at off campus meetings including the Annual Meeting of the Kentucky Academy of Science (29 presentations and 9 awards received). Off-campus presentations and awards are listed below each abstract where appropriate. It should be noted that a number of these projects were also presented on campus at the 12<sup>th</sup> Annual Undergraduate Research and Internship Symposium, October, 2011 (also indicated).

## ACKNOWLEDGEMENTS

This publication would not have been possible without the support of many people. We acknowledge Chad Berry, Academic Vice President and Dean of the Faculty, for providing funds to print hard copies of these abstracts. Also, gratitude is extended to Berea College faculty for their contributions, and of course to the students whose hard is reflected in this journal. This year, three Biology majors, Cecilia Albers, Katie Massana, and Helena Pett took on the primary responsibility for putting this publication together; they have done an exemplary job and I want to thank them for completing this task. We would also like to acknowledge Michon Martin, a junior Biology Major, for the outstanding cover art gracing this publication. Finally we would like to thank all the off-campus mentors at the following universities for supporting Berea students during the summer of 2011 (number of Berea students in brackets): Marshall University {1}, Mayo Clinic {2}, Miami University {1}, Penn State College of Medicine {1}, University of North Carolina Chapel Hill {1}, University of Kentucky {3}, University of Tennessee {1} and Vanderbilt University {4}.

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## **AGRICULTURE AND NATURAL RESOURCES PROGRAM**

Incorporating Winter Annuals into Pasture Rotations for Beef Cattle at the Berea College Farm. LISA L. BAXTER<sup>1</sup>. <sup>1</sup>Agriculture and Natural Resources Program, Berea College, Berea, Kentucky 40404.

Drought stress and poor pasture management have increased weed populations in some of the cattle pastures on the Berea College Farm. The purpose of this project is to evaluate the projected benefits of incorporating winter annuals such as wheat, rye, and ryegrass in the pasture rotations to extend the grazing season while improving pasture quality and reducing the dependence on stored feed. Animal benefits were analyzed based on the percentage of total digestible nutrients and crude protein found in winter annuals as opposed to stockpiled fescue or fescue hay. Anticipated environmental benefits included managing invasive weed populations without the use of herbicides, better nutrient distribution and recycling, and limiting the number of nutrients removed from the fields. Preliminary calculations showed that grazing winter annuals rather than feeding fescue hay could save the farm over \$2000 annually. Based on these projections, the incorporation of winter annuals is an economic way to improve pasture quality and reduce dependence on stored feed while meeting the nutritional requirements of the brood cows in the winter months.

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Agricultural Section; 2<sup>nd</sup> place in undergraduate research competition)*

## **AGRICULTURE AND NATURAL RESOURCES PROGRAM**

Outdoor Hog Production: Average Daily Gains and Behavioral Differences of Growing Hogs with and without Access to Pasture. SAMANTHA KINDRED<sup>1</sup> and MICHAEL PANCIERA<sup>1</sup>,  
<sup>1</sup>Agriculture and Natural Resources Program, Berea College, Berea, Kentucky 40404.

Since the 1960's swine production has become more intensive and the majority of hogs are raised indoors on a grain based diet. Small farmers are exploring systems for raising hogs outdoors. Information is needed on animal behavior, feed consumption, production costs, and performance for hogs on pasture. This study compared the feed consumption, weight gain, and behavioral differences of pigs raised on a bare lot and pigs rotated through paddocks of a rape-clover pasture mix. Groups of 30 growing pigs (62 kg) were placed in both systems. All pigs had access to full feed and drinking water. The pigs on pasture consumed 20% less grain (455 kg) during the 28 day period, and, on average, gained 4 kg less than the pigs raised without access to forage. Behavioral observations indicated that production systems differed in handling ease, rooting, patterns of forage consumption, and the effects of heat. The modest reduction in production efficiency (22% lower ADG) of pastured vs. lot-raised hogs was compensated for by increased ease of handling. Loading, weighing, and handling the pigs that were raised on rotational pasture proved to be easier and less stressful for both the handlers and the animals. Waste was high in a 4-day rotation, but each time the pigs were moved to a new paddock, the rate of consumption seemed to increase, suggesting that shorter rotations could decrease waste and increase forage intake. Reduced costs in pasture systems resulted in significantly higher profits when compared to conventional production.

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Agricultural Sciences Section; 3<sup>rd</sup> place in undergraduate research competition)*

**Anne Ray Charitable Trust**

## AGRICULTURE AND NATURAL RESOURCES PROGRAM

Out with the Hogs and In with the Fish: Feasibility of Tilapia Farming in a Former Hog-waste Lagoon. KYLE WATKINS<sup>1</sup> and SEAN CLARK<sup>1</sup>, <sup>1</sup>Agriculture and Natural Resources Program, Berea College, Kentucky 40404.

The feasibility of profitably raising tilapia, *Oreochromis niloticus* (Linnaeus, 1758), in a former hog-waste lagoon was evaluated on the Berea College Farm during the summer of 2011. Tilapia were grown in cages suspended in a 0.26-acre, aerated pond on the Berea College Farm that held liquid hog waste until spring, 2010. Four cages (4 by 4 ft) were each stocked in late May, 2011, with 50 fish weighing an average of 0.75 lbs. The fish were fed conventional pellet feed throughout the summer and harvested in mid-September at an average weight of 1.3 lbs. Standard water quality variables, including temperature, dissolved oxygen, alkalinity, chloride, nitrite, water hardness, pH, and ammonia were measured regularly and all were within recommended ranges. An economic analysis was performed using input costs and market value to determine if the enterprise could be profitable in the future. Labor for feeding and harvesting accounted for the greatest fraction of the budget, but the cost of purchasing fish stock was also considerable. The costs of production exceeded gross returns when selling the fish live. Even with value added through processing (filleting), the costs still exceeded projected gross returns. Substantial improvements in labor efficiency, less expensive fish stock, scaling up the operation by at least two-fold, and selling to high-end, specialty markets would be needed to ensure profitability.

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Agricultural Sciences Section)*

**Anne Ray Charitable Trust**

## **BIOLOGY PROGRAM**

Runx1 Interacts with Delta Np63 alpha to Regulate Target Genes. MARCELINE AENGWANAMA<sup>1,2</sup>, CHRISTOPHER BARTON<sup>3,4</sup>, and JENNIFER PIETENPOL<sup>3,4</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Aspirnaut Program; <sup>3</sup>Department of Biochemistry; <sup>4</sup>Vanderbilt Ingram Cancer Center, Vanderbilt University, Nashville, Tennessee 37232.

P63 (a protein) is over-expressed in a number of cancers such as breast, head and neck, lung, prostate, bladder and esophageal cancers. The predominant isoform of p63, Delta Np63 alpha is very important for skin development, epithelial stem cell proliferation and maintenance of complex embryonic development in ectodermal lineages. Due to its importance during early development, it is imperative that the molecular mechanisms underlying the function of p63 are further elucidated. Data has established that Delta Np63 alpha binds to the Runx1 gene, and are co-expressed in specific cell types. They may be interlinked in regulating expression of downstream genes important for the development of cells and regulatory pathways important in skin morphogenesis. Through proteomic screening experiments, Runx1 was identified as a potential p63-interacting protein. The goal of this research was to confirm Runx1 as a p63-interacting protein, as well as to identify target genes in which Runx1 may cooperate with Delta Np63 alpha to regulate transcription. Knowledge of this will provide mechanistic insight to proteins that function as upstream regulators of p63, some of which may be involved in development and tumorigenesis. To investigate this, we transfected H1299 cells (a non-small cell lung cancer cell line) with plasmids to exogenously express Runx1 and p63. Total RNA from H1299 cells was isolated and purified. mRNA levels were analyzed by quantitative real-time PCR. Protein lysates were also isolated for western blotting. Our data identified DPP4 and PDGFD as p63/ Runx1 regulated genes.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Cellular and Molecular Biology Section)*

### **Vanderbilt University Internship**

## **BIOLOGY PROGRAM**

The Role of Activated Leukocyte Cell Adhesion Molecule in Triple Negative Breast Cancer. CECILIA ALBERS<sup>1,2</sup>, BOJANA JOVANOVIĆ<sup>3,4</sup>, BRIAN D. LEHMANN<sup>5</sup>, SHANNA ARNOLD<sup>6</sup>, JOSHUA A. BAUER<sup>5</sup>, JENNIFER A. PIETENPOL<sup>4,5</sup>, HAROLD L. MOSES<sup>3,4</sup>, and ANDRIES ZIJLSTRA<sup>3,6</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Berea Kentucky 40404; <sup>2</sup>Aspironaut Program; <sup>3</sup>Department of Cancer Biology; <sup>4</sup>Vanderbilt-Ingram Cancer Center; <sup>5</sup>Department of Biochemistry; <sup>6</sup>Department of Pathology, Vanderbilt University, Nashville, Tennessee 37232.

Breast cancer is the number one cancer of women in the United States and Europe. Recently studies have demonstrated that breast cancer can be broken down into subtypes based on its molecular receptors, one of which being Triple Negative Breast Cancer (TNBC). Known for its lack of the estrogen, progesterone, and HERII receptor, TNBC can also be broken down into seven subtypes. One of these subtypes known as Luminal Androgen Receptors (LAR) contains a large number of androgen receptors. This project looked at several androgen receptors producing TNBC cell lines and LAR cell lines to determine if there was a correlation between having high androgen receptor expression and the expression of cellular receptor protein Activated Cellular Adhesion Molecule (ALCAM) and shedding of ALCAM. Due to small sample size, it is difficult to tell, but it appears that these androgen expressing cells do express ALCAM and shed ALCAM as well.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Cellular and Molecular Biology Section)*

### **Vanderbilt University Internship**

## BIOLOGY PROGRAM

Constant Bright Light Abolishes Rhythms in House Sparrow (*Passer domesticus*). AMANDA BARTON<sup>1</sup>, AMIT K. TRIVELDI<sup>2</sup>, and V.M. CASSONE<sup>2</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Kentucky 40404, <sup>2</sup>Department of Biology University of Kentucky, Lexington, Kentucky 40506.

Circadian rhythms are rhythms of endogenous origin and have frequencies of about a day. These rhythms have been studied in almost all types of organisms ranging from very small organisms like cyanobacteria up to higher organisms like mammals, including humans. The circadian rhythms are under the control of groups of specialized neurons called clock (circadian clock). In mammals the central clock is located on either side of the third ventricle just above the optic chiasma and called Suprachiasmatic Nucleus (SCN). However, in birds, at least three separate structures, pineal, retina, and hypothalamus constitute together the complex bird clock. These clock(s) express transcription factors called clock genes. The clock system constitutes positive and negative transcriptional/translational feedback loops. The CLOCK/BMAL<sub>1</sub> heterodimer binds to the E-box enhancer elements of promoters of *Per* and *Cry* and activate their transcription. As a result, the *Per* and *Cry* proteins are translated in the cytoplasm and form heterodimers that are translocated into the nucleus. In the nucleus, *Per/Cry* heterodimers inhibit CLOCK/BMAL<sub>1</sub>-dependent transcriptional activation which leads to a decrease in their own transcription levels. The role of light in the entrainment of clock has been well studied, however, less is known about how continuous bright light affects the metabolic uptake and expression of clock genes in birds.

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation – Cellular and Molecular Biology Section)*

**University of Kentucky (KBRIN Funded Research)**

## BIOLOGY PROGRAM

*Proterometra macrostoma* (Trematoda: Azygiidae): Location of the Redia and Emergence Path from the Snail Intermediate Host, *Elimia semicarinata* (Gastropoda: Pleuorceridae). ERICKA BERG<sup>1</sup>, BAILEY KING<sup>1</sup>, MICHON MARTIN<sup>1</sup>, JULIANNA DOLAN<sup>1</sup>, FRANCESKA MEHMETI<sup>1</sup>, and RONALD ROSEN<sup>1</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Kentucky 40404.

The digenetic trematode, *Proterometra macrostoma*, is found in freshwater east of the Mississippi. It requires a two-host life cycle, incorporating a snail intermediate host and a centrarchid fish definitive host. Several past studies suggest that *P. macrostoma* rediae develop in the snail mantle cavity. However, recent work suggests an osmotic environment approximating artificial snail water is more conducive to redial development compared to artificial pond water. In addition, the path by which the cercaria exits the snail is unclear. The objectives of this study were to describe the: 1) precise location of the redia in the snail intermediate host, 2) mechanism by which the cercaria exits the redia and where retraction of the distome body into the cercarial tail occurs, and 3) emergence path of the cercaria out of the snail. Histological sections clearly show rediae developing in close association with the digestive tract, within the body cavity/hemocoel of the snail, and isolated from the mantle cavity by the mantle membrane. Retraction of the distome body into the cercarial tail occurs following the emergence of the cercaria from the redia. Cercariae must then traverse the mantle membrane, enter the mantle cavity and emerge into freshwater through a siphon-like structure formed by the mantle collar of the snail.

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*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation – Zoology Section; 1<sup>st</sup> place in undergraduate research competition)*

### **Berea College URCP Funded Research**

## BIOLOGY PROGRAM

The Role of Bone Morphogenic Proteins in Mammary Gland Differentiation. CHARLI BOBBIT<sup>1</sup>, MARY AAKRE<sup>3</sup>, AGNES GORSKA<sup>3</sup>, ANNA CHYTIL<sup>3</sup>, PHIL OWENS<sup>3</sup>, and HAL MOSES<sup>2</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Aspironaut Program; <sup>3</sup>Department of Cancer Biology, Vanderbilt University, Nashville, Tennessee 37232.

Bone Morphogenic Proteins (BMPs) are a member of the transforming growth factor- $\beta$  (TGF- $\beta$ ) superfamily. They bind to type I and type II serine-threonine kinase receptors (Miyazono *et al.*, 2009). BMPs play an important role in controlling epithelial cell proliferation, differentiation, and apoptosis (Shemanko *et al.*, 2009). Noggin binds BMP and inhibits it when present in the extracellular space. It was recently seen that BMP may play a role in the differentiation of mammary glands. The HC11 cell line of mouse mammary epithelial has been used as a model for mammary epithelial cell proliferation and differentiation (Shemanko *et al.*, 2009). HC11 cells are able to be used in culture because they can produce their own extracellular matrix proteins (Chammas *et al.*, 1994). In a controlled environment with a hormone treatment the HC11 cells will become competent and will differentiate to produce milk proteins such as  $\beta$ -casein (Shemanko *et al.*, 2009). This information led to the question of how HC11 cells that are producing milk proteins would react to BMPs. Our hypothesis is that BMP will induce differentiation in HC11 cells. The milk protein  $\beta$ -casein, used as a differentiation marker, was increased in the BMP4 treated cells.  $\alpha$ -Lactalbumin, another milk protein, was increased in the TGF $\beta$  treatment and also in the BMP4 treated cells. HC11 cells treated with TGF $\beta$  or BMP4 had a decrease in proliferation. This decrease was possibly due to alternated differentiation in response to TGF $\beta$  or BMP4. There was an increase of Keratin 5 positive cells in BMP4 treated cells and an increase in Keratin 8 cells in the TGF $\beta$  treatment. Vimentin showed an increase in the TGF $\beta$  treatment and Ecadherin increased in the BMP4 treatment.

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### **Vanderbilt University Internship**

## **BIOLOGY PROGRAM**

LKB1 Effect on MicroRNA Expression in Lung Adenocarcinoma. HORTON LI<sup>1,2</sup>, JACOB M. KAUFMAN<sup>3</sup>, JOSEPH M. AMANN<sup>3</sup>, and DAVID P. CARBONE<sup>3</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Kentucky; <sup>2</sup>Vanderbilt Summer Science Academy, <sup>3</sup>Department of Biochemistry, Vanderbilt Ingram Cancer Center, Vanderbilt University, Nashville, Tennessee 37232.

Lung cancer is the leading cause of cancer deaths in men and women worldwide. LKB (STK 11) is a serine/threonine kinase that is a negative regulator of mTOR signaling, and acts as a tumor suppressor. It is inactivated in 30% of lung adenocarcinomas and 5-15% of primary lung squamous-cell carcinomas. The LKB1/AMPK signaling pathway functions as a tumor suppressor and is a key regulator of cancer cell metabolism and proliferation. Loss of LKB1 leads to activation of its downstream pathway, which can be inactivated by pharmacological molecules such as metformin or specific pathway inhibitors in cancer cells. In an effort to understand how LKB1 signaling affects cancer cell growth and proliferation, we added LKB1 back to LKB1 deficient lung cancer cell lines by retroviral infection. After adding back LKB1, we measured changes in proliferation, drug sensitivity to phenformin and R1507, as well as microRNA expression. We observed a decrease in cell proliferation and a change in sensitivity to phenformin. Examination of public microRNA databases revealed eight microRNAs that were differentially expressed between wild and LKB1 mutated type cell lines. Results from our own microRNA expression studies are pending for our LKB1 “add back” cell lines. These studies should help us better understand the mechanisms that these tumors use to control particular cell behaviors. This increased understanding may likely lead to the discovery of new AMPK activating agents and allows us to explore the potential of the LKB1/AMPK signaling pathway as a new target for anticancer drug development. Our goal would be to develop a targetable therapeutic to benefit patients whose lung tumors have lost the LKB1 tumor suppressor.

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### **Vanderbilt University Internship**

## BIOLOGY PROGRAM

*Proterometra macrostoma* (Trematoda: Azygiidae): Effect of Serotonin and Melatonin on Redial Movement and Emergence of the Cercaria from the Redia and the Snail, *Elimia semicarinata* (Gastropoda: Pleuroceridae). KATIE MASSANA<sup>1</sup>, FRANCESKA MEHMETI<sup>1</sup>, JULIANNA DOLAN<sup>1</sup>, ERICKA BERG<sup>1</sup>, BAILEY KING<sup>1</sup>, MICHON MARTIN<sup>1</sup>, and RONALD ROSEN<sup>1</sup>,  
<sup>1</sup>Biology Program, Berea College, Berea, Kentucky 40404.

*Proterometra macrostoma* is a digenetic trematode that parasitizes a snail intermediate host and centrarchid fish definitive host. Previous work has indicated that: (1) the intramolluscan larval stages are located in the snail's mantle cavity, presumably in an osmotic environment approximating artificial pond water (APW), and (2) dark conditions (exogenous trigger) promote the release of *P. macrostoma* cercariae from snails. An internal or endogenous trigger for cercarial release has yet to be determined. The purpose of this study was to evaluate the: (1) longevity of the *P. macrostoma* redia in APW vs. ASW (artificial snail water) and (2) effect of serotonin and melatonin on redial movement and the release of cercariae from rediae *in vitro* and from snails *in vivo*. Significantly more rediae showed sustained movement in ASW than in APW after five hours. Both serotonin and melatonin in ASW increased muscular contractions and movement of rediae, but the duration of these movements was not significantly different when compared to controls after four hours. Only serotonin promoted the release of significantly more cercariae *in vitro*. No significant difference was observed in the average number of cercariae released from snails treated in ASW with serotonin or melatonin over four days.

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### **Berea College URCP Funded Research**

## BIOLOGY PROGRAM

Understanding SERF Function: Creation and Behavioral Analysis of dSERF Deletion Mutants. KAREN REYNOLDS<sup>1</sup>, BRIAN C. RYMOND<sup>2</sup>, and DOUG HARRISON<sup>2</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Department of Biological Sciences, University of Kentucky, Lexington, Kentucky 40506.

The autosomal recessive form of proximal Spinal Muscular Atrophy (SMA) is a genetic disease that causes the loss of the motor neurons and is the leading cause of genetic infant mortality in the United States. It has been linked to mutations of the Survival of Motor Neuron (SMN) genes, but the large phenotypic variability of the disease cannot be completely explained by SMN alone. Previous research has identified several other genes that may contribute to the disease state, including SERF, which is located just upstream of the SMN1 and SMN2 genes in humans. When SERF1 is deleted, along with SMN1, SMA is most severe. SERF appears phylogenetically conserved across all fungal and animal taxa, but its biological function has not been identified in any organism. Our goal was to investigate the natural function of SERF in *Drosophila melanogaster* so as to understand its potential relevance in SMA or related neurological diseases. Our research shows that a deletion which encompasses SERF along with a downstream uncharacterized gene results in severe locomotion dysfunction. The purpose of this project was to create a *D. melanogaster* mutant missing only SERF by a P-element excision mutagenesis screen, in order to study the effects of this deletion and compare it to the currently available SERF mutant. Potential deletion mutants were screened using the Polymerase Chain Reaction (PCR) and six deletion candidates were identified. These mutants are being screened for flight ability and general mobility defects.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

**University of Kentucky (KBRIN Funded Research)**

## BIOLOGY PROGRAM

Detection and Mapping of Invasive Plant Species and Hiking Trails at Indian Fort Mountain in Berea, Kentucky. KATHERINE D. WEBB<sup>1</sup> and ALYSSA B. HANNA<sup>1</sup>, <sup>1</sup>Biology Program, Berea College, Berea, Kentucky 40404.

Invasive plants are a widespread ecological problem that threaten native biodiversity. The Indian Fort trails, also known as the Pinnacle, are popular hiking destinations with the potential to act as avenues for invasive plants into the forest. We determined what invasive species were present along the trails and where they were located. We also updated the trail map. In July through August we surveyed and mapped the Pinnacle trails using a GPS. A GPS point was taken every 1.5 to 3 meters along straight paths and every 0.5 meters` along curved paths to ensure adequate mapping. We also notated the existence and location of invasive plants within 3 meters of the trail. Long-term invasive plant monitoring plots were established every 100 meters along the trail for a total of 106 monitoring plots. Ten invasive plant species were observed along the trails; however, only seven were present in the established monitoring plots. The most common species, *Microstegium vimineum*, was found in 11% of the plots. The second most common species were *Ailanthus altissima* and *Alliaria petiolata*, both found in 4% of the plots. Furthermore, 14% of the plots with invasive species contained at least two invasive plants. Future monitoring should occur in spring, summer, and early fall to ensure detection of invasive species. This study will serve as the groundwork for future experiments involving invasive species control efforts, demography, and interactions between invasive and native plant communities. Additionally, a new informative trail map was created that will benefit the Berea community.

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## CHEMISTRY PROGRAM

Synthesis of Fluorescent Derivatives of Lysine and Glutamic Acid. DALLAS COOK<sup>1</sup>, RUSSELL HAMMOND<sup>1</sup>, HORTON LI<sup>1</sup>, and MATTHEW SADERHOLM<sup>1</sup>, <sup>1</sup>Chemistry Program, Berea College, Berea College, Berea, Kentucky 40404.

A standard method for assaying peptidase activity is to label a peptide substrate with a fluorogenic group at one end of a peptide substrate and a fluorescence-quenching group at the other end. When the peptidase cleaves the substrate, fluorescence can be observed proportional to the activity. To build internally-quenched fluorogenic substrates for the peptidase neurolysin, we evaluated the synthesis of two different fluorenylmethoxycarbonyl (Fmoc)-protected amino acids: Fmoc-Glutamine(N-(2,4-dinitrophenyl)-ethylenediamine) (Fmoc-Gln(EDDnp)-OH) and Fmoc-Lysine(N-(2,4-dinitrophenyl) (Fmoc-Lys(Dnp)-OH). Both amino acids were synthesized by multiple routes. After evaluation of the syntheses, we determined that Fmoc-Lys(Dnp)-OH is much easier to synthesize with a higher yield.

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## CHEMISTRY PROGRAM

Synthesis of Fluorescence-Quenching Amino Acids. DALLAS COOK<sup>1</sup>, RUSSELL HAMMOND<sup>1</sup>, HORTON LI<sup>1</sup>, and MATTHEW SADERHOLM<sup>1</sup>, <sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404.

A standard method for assaying peptidase activity is to label a peptide substrate with a fluorogenic group at one end of a peptide substrate and a fluorescence-quenching group at the other end. When the peptidase cleaves the substrate, fluorescence can be observed proportional to the activity. To build internally-quenched fluorogenic substrates for the peptidase neurolysin, we evaluated the synthesis of two different fluorenylmethoxycarbonyl (Fmoc)-protected amino acids: Fmoc-Glutamine(*N*-(2,4-dinitrophenyl)-ethylenediamine) (Fmoc-Gln(EDDnp)-OH) and Fmoc-Lysine(*N*-(2,4-dinitrophenyl) (Fmoc-Lys(Dnp)-OH). Both amino acids were synthesized by multiple routes. After evaluation of the syntheses, we determined that Fmoc-Lys(Dnp)-OH is much easier to synthesize with a higher yield.

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Chemistry Section)*

## CHEMISTRY PROGRAM

Combinatorial Synthesis of a Thiourea Library for the Aminolysis of *N*-acyl Homoserine Lactones. CHIDO M. HAMBIRA<sup>1</sup>, MICHAEL BERTUCCI<sup>2</sup>, and MIKE GAGNÉ<sup>2</sup>, <sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Department of Chemistry, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27514.

In bacteria, regulation of gene expression in response to variations in cell-population density is called quorum sensing. This process of intercellular communication is conducted through small molecules known as autoinducers, and is responsible for a variety of effects including increased virulence, drug resistivity, conjugation, and biofilm formation. In the Gram-negative bacteria, *Pseudomonas aeruginosa*, the autoinducers are acylated homoserine lactones (AHLs), which have been linked to the formation of drug-resistant biofilms in cystic fibrosis patients. One unexplored way to quench this quorum sensing process is an amine attack of the homoserine lactone, rendering the molecule inactive. The major purpose of this study was to synthesize a library of thiourea compounds consisting of a terminal amine, and screen for potential hits against C<sub>6</sub>-AHL. This synthesis was carried out using solution phase and solid phase combinatorial chemistry. The reaction was monitored by React IR, and the products were characterized by GC-MS and NMR spectroscopy. Mass analysis of hits was done by MALDI.

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**University of North Carolina, Chapel Hill Internship**

## CHEMISTRY PROGRAM

Blood Plasma Coagulation Induced by Poly (ethylene glycol) Materials. IMELDA HOT<sup>1</sup> and CHRISTOPHER A. SIEDLECKI<sup>2</sup>, <sup>1</sup>Chemistry and Physics Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Biomedical Engineering Institute, Department of Surgery and Bioengineering, Penn State College of Medicine, Hershey, Pennsylvania 17033.

The traditional view of the blood coagulation cascade is that it is stimulated by electrostatic interactions by negatively charged surfaces and Hageman factor (FXII), but recent studies have shown activation by many surfaces. In this study, we use poly (ethylene glycol) (PEG) surfaces to induce contact activation of blood proteins and describe the coagulation pathway. Several PEG molecules of different wettability and size are shown to have lower clotting times than the hydrophobic control sample-OTS. Furthermore, this is contradictory to findings that hydrophilic substrates adsorb proteins less efficiently than hydrophobic surfaces.

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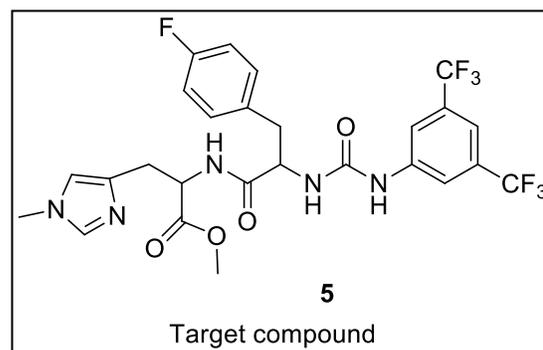
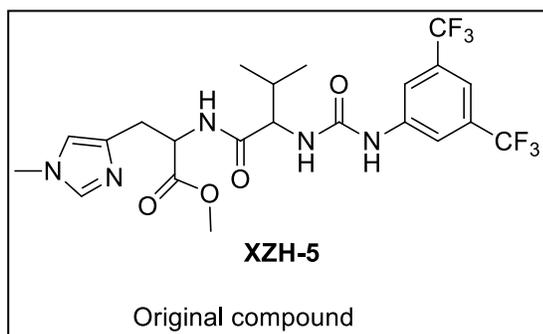
*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation - Chemistry Section)*

**Penn State College of Medicine Internship**

## CHEMISTRY PROGRAM

Design and Synthesis of STAT3 Inhibitor. CHYNA JOHNSON<sup>1</sup>, NATE CARMEN<sup>2</sup>, PHILIAS DAKA<sup>2</sup>, and HONG WANG<sup>2</sup>, <sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Department of Chemistry & Biochemistry, Miami University, Oxford, Ohio 45056.

Previous research shows that coupled L-Histidine derivatives are effective in the inhibition of STAT3 protein. Variations of the XZH-5 small molecular inhibitor have been synthesized and are being tested for their effectiveness as an inhibitor of the STAT3 protein in the HCC cancer cells. The following compounds were used in the synthesis of the target compound: methyl 2-(2-(3-(3,5-bis (trifluoromethyl) phenyl) ureido)-3-(4-fluorophenyl) propanamido)-3-(1-methyl-1H-imidazol-4-yl) propanoate. The synthesis can be divided into two parts. The first part is the synthesis of the starting material (S)-methyl 2-amino-3-(1-ethyl-1H-imidazol-4-yl), and the second is the coupling of methyl 2-amino-3-(1-ethyl-1H-imidazol-4-yl) to phenylalanine derivative and the 3,-5-Bis(trifluoromethyl)phenyl isocyanate. <sup>1</sup>H NMR and <sup>13</sup>C NMR spectroscopy were used to confirm the product.



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### **Miami University Internship**

## CHEMISTRY PROGRAM

Synthesis of Enantioenriched  $\beta$ -Ketoesters via an Azaferrocene-Catalyzed Ketene-Claisen Condensation. CHELSEY LLOYD<sup>1</sup>, MICHELLE BLOOM<sup>1</sup>, and MARY ROBERT GARRETT<sup>1</sup>,  
<sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404.

The goal of this research was to develop a new reaction to synthesize  $\beta$ -ketoesters in high enantiomeric excess. The main reaction proposed to synthesize  $\beta$ -ketoesters was a ketene-Claisen condensation reaction using an azaferrocene catalyst. Other targeted catalysts were quinine derivatives, benzoyl quinine (BQ) and acetyl quinine (AQ). These catalysts are nucleophilic so theoretically a zwitterionic enolate would form when added to a ketene. This zwitterionic enolate would then react with an aromatic ester to then produce the  $\beta$ -ketoester after displacement of the catalyst. The azaferrocene catalyst proved to be very difficult to synthesize and after many attempts, was set aside to pursue other catalyst possibilities; thus, the quinine derivatives were then used. These derivatives are more stable than quinine since they do not have the acidic proton in their structure. A variety of reaction combinations were examined varying the temperature, solvent, acid chloride (ketene precursor), and base. Reactions were monitored by thin-layer chromatography (TLC), <sup>1</sup>H, and <sup>13</sup>C NMR analysis, but will have to be examined more closely and supplementary reaction attempts in the future.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation – Chemistry Section; 2<sup>nd</sup> place in undergraduate research competition)*

**Berea College URCP Funded Research**

## CHEMISTRY PROGRAM

Epitope Mapping of Vimentin in Arthritis-susceptible HLA-DRB1\* 0401 and resistant \*0402 mice. KELLY MOUAPI<sup>1</sup>, CHELLA DAVID<sup>2</sup>, and VEENA TANEJA<sup>2</sup>, <sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Department of Immunology, Mayo Clinic, Rochester, Minnesota 55905.

Predisposition to rheumatoid arthritis (RA) has been associated with the presence of human leukocyte antigen (HLA) class II molecules-DR and DQ. Patients with RA produce antibodies to Vimentin and harbor Vimentin-reactive T-cells. It has been hypothesized that response to Vimentin precedes onset of RA, and is associated with presence of HLA-DRB1\*0401 gene. To investigate the role of DR4 in susceptibility and resistance to arthritis, mice expressing \*0401 and \*0402 gene, but lacking endogenous class II molecules were generated. Transgenic mice were immunized with Vimentin and challenged *in vitro* with 20mer Vimentin-peptides. Using this approach, we confirmed the epitopes present in RA patients and also identified two new epitopes in \*0401 and \*0401/DQ8 mice. Further, we showed that females generated higher response to the Vimentin peptides compared to males. Arthritis-resistant \*0402 mice generated response to Vimentin and its peptides although \*0402 and \*0401 mice clearly responded to different peptides. Interestingly, naïve \*0401 and \*0402 mice also generated mild response to Vimentin and its peptides. The two new epitopes identified in immunized mice were also responsive in naïve \*0401 mice suggesting their role in pathogenesis.

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*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation – Physiology and Biochemistry Section; 1<sup>st</sup> place in undergraduate research competition)*

### **Mayo Clinic Internship**

## CHEMISTRY PROGRAM

Characterization of Internally-Quenched Fluorescent Peptide Substrates for the Peptidase Neurolysin. DIEGO MOYA<sup>1</sup>, ELIJAH WHITAKER<sup>1</sup>, MELANIE BURT<sup>1</sup>, JULIANNA DOLAN<sup>1</sup>, and MATTHEW SADERHOLM<sup>1</sup>, <sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404.

The peptidase neurolysin is a medically-interesting protein as it is involved in controlling the concentration of a wide range of neuropeptides that regulate, among other things, blood pressure. However, the molecular reasons for neurolysin's peptide specificity remain unclear as it will cleave a wider range of peptide sequences than expected. Neurolysin's active site is a deep cleft with a flat binding site for substrate recognition, so the source of its specificity is yet to be determined. To probe its specificity further, we began to synthesize internally-quenched fluorogenic peptide analogs of neurotensin, neurolysin's preferred substrate. We report here preliminary results confirming that peptides synthesized at Berea College are viable substrates and propose a set of future peptides to construct and assay to investigate neurolysin's "fuzzy specificity" further.

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## CHEMISTRY PROGRAM

Synthesis of Enantioenriched  $\beta$ -Ketoesters via a Quinine-Catalyzed Ketene-Claisen Condensation. TRENA PAYTON<sup>1</sup>, AMANUEL TESFAMICHAEL<sup>1</sup>, and MARY ROBERT GARRETT<sup>1</sup>,  
<sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404.

The goal of this research was to find a new way to enantioselectively synthesize  $\beta$ -ketoesters (found in the backbone of drugs and pharmaceuticals). New methods of synthesis are beneficial because molecule enantiomers can have varying effects on the body. The main reaction involved a selected catalyst, a ketene precursor (an acid chloride), and an ester to affect a ketene-Claisen type condensation. The catalysts used were quinine and some of its derivatives: benzoyl quinine (BQ) and acetyl quinine (AQ) which were synthesized in high yields from previously reported literature. These catalysts are nucleophilic; so theoretically a zwitterionic enolate would form when added to a ketene (formed *in situ*). This zwitterionic enolate would then react with an aromatic ester to produce the  $\beta$ -ketoester after displacement of the catalyst. Numerous reaction combinations were examined varying the temperature, solvent, acid chloride (ketene precursor), and base. Reactions were monitored by thin-layer chromatography (TLC), <sup>1</sup>H, and <sup>13</sup>C NMR analysis which will be beneficial for examining in the future.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation – Chemistry Section)*

**Berea College URCP Funded Research**

## CHEMISTRY PROGRAM

The Mechanism of Action of *Prevotella histicola* in the Immunomodulation of Experimental Autoimmune Encephalomyelitis (EAE). PREMILA SAMUEL<sup>1</sup>, ARIKA WUSSOW<sup>2</sup>, and ASHUTOSH K. MANGALAM<sup>2</sup>. <sup>1</sup>Chemistry Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Immunology Department, Mayo Clinic, Rochester, Minnesota 55906.

Multiple sclerosis (MS) is an inflammatory autoimmune disease affecting the central nervous system. Genetic and environmental factors may interact in different ways to influence the outcome of MS. Recently, a lot of interest has been generated in studying the role of gut microbiota as a possible environmental factor in the immunopathogenesis of MS. This hypothesis is supported by recent reports that patients with inflammatory diseases have reduced fecal levels of certain commensal bacteria, suggesting possible immunomodulatory role of commensal bacteria in these diseases. Previously, we have shown that human gut specific commensal bacteria, *Prevotella histicola* can suppress experimental autoimmune encephalomyelitis (EAE), an animal model of MS, in HLA-DR3.DQ8 transgenic mice. In this study, we investigated the mechanism of action of immunomodulatory activity of *P. histicola* by investigating the ability of *P. histicola* to modulate pro and anti-inflammatory cytokine production in lipopolysaccharides (LPS) stimulated epithelial and dendritic cells. Our preliminary data shows that the *in vitro* treatment of Caco-2, a human intestinal epithelial cell line, and THP-1, a human monocytic cell line, with *P. histicola* supernatant resulted in the down-regulation of pro-inflammatory cytokines TNF- $\alpha$  and IL-8, and the up-regulation of anti-inflammatory cytokine IL-10. Likewise, the *in vitro* treatment of dendritic cells and macrophages (derived from HLA-DR3.DQ8 double transgenic mice) with *P. histicola* supernatant suppressed the production of TNF- $\alpha$ , while inducing the production of IL-10. Thus our preliminary data indicate that *P. histicola* might suppress EAE in HLA class II transgenic mice through modulation of pro- and anti-inflammatory cytokines.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Oral Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation – Cellular and Molecular Section; 1<sup>st</sup> place in undergraduate research competition)*

### **Mayo Clinic Internship**

## **CHILD AND FAMILY STUDIES PROGRAM**

Berea College Gardening Project. LYDIA JOINER<sup>1</sup> and NEIL MECHAM<sup>1</sup>, <sup>1</sup>Child and Family Studies Program, Berea College, Berea, Kentucky 40404.

There is a growing interest among American college students to increase both their colleges' and their own sustainability. Gardening is generally a central theme of campus initiatives when trying to increase sustainability. The Berea College Student Gardening Project investigated how gardening might affect students over the course of the summer. Twenty students, who tended to their own garden plot, participated in the study by reporting the amount of vegetables and fruits they ate during certain weeks. Everyone was asked to report their eating behaviors seven times throughout the summer using a Food Frequency Questionnaire (FFQ). In addition to the questionnaire, nineteen students were interviewed to discover what effects gardening might have had on them and what affected their gardening experience. A phenomenology approach of qualitative data analysis was used while working with the interview data. Experience emerged as a central theme as both a hindrance (students lacked experience and felt as if they were not doing a good job with their gardens) and a benefit (everyone was looking forward to gardening again and doing a better job). The students realized that their gardens were too small to make a substantial contribution to their sustainability, but they considered the knowledge that they gained through gardening as a step towards becoming more self-sufficient. Students reported that having fresh organic vegetables was a benefit of gardening, but the analysis of the FFQs revealed that they did not eat more vegetables. However, students did eat more fruit as the summer progressed.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Oral Presentation)*

### **Berea College URCP Funded Research**

## CHILD AND FAMILIES STUDIES PROGRAM

African American Families and their Heritage in Garrard County Kentucky--Phases I and II. STACEY ROBERTS<sup>1</sup>, BRITTANY STOWERS<sup>1</sup>, and JANICE B. BLYTHE<sup>1</sup>, <sup>1</sup>Child and Family Studies Program, Berea College, Berea, Kentucky 40404.

Physical structures, along with cultural, social, educational, and economic data describe the “stories”, *i.e.* heritage of a community. Moreover, oral histories, artifacts, homes, schools, churches, cemeteries, barns, organizations, businesses, public records, and primary and secondary documents concretize this historic landscape. Building on qualitative results from a 2010 study, objectives for this eight-week project were to expand our exploration of the heritage of African Americans in Garrard County (GC). This continuation involved drafting narratives about the educational experiences of black children; documenting black farmers as property owners; constructing narratives about diverse religious practices in black congregations; conducting additional oral histories; and detailing the life of one physician. Results of this study include student-generated conversations and essays about the research process, with a particular focus on qualitative or ethnographic methodologies. Eleven (11) oral histories were conducted (birthdates between 1920 and 1961) and included representatives from Lancaster proper (1) and rural communities of Davistown (3), Boones Creek (2), Buckeye (2); Scotts Fork (1), Bryantsville (1), and Flatwoods (1). Oral history data and library research conducted at Berea College, Eastern Kentucky University, Garrard County Public Library, University of Louisville, University of Kentucky, and the Kentucky History Center supported the expansion of narratives about two black educators (Miss Lillie B. Mason and Mrs. Tommie F. Merritt), two Rosenwald Schools, black education during segregation, church histories (Davistown, Paint Lick, Buckeye, and St. Paul Predestinarian Baptist), black farmers, and Dr. William Johnson, an African American physician’s 50-year contribution to the quality of life throughout GC.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

**Berea College URCP Funded Research**

## EDUCATION STUDIES PROGRAM

The Creation of a Community of Teachers: Nurturing Professional Identity in a Community of Practice. JON SADERHOLM<sup>1</sup>, ERIC ARTHUR<sup>1</sup>, HENRY FREMIN<sup>1</sup>, MEGAN MCCARTY<sup>1</sup>, and HEATHER BROWN<sup>1</sup>, <sup>1</sup>Teacher Preparation Programs, Berea College, Berea, Kentucky 40404.

Practicing teachers, college faculty, and student researchers met to discuss essential experiences, skills, and understandings necessary to successfully enter the teaching profession. Teachers were grouped according to discipline and were asked to describe their own experiences in their teacher preparation programs, the essential instructional models in their discipline, and those skills necessary in order to apply those models. Qualitative analysis of the documents and transcripts indicated that elements clustered into four strands of teaching skills (Instructional Design, Resource Management, Interacting & Monitoring, and Assessment) and a separate strand of communication and collaboration skills (Parent & Community, Collegial & Administrative, and Professional). Across disciplines, teachers thought that student teachers needed proficiency with several instructional models in order to be ready to teach. These are Whole-Class Instruction, Small-Group Instruction, and Guided Independent Inquiry. Teachers described several phases through which students pass while learning these skills. These are phases of Exposure, Practice, and Incorporation. Teachers also described particular areas of content or discipline-specific modes of inquiry that should be practiced. Examples are active inquiry in science, the composing or writing process in English, and analyzing original documents in social studies. These four characteristics serve as the framework structuring all student experiences with the Community of Teachers. In general, through a four-semester sequence of intentional experiences, students first will be exposed to instructional practice, then plan and implement lessons using each of the three instructional models while demonstrating progressively more challenging skills following an apprenticeship model with mentor teachers.

*Accepted for presentation at the Annual Meeting of the Association of Independent Liberal Arts Colleges for Teacher Education on February 18<sup>th</sup> in Chicago Illinois.*

## ENGLISH AND THEATER PROGRAM

Completing an Appalachian Literature Anthology. KATHERINE EGERTON<sup>1</sup> and MORGAN SMITH<sup>1</sup>, <sup>1</sup>English and Theater Program, Berea College, Berea, Kentucky 40404.

*Appalachian Gateway: An Anthology of Contemporary Literature* is designed to introduce the reader to the work of approximately twenty-five contemporary Southern Appalachian fiction writers and poets. For each author, in addition to a short story or a selection of poems, we will present a biographical sketch and a brief annotated bibliography of relevant primary and secondary sources for further reading and research. For faculty designing courses, *Appalachian Gateway: An Anthology of Contemporary Literature* will provide a range of excellent contemporary selections as well as biographical information, suggestions for further reading, and guidance for student research. This anthology can be useful for courses in contemporary regional literature, in Appalachian Studies, and in creative writing. It may be used as the only required text, in conjunction with other assigned books for class assignments, and as a quick guide for students to use to decide upon authors to select for individual class presentations or papers. This anthology will give students and teachers an excellent overview of this dynamic and diverse field. We also hope that high school teachers throughout the region will use this anthology to find works and writers to teach in their classrooms, creating more readers who will seek out Appalachian literature on college campuses, through the regional journals, and beyond.

**Berea College URCP Funded Research**

## PHYSICAL EDUCATION AND HEALTH PROGRAM

Taichi Improves Kinetic Link Coordination. AARON MEADOWS<sup>1</sup> and JEFF MCCLUNG<sup>1</sup>,  
<sup>1</sup>Physical Education and Health Program, Berea College, Berea, Kentucky 40404.

Nine subjects (4 women, 5 men, 18-22 yr, BMI < 25) of the original 24 completed the study. All had limited experience in the martial arts or athletics participation prior to this study. Training was offered for two hours each night over a six-week period. The average number of hours attended by the subjects were 32±10.5 hr. The pre-instruction Functional Movement Screen (FMS) (17.3±1.5) compared to post-instruction (20.1±1.5), p<.01. Taichi training improves the quality of functional movement. In the standing medicine ball throw, the running medicine ball throw, and the Overhand ball throw, the initial movement pattern showed a simultaneous segmental rotation (SSR) at the knee, hip, and shoulder followed by sequential segmental rotation in the elbow and wrist. In the post-tests all segments showed a sequential segmental rotation pattern (p<.05). In the Tennis forehand, SSR followed shoulder to wrist in the pre-test then SSR from knee to wrist post-instruction, though the differences were not significant (p=.57). The purpose of this study was to see if learning Taichi could have a cross-training effect on movements that require very rapid movements with force generation as the targeted end result. All of the performance skills required SSR for optimal execution. Taichi also requires SSR for its most efficient technique although it is non-ballistic. It is usually believed that to produce fast movement patterns, you need to train fast. That does not appear to be the case from this study.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation-Physical Education & Health)*

*59<sup>th</sup> Annual Meeting of the American College of Sports Medicine, May 29-June 2, 2012, San Francisco, California*

**Berea College URCP Funded Research**

## PHYSICS PROGRAM

Laser Ablation of Boron Fullerenes. MARISSA BROWN<sup>1</sup>, MACKENZIE ENDRES<sup>1</sup>, ROHAN ISAAC<sup>1</sup>, TOMMY BOYKIN<sup>1</sup>, and AMER S. LAHAMER<sup>1</sup>, <sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404.

The production of carbon fullerenes has been widely observed and reproduced since their discovery; analogous structures with boron and nitrogen have been theoretically predicted to energetically stable at ambient conditions. To accomplish the synthesis of these large boron clusters and fullerenes, specifically C<sub>12</sub>B<sub>24</sub>N<sub>24</sub>, powdered compounds of carbon, boron, nitrogen, and silicon were compressed in a cylinder, cured, and then ablated with an Nd: YAG 532 nm laser under low flow of argon and nitrogen. The results were analyzed using a Time of Flight mass spectrometer. The compound C<sub>12</sub>B<sub>24</sub>N<sub>24</sub> was not observed, although several C<sub>x</sub>N<sub>y</sub> compounds were observed.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation – Physics and Astronomy Section; 1<sup>st</sup> place in undergraduate research competition)*

### **Berea College URCP Funded Research**

## PHYSICS PROGRAM

Copper-Based Superconductors, TOMMY BOYKIN<sup>1</sup>, ROHAN ISAAC<sup>1</sup>, MARISSA BROWN<sup>1</sup>, MACKENZIE ENDRES<sup>1</sup>, and AMER S. LAHAMER<sup>1</sup>, <sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404.

The  $Y_1Ba_5Cu_6O_{13}$  (Y156) superconductor has been synthesized successfully using the solid state method. The phase purity of  $Y_1Ba_2Cu_4O_8$  (Y124),  $Y_2Ba_4Cu_7O_{15}$  (Y247),  $Tl_4Ba_5Ca_2Cu_{10}O_x$ ,  $Y_1Ba_3Cu_4O_9$  (Y134),  $Sc_1Mg_2Ag_3O_7$  (Sc123) superconductors were not conclusive. X-ray diffraction technique was used in identifying the crystal structures of these superconductors.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Oral Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation - Physics and Astronomy Section)*

### **Berea College URCP Funded Research**

## PHYSICS PROGRAM

Synthesis and Characterization of Half-Metallic Heusler Alloys. MARISSA BROWN<sup>1</sup>, MACKENZIE ENDRES<sup>1</sup>, ROHAN ISAAC<sup>1</sup>, TOMMY BOYKIN<sup>1</sup>, and AMER S. LAHAMER<sup>1</sup>,  
<sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404.

The theoretically predicted half-metallic Heusler compounds  $\text{Co}_2\text{FeX}$  (where  $X = \text{Si}$  and  $\text{Ge}$ ) were synthesized using the solid state method. Their crystal structures were verified using x-ray diffraction. Their magnetic properties were studied using Mössbauer spectroscopy. It was found that the Hyperfine Magnetic Field decreased with increasing lattice constant, which agrees with predicted theoretical behavior of these compounds.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Oral Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation – Physics and Astronomy Section; 2<sup>nd</sup> place in undergraduate research competition)*

### **Berea College URCP Funded Research**

## PHYSICS PROGRAM

Influence of Boundary Conditions on Metastable Lifetimes for the Ising Model on Hyperbolic Plane. DIPENDRA SHARMA CHAPAGAIN<sup>1</sup>, JAMES T. MOLCHANOFF<sup>2</sup>, and HOWARD L. RICHARD<sup>2</sup>, <sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Department of Physics, Marshall University, Huntington, West Virginia 25755.

The Ising model provides a simple model that has been used to study metastable decay in Euclidean spaces. In the Euclidean plane, it has been shown that droplets typically are more easily nucleated on the boundary of a system with open boundary conditions. However, both the circumference and the area of a circle grow much more quickly with the radius in the hyperbolic plane, so boundary conditions are probably much more important. Furthermore, it is not easy to implement periodic boundary conditions in the hyperbolic plane.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Physics and Astronomy Section)*

### **Marshall University Internship**

## PHYSICS PROGRAM

Densities and Compressibilities of Chiral Molecules in the Liquid State: Chiral Discrimination. IMELDA HOT<sup>1</sup> and AMER S. LAHAMER<sup>1</sup>, <sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404.

Chiral molecules play important roles in many biological processes including the function of certain medicinal drugs. The interaction difference between the *R*- and *S*- enantiomers is called chiral discrimination. Chiral discrimination between the *R*- and *S*- enantiomers of several chiral molecules (Carvone, Fenchone, Limonene and Pinene) were studied from the measurements of density and sound velocity as a function of temperature in mixed enantiomeric fractions. Unlike water, in which the speed of sound increases with temperature, our results of the above chiral molecules showed a decrease in the speed of sound as well as a decrease in density as temperature increased. Data on the density and speed of sound were used to determine the compressibilities and volume excesses of these chiral molecules.

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation - Physics and Astronomy Section)*

## PHYSICS PROGRAM

Ground State Energies and Configurations of Nanoclusters in Two and Three Dimensions. CHAD PERUGGIA<sup>1</sup>, FIDEL TEWOLDE<sup>1</sup>, and MARTIN VEILLETTE<sup>1</sup>, <sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404.

The process of self-assembly of particles into nanoclusters is an open problem in condensed matter physics. The configuration of nanoclusters is determined by thermodynamic consideration. For low temperatures, the entropic contribution to the partition function is vanishingly small and only energetics contributions are at play. Although it is relatively simple to find the ground state energy of such nanoclusters, the number of degenerate states for a given number of particles had not been understood in a generalized manner. In this study, we address this issue by considering a group of  $N$  identical particles with contact interactions. The problem of enumerating all the possible degenerate states is tackled by first investigating the degenerate states in two dimensions with particles assembling with 90 degrees bonding angle, followed by 60 degrees bonding angle and finally three-dimensional structures with 90 degrees bonding angle. To solve this problem, we used a computer-algebra system and program's written in C++ to devise algorithms that enable us to enumerate all possible geometric arrangement for a large number of particles. Our approach is based on the partition and permutation sequences of particles. We achieved much insight into the problem from our two dimensional models, learning how particles will interact in two dimensions and noticing a similar pattern for three dimensional bonding. We were able to find all degenerate states for structures in two dimensions and we were able to devise a method for a three dimensional square lattice structure where we were able to find the degenerate states. This is a step in the right direction for small cluster bonding research and we hope that this will provide the necessary insight to move forward for the case of packing of nanospheres.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Physics and Astronomy Section)*

**Berea College URCPD Funded Research**

## PHYSICS PROGRAM

The Identification of Few Layer Graphene and the Growth of Nanoribbons on Silicon Nitride Substrates. CHRISTOPHER B. YALUMA<sup>1</sup> and DOUGLAS STRACHAN<sup>2</sup>, <sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Department of Physics, University of Kentucky, Lexington, Kentucky 40506.

The goal of this research is to construct few-layer graphene Field Effect Transistors or FETs on transparent membranes. These can be created by having a bi-layer graphene (BLG) put on a silicon wafer containing a transparent membrane such as silicon nitride ( $\text{SiN}_x$ ) or silicon dioxide ( $\text{SiO}_2$ ). The wafer is then appropriately cut out and removed, leaving the bi-layer graphene suspended on top of the membrane. When you have the BLG suspended, it is now possible to use a gate electrode that creates the electric field and connects the source with the drain. However, this cannot be achieved without having a quick and efficient method to identify single layer and bi-layer graphene. Few-layer graphene (FLG) samples can be prepared easily using a process known as mechanical exfoliation (the scotch tape method). Once we have these FLGs stack on top of a membrane, we can then begin the process of identification. There are many methods that can be used to identify few-layer graphene; for example, the Atomic Force Microscopy (AFM) or the Raman Spectroscopy. Finding an easier and faster way to identify few-layer graphene is an important step in the construction of graphene-based transistors. This was the focus of my research the past summer and I had to use the Optical Microscope, the Ellipsometer, PMMA solution, and the AFM to help me identify few layer graphene. On the other hand, I also got interested in growing Nanoribbons on silicon nitride substrates as opposed to the traditional silicon dioxide substrates. To grow the nanoribbons, I used the Lindberg Furnace which was typically run at high temperatures i.e. up to 950 degrees Celsius.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Physics and Astronomy Section)*

### **University of Kentucky Internship**

## PSYCHOLOGY PROGRAM

Neurophysiological Indices of Cognitive Style. JOSHUA CALLAHAN<sup>1</sup>, YUTA KATSUMI<sup>1</sup>, CHIDO MATARA<sup>1</sup>, SHELBY WILLIAMS<sup>1</sup>, and ROB SMITH<sup>1</sup>, <sup>1</sup>Psychology Program, Berea College, Berea, Kentucky 40404.

Interest is growing in the neurobiological bases of “cognitive styles,” or ways in which individuals prefer to (or tend to) process information. In particular, advances in the use of electroencephalograph (EEG) techniques for measuring and localizing specific neural activities related to cognitive styles and task performance are yielding some promising new findings. For our study, we analyzed the differences and changes in EEG measures of participants’ cortical activation while they completed a computerized cognitive activity called the mental rotations task. Spectral power analysis of the resultant EEG records revealed a number of significant interactions and main effects in the alpha frequency band in three of our four neurocognitive regions of interest (left paramedial, right paramedial, and midline). In particular, certain dimensions of cognitive styles (functions, leanings, and scope) evidenced greater alpha frequency suppression in very specific cortical regions during the mental rotations task. This suggests that a greater amount of concentration and effort was required during the task if one preferred an executive, conservative, or local style of thinking over a legislative, liberal, or global style of thinking.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*24<sup>th</sup> Annual Convention of the Association for Psychological Science, May 24-27, 2012, Chicago, Illinois.*

### **Berea College URCP Funded Research**

## PSYCHOLOGY PROGRAM

From Anecdote to Assessment: the Robust Beauty of Using Multiple Regression and Path Analysis to Explore Retention, Graduation, and Academic Performance at a Small Liberal Arts College. KRISTINA CARTER<sup>1</sup>, SARA DEAN<sup>1</sup>, VALERIE FROST<sup>1</sup>, ALENA GORDIENKO<sup>1</sup>, and DAVID PORTER<sup>1</sup>, <sup>1</sup>Psychology Program, Berea College, Berea, Kentucky 40404.

This study involved the intensive analyses of an extensive database reflecting the academic performance and outcome attainment of a cohort of students who entered Berea College in the summer of 2006. The path model derived from these data suggests that students' academic performance, primarily in two required general studies courses, significantly predicted outcomes such as retention, graduation, grade point average, and performance in a capstone general studies critical thinking course. The influences of exogenous variables such as race, gender, and family financial status, as well as student responses to the Cooperative Institutional Research Program (CIRP), had little influence on students' subsequent academic performance or outcomes. A small influence of composite high school GPA and ACT scores persisted throughout students' undergraduate experience. Although early academic performance only explains about a third of the variance in retention and graduation, it predicts nearly eighty percent of variance in students' graduation GPA. Predicting performance in the critical thinking capstone course was more difficult. The model derived from the 2006 cohort was validated by applying it to a cohort of students who entered the college in 2009. Overall, these results provide useful information to administrators and faculty at Berea College and also pose broader questions for other post-secondary educational institutions.

*Center for Assessment and Research Studies, July 2, 2011, James Madison University, Harrisonburg, Virginia, Invited Presentation*

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Oral Presentation)*

*97th Annual Meeting of the Kentucky Academy of Science, November 6, 2011, Murray State University, Murray, Kentucky (Poster Presentation – Psychology Section; 1<sup>st</sup> place in undergraduate research competition)*

*Association for Psychological Science Annual Convention, May 24, 2011, Chicago, Illinois. (Poster Presentation)*

### **Berea College URCPP Funded Research**

## PSYCHOLOGY PROGRAM

The Effects of Gender and Writing Assignments on Implicit Attitudes about Gender Roles.  
RACHEL KREBS<sup>1</sup>, <sup>1</sup>Psychology Program, Berea College, Berea, Kentucky 40404.

Traditionally, men have been the breadwinners, whereas women were expected to be homemakers and caregivers. This traditional arrangement is changing; many women have taken jobs outside the home. To what extent are attitudes changing to reflect this new reality? A 2x2x2 mixed design ANOVA test was used to analyze whether and how a subjects' gender and a particular writing assignment affected implicit and explicit attitudes. Although explicit survey results did not reveal any differences in genders or any effects of the writing assignments, the IAT showed several significant differences. Women's implicit attitudes initially were slightly more conservative than men's. Writing affected the attitudes of both men and women in the direction toward the writing they had been required to do. Women's attitudes were slightly more affected by the writing activity than were men's.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Oral Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation – Psychology Section)*

## PSYCHOLOGY PROGRAM

Perception of Aging: The Power of Knowledge and Action. RAVEN WEAVER<sup>1</sup>, <sup>1</sup>Psychology Program, Berea College, Berea, Kentucky 40404.

We live in a youth-oriented culture, yet the Baby Boomers are coming “of age” at a time when aging is feared. Studies have shown that attitudes are fluid and prone to change when participants are engaged in activities about aging and the elderly. In this study, 64 Berea College students composed brief written responses to either positive or negative prompts. Half of the subjects also were provided with correct answers to an aging quiz that all participants completed. All subjects took the “Age” Implicit Associations Test (IAT) and the Explicit Attitudes questionnaire before and after these tasks. No changes were observed in subjects’ explicit attitudes toward the elderly; however, the IAT reflected significant shifts in subjects’ implicit attitudes in accordance with the type of writing activity they had completed. The knowledge level of participants interacted marginally with treatment, suggesting the fluidity of implicit attitudes. Individuals with higher knowledge levels were more susceptible to implicit attitudinal change.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Oral Presentation- Psychology Section)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation - Psychology Section)*

## **SOCIOLOGY PROGRAM**

The Dual-Role Controversy: Understanding Student Perceptions of Dual-Role Interactions in Higher Education. FELICIA HELVEY<sup>1</sup>, <sup>1</sup> Sociology Program, Berea College, Berea, Kentucky 40404.

Crossing boundaries of accepted social roles can have lasting consequences in a college or university setting, as these interactions are shown to have negative effects for everyone involved. Policies banning particular interactions between students and faculty have been implemented in institutions to curb the negative consequences of these relationships. However, often students are never asked for their opinion on these policies or how appropriate they find banned interactions. This research found that Berea College students generally favor establishing a policy defining appropriate and inappropriate student-faculty interactions. Additional findings include a generally unfavorable opinion toward sexual interactions between students and faculty, with respondent gender significantly influencing appropriateness rating.

*48<sup>th</sup> Annual Meeting of Anthropologists and Sociologists of Kentucky, October 21-22, 2011, Northern Kentucky University, Williamstown, Kentucky (Oral Presentation- 1<sup>st</sup> place in undergraduate research competition)*

## **SOCIOLOGY PROGRAM**

A Closer Look at the Alphabet Community: The Coming Out Experience of Berea College Student. COURTNEY STEVENS<sup>1</sup>, <sup>1</sup> Sociology Program, Berea College, Berea, Kentucky 40404.

“Coming out of the closet” can be a difficult, sometimes dangerous process. This study focuses on the experiences of Berea College students when coming to terms with their non- heterosexuality. Through qualitative research, I interviewed ten male and ten female Berea College students who do not identify as heterosexual. Themes that arose during the interviews included identity formation, inappropriateness of labels, religious and family responses, and homosexuality as a “choice”. Results suggest that the majority of respondents had difficult coming out experiences but that Berea College has been a welcoming setting for those students who have come out.

*48<sup>th</sup> Annual Meeting of Anthropologists and Sociologists of Kentucky, October 21-22, 2011, Northern Kentucky University, Williamstown, Kentucky (Oral Presentation- 3<sup>rd</sup> place in undergraduate research competition)*

## **TECHNOLOGY AND INDUSTRIAL ARTS PROGRAM**

Reinventing the Electric Vehicle: Design of a Flexible Research Vehicle for Future Studies at Berea College. BRIAN M. EASTERDAY<sup>1</sup>, TIERAH ELLARD<sup>1</sup>, MATTHEW P. JENKINS<sup>1</sup>, JORDAN O. MONGER<sup>1</sup>, and MARK P. MAHONEY<sup>1</sup>, <sup>1</sup>Technology and Industrial Arts Program, Berea College, Berea, Kentucky 40404.

The focus of the creative project was to develop a flexible research vehicle that provides students an outlet to explore alternative energies as they apply to transportation. The research vehicle had to be versatile in its disposition, by changing not only the magnitude and type of load, but also the shape of the vehicle to fit future needs. Additionally, the research vehicle had to be able to travel on varied terrains across the campus. The initial product of this research is an electric, multi-terrain vehicle with an easily modified central core structure, a ground clearance of twelve inches, and an approximate payload capacity of two tons. In its current configuration, it is a two passenger vehicle that has an anticipated running time of up to five hours.

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

*97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Poster Presentation - Engineering Section; 2<sup>nd</sup> place in undergraduate research competition)*

### **Berea College URCP Funded Research**

## TECHNOLOGY AND INDUSTRIAL ARTS PROGRAM

The Effects of the Addition of  $\text{SrCl}_2$  and  $\text{HoF}_3$  onto Photo Luminescent Z-BLAN Glass. HODARI-SADIKI JAMES<sup>1</sup>, RUSSELL L. LEONARD<sup>2</sup>, and JACQUELINE A. JOHNSON<sup>2</sup>, <sup>1</sup>Physics Program, Berea College, Berea, Kentucky 40404; <sup>2</sup>Department of Materials Science & Engineering, University of Tennessee Space Institute, Tullahoma, Tennessee 37388.

We have been working with a new form of X-ray detection plate made of a special composition of Z-BLAN glass. The glass possesses the properties of being photo luminescent and in some cases, a very efficient storage phosphor when properly heat treated. Our group sought to modify the composition of the Z-BLAN glass in two ways: 1) by replacing the compound Barium Chloride ( $\text{BaCl}_2$ ) which is essential to the glass' production of nano-crystals and therefore it's property as a reliable storage phosphor, with Strontium chloride ( $\text{SrCl}_2$ ); and 2) replacing the essential dopeant Europium Chloride ( $\text{EuCl}_2$ ) with Holmium Fluoride ( $\text{HoF}_3$ ). Tests involving, X-ray diffraction, differential scanning calorimetry, and photostimulated luminescence (PSL) were then carried out to observe the effects of the change. The addition of  $\text{SrCl}_2$  showed effects on the crystallization temperature of the glass, while  $\text{HoF}_3$  addition was seen to have effects its photo luminescent properties.

*97<sup>th</sup> Annual meeting of the Kentucky Academy of Science, November 4-5, 2011, Murray State University, Murray, Kentucky (Oral Presentation – Engineering Section; 2<sup>nd</sup> place in undergraduate research competition)*

**University of Tennessee Space Institute Internship**

## TECHNOLOGY AND INDUSTRIAL ARTS PROGRAM

Exploring the History, the Construction, and the Music of the Kentucky Dulcimer. ALAN MILLS<sup>1</sup> and SAMUEL HAWES<sup>1</sup>, <sup>1</sup>Technology and Industrial Arts Program, Berea College, Berea, Kentucky 40404.

The purpose of this creative project was to explore the history, construction and music of the Kentucky dulcimer. Ed Thomas and John Tignor were the two Kentucky dulcimer builders that this project focused on. The participants traveled to Hindman Settlement School to research the history and construction techniques used by these two builders. Exact replicas were made from an original Ed Thomas and John Tignor dulcimer. These replicas were placed in Berea College's dulcimer collection to allow interested parties to play and experience the sound of a historically accurate instrument. Participants attended the Kentucky Music Week in Bardstown, Kentucky and video recorded professional dulcimer player, Steven Seifert. This music was placed in the traditional music sound archives at Berea College. The participants designed a dulcimer website and organized a dulcimer exhibit to be held at Berea College in 2012.

*Ed Thomas and John Tignor Replicas Available in the Teaching Collection Located in the Loyal Jones Appalachian Center*

*12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011, Berea College, Berea, Kentucky (Poster Presentation)*

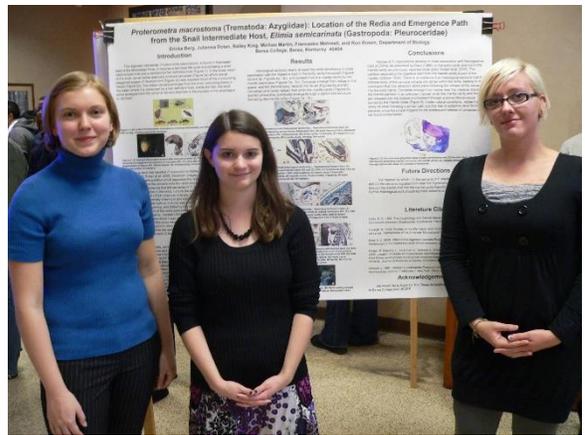
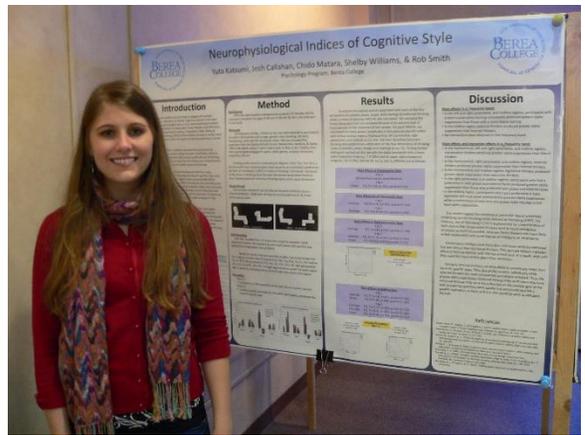
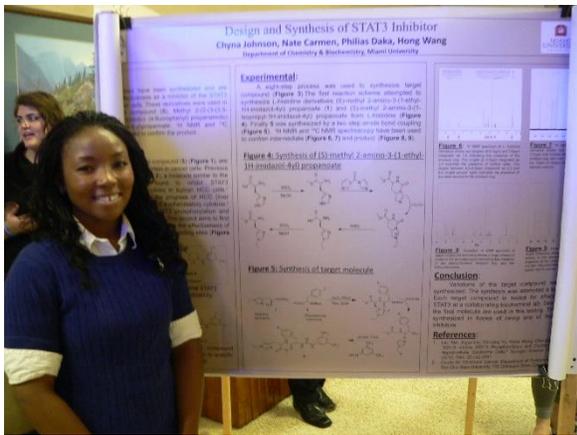
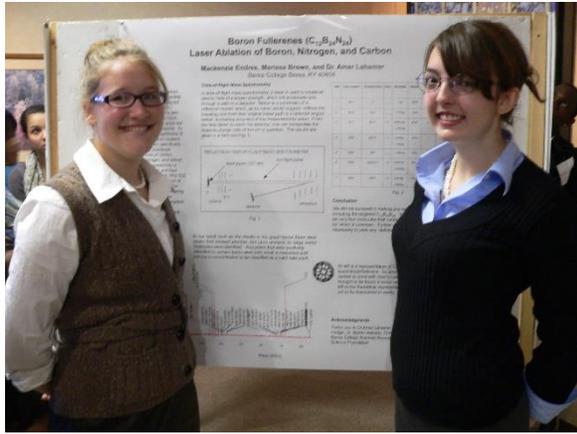
**Berea College URCP Funded Research**

## WOMEN'S AND GENDER STUDIES PROGRAM

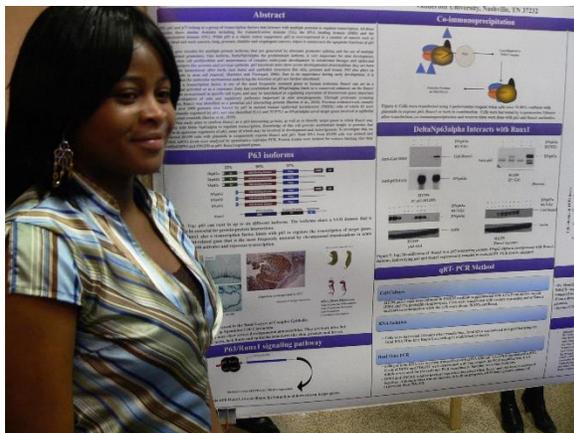
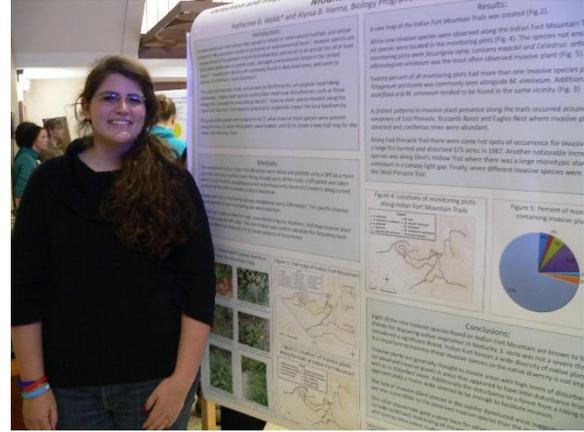
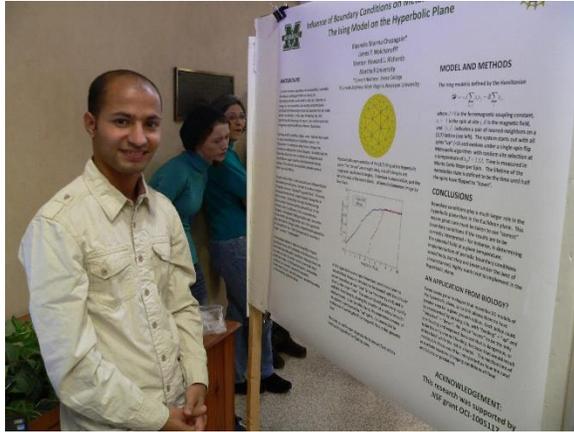
Take Back the Kitchen: Traditional Recipes for a Small Planet. CHRISTINE TRUJILLO<sup>1</sup> and PEGGY RIVAGE-SEUL<sup>1</sup>, <sup>1</sup>Women's and Gender Studies Program, Berea College, Berea, Kentucky 40404.

At this historical juncture, worldwide food shortages and concern for sustainable environmental practices dominate agendas for global social relations. The project to articulate a fourth wave of feminism to “take back the kitchen” focuses on traditional food practices of third world women, arguing that economically marginalized areas of the world are important laboratories for researching cures for the illness, disease, and obesity that plagues the global community. As we look to the world's majority for lessons on how to eat in order to thrive, we will find that women form the productive core of these vital practices. This summer research project took us to the rural environs of Delores Hidalgo, Guanajuato, Mexico, to interview women in their kitchens as they prepare traditional foods that ensure a sustainable food supply for the world's majority. Our investigation involved traditional feminist and Freirean research methodologies of participation and observation. Using videotaping and oral recording, as well as hands-on practice of traditional food production, we collected information for a text, *Take Back the Kitchen: A New Agenda for Feminism's Fourth Wave*, to be published in 2013.

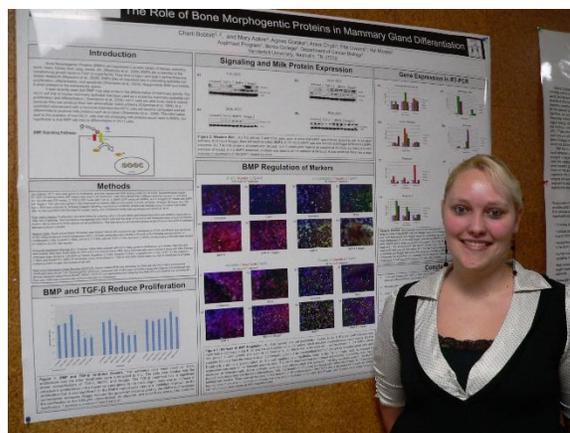
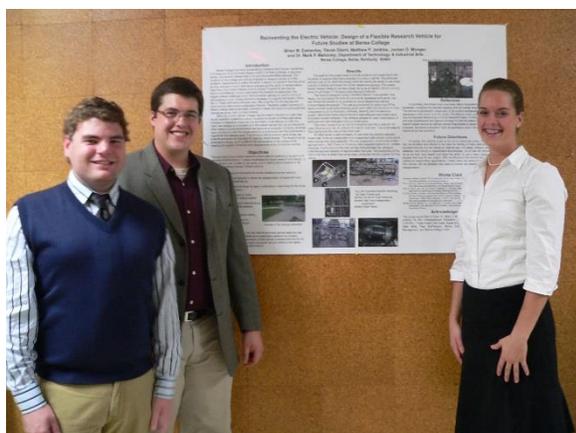
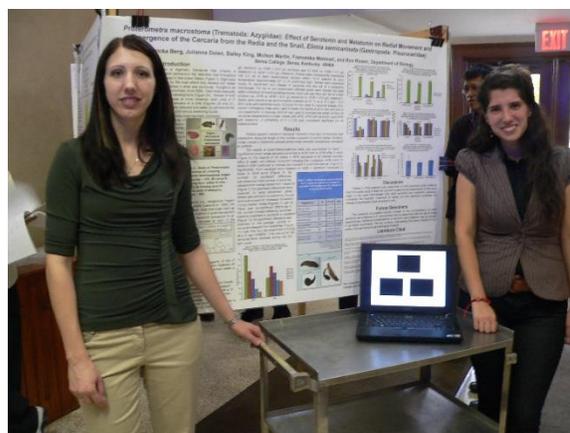
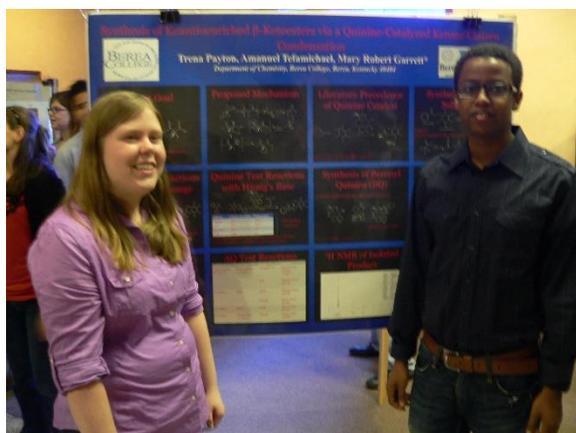
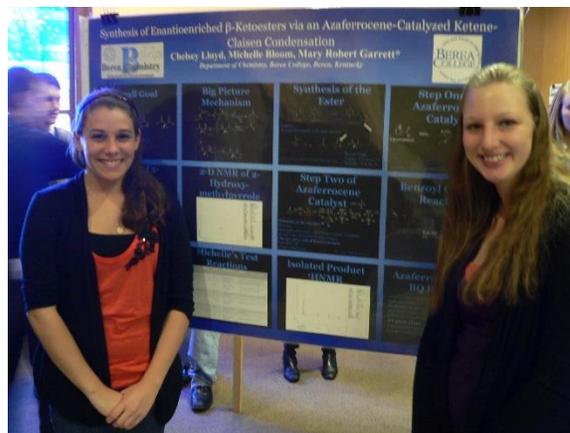
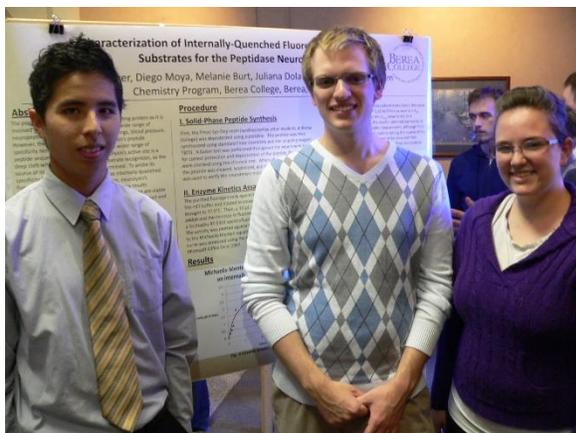
**Berea College URCP Funded Research**



**Figure 1. Berea College student presentations at the 12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011**



**Figure 2. Berea College student presentations at the 12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011**

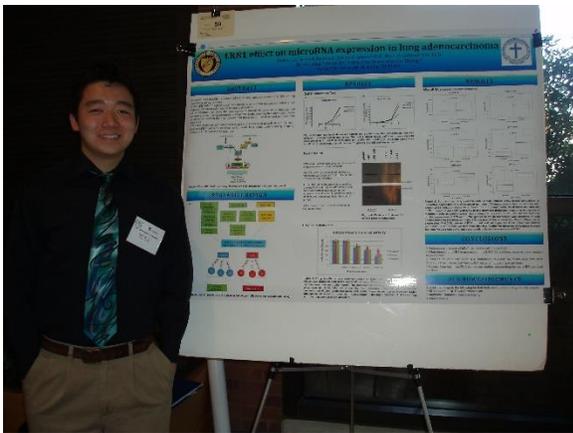


**Figure 3. Berea College student presentations at the 12<sup>th</sup> Annual Berea College Undergraduate Research Symposium, October 21, 2011**

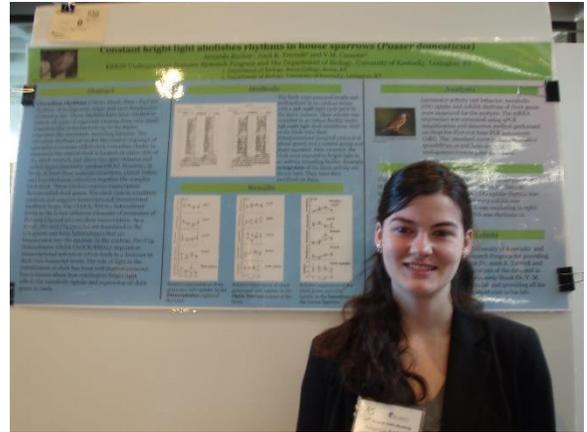


**Figure 4. Berea College  
URCPP Student  
Research, Summer 2011**





**Figure 5. Berea College students at the 97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 5-6, 2011**



**Figure 6. Berea College students at the 97<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 5-6, 2011**