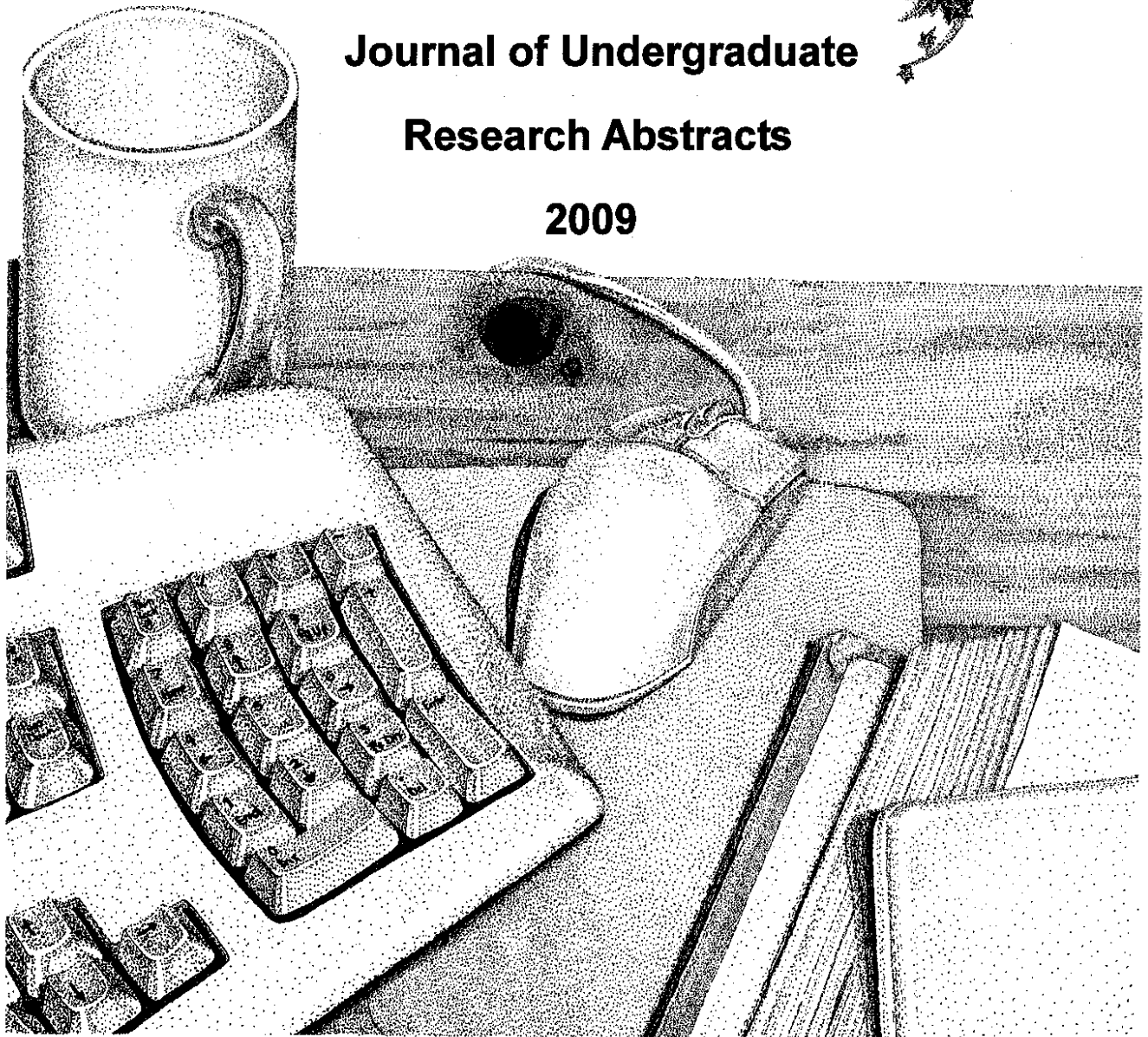


**Berea College**  
**Journal of Undergraduate**  
**Research Abstracts**  
**2009**



# INTRODUCTION

**(Ronald B. Rosen, Professor of Biology, Editor)**

During the Fall 2006 Science Retreat, the science faculty at Berea College approved a student initiative proposed by Emilie Throop (Biology - Class of 2007; presently a graduate student at Kansas State University) to publish abstracts of undergraduate research on an annual basis. The inaugural edition of the, "Berea College Journal of Undergraduate Research Abstracts Science Division 2006", was published with Emilie's assistance. In this fourth issue an effort has been made once again to include undergraduate research completed by students in disciplines outside the sciences. The common theme to the research represented by these abstracts is that the: (1) original proposal was peer-reviewed and/or (2) work was subsequently presented by undergraduates at an off-campus meeting. Though certainly not inclusive of all the undergraduate research conducted last year by Berea College students, this year's journal contains 38 abstracts representing majors from nine different academic departments. These abstracts represent research completed on-campus with funds provided by Berea College's Undergraduate Research and Creative Projects Program (URCPP – 7/7 projects reporting), several externally funded on-campus projects, and senior research projects. Off-campus projects were funded by the Kentucky Biomedical Research Infrastructure Network (KBRIN) at the Universities of Kentucky and Louisville, and by various universities and research organizations around the country. The abstracts are published as submitted; editorial changes have only been made: (1) to the titles of each abstract by the editor to ensure consistency of style and (2) by department chairs. Much of this collaborative work was presented at off-campus meetings including the Annual Meeting of the Kentucky Academy of Science (34 presentations and 13 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 10<sup>th</sup> Annual Undergraduate Research & Internship Symposium, October, 2009. Hopefully this publication will continue in the future and serve as a resource for: (1) Berea College's efforts in admissions, development, and departmental self-studies and (2) students to locate interesting programs for future research and acknowledge their accomplishments.

## ACKNOWLEDGEMENTS

This fourth edition of the, "Berea College Journal of Undergraduate Research Abstracts", would not have been possible without the support of many people. I acknowledge Carolyn Newton, Academic Vice-President/Provost, for providing funds to print hard copies of these abstracts. Also, many thanks to Berea College faculty for their contributions, and of course to their students for whose hard work this journal is a reflection. Once again, we wish to acknowledge Elizabeth Fleming (senior Biology/French double major) for providing the

beautiful cover art. Finally, we would like to thank all the off-campus mentors at the following research centers and universities for supporting Berea students during the summer of 2009 (number of Berea students in brackets): Iowa State University {1}, Mayo Clinic {2}, Purdue University {1}, Tulane University {1}, University of California, Davis {1}, University of Georgia {1}, University of Kentucky {3}, University of Louisville {1}, Vanderbilt University {3}, and Virginia Polytechnic Institute {2}. A special acknowledgement is once again extended to former Berea College students and current trustees, Dr. Harold Moses (Vanderbilt University) and Dr. Chella David (Mayo Clinic), for continuing to coordinate and support research experiences at their respective institutions for Berea College undergraduates.

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## DEPARTMENT OF ART

Plainware pottery from the Palace of Nestor at Pylos. JULIE HRUBY and SAMANTHA WILLIAMS, Department of Art, Berea College, Berea, KY 40404.

During the summer of 2009, a small team travelled to Greece to continue the analysis of the pottery from the pantries of the Mycenaean Palace of Nestor, destroyed in a fire around 1180 BCE. This year's study focused on the contents of room 20, which contained approximately 500 kg of pottery (both serving and table wares), and on the materials found beneath the destruction-era floor levels of rooms 18-21. Detailed examination of the destruction-era remains from room 20 has improved our understanding of the functioning of that feasting assemblage; for example, there were substantially more perforated dippers or strainers than the excavators had originally reported, raising questions about what food was served and how. From materials discovered under the level of the floor, it is possible to reconstruct something of chronological development of the palace's ceramic traditions. Interestingly, these materials suggest that while Pylos pottery was quite different from the better-known ceramics of Mycenae at the time of the Palace of Nestor's final destruction, its earlier potting traditions may not have been as different. Additionally, while we are accustomed to thinking of the palace as having burned only once, the discovery of burnt mud-brick in a lot from below floor-level raises the question of whether the palace might have burned at some point previously. Stratigraphic data from the excavation notebooks and photos supports the hypothesis that the palace burned more than once.

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF BIOLOGY

Effect of praziquantel on natural infections of the snail, *Elimia semicarinata* (Gastropoda: Pleurocerida), with the trematode, *Proterometra macrostoma* (Digenea: Azygiidae). CECILIA ALBERS, ADAM CHAMBERS, ADAM MEADOR, KELLY NJINE MOUAPI, KRYSTINA SANDEFUR, LEE WARE, and RONALD ROSEN, Department of Biology, Berea College, Berea, KY 40404.

*Elimia semicarinata* is a snail that inhabits streams and rivers in the central and southeastern United States. In many of these areas it serves as an intermediate host for the digenetic trematode, *Proterometra macrostoma*. Inside the snail the parasite undergoes asexual polyembryony to produce intramolluscan larval stages (i.e., rediae and cercariae). Praziquantel is an anthelmintic drug used in the treatment of adult trematode infections. Little is known about this drug's use on snails for the treatment of trematode larvae. The purpose of this experiment was to evaluate the effectiveness of praziquantel for treating naturally infected *E. semicarinata*. A significant difference was found in the number of rediae shed on days 3 and 7 PE (post-exposure) in control snails and those exposed to four levels of praziquantel. Similarly, a significant difference was found in the number of cercariae shed on days 3 and 7 PE between these groups. Shedding of rediae was largely restricted to treated snails, and occurred during the first four days PE to praziquantel. No cercariae were shed from snails exposed to the highest dose of the drug. Mortality of treated snails peaked at day 4 PE, and there was a significant difference found in mortality between the control and treated snails at day 7 PE.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation –Agricultural Sciences Section; 2<sup>nd</sup> place in undergraduate research competition)*

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF BIOLOGY

Development of an improved replicating plasmid for *Myxococcus xanthus*. STACY ASSAN<sup>1</sup>, WESLEY BLACK<sup>2</sup>, and ZHAOMIN YANG<sup>2</sup>, <sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Biological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24016.

Myxobacteria are Gram-negative social bacteria that are found ubiquitously in the soil. Two major areas of myxobacterial research involve surface motility and multicellular development. Myxobacteria are also well-known producers of secondary metabolites, one of which is currently used to treat cancer. Until recently no replicating plasmid had been discovered in myxobacteria and, as a result, genetic manipulation required integration of genetic material onto the chromosome. The purpose of this study was to improve an existing replicative plasmid that was originally created for *Myxococcus xanthus* and to better understand its mechanism of replication. More specifically the putative origin of replication, which is thought to encode a gene of unknown function, was isolated and cloned to determine if gene expression was required for replication.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Microbiology Section)*

**Virginia Polytechnic Institute and State University Research Internship**

## DEPARTMENT OF BIOLOGY

Myelin-specific antibodies play an important role in PLP<sub>91-110</sub> induced EAE in HLA transgenic mice. DIKSHYA BASTAKOTY<sup>1</sup>, ASHUTOSH MANGALAM<sup>2</sup>, and CHELLA A. DAVID<sup>2</sup>  
<sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Immunology, Mayo Clinic, Rochester, MN 55905.

Multiple Sclerosis (MS) is an inflammatory and demyelinating disease of the central nervous system. It is an autoimmune disease with well-established links to the MHC gene on Chromosome 6. Various allelic combinations of the DR, DP and DQ alleles in HLA class II are found to cause predisposition to the disease. The role of T-cell-mediated immunity has been extensively studied in MS disease progression, but the role of the B-cell and antibodies is not so well understood. In this study, the role of B-cell mediated immunity in the immunopathogenesis of MS in specific genotypes was investigated. Transgenic mice that express only selective human class II genes were used for the experiments along with Experimental Autoimmune Encephalomyelitis (EAE) as a model. Previous data indicated that DR3DQ8 mice showed increased disease severity of PLP<sub>91-110</sub> induced EAE relative to DR3 mice. In this experiment, the sera of DR3DQ8 mice demonstrated higher levels of myelin-specific antibodies than the sera of DR3 mice. The CNS tissue of DR3DQ8 mice also displayed increased deposition of antibodies when compared to that of DR3 mice. Similar trends were seen in the relative mRNA expression of complement proteins. Preliminary data indicates that sera from DR3DQ8 mice is able to initiate more antibody-dependent cell-mediated cytotoxicity on mixed glial culture than sera from DR3 mice, suggesting direct antibody involvement. Further investigation into these findings may help illustrate the role of humoral immunity in MS immunopathogenesis.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation –Cellular and Molecular Biology Section; 2<sup>nd</sup> place in undergraduate research competition)*

**Mayo Clinic Research Internship**

## DEPARTMENT OF BIOLOGY

Characterization of a potential type I secretion system in *Burkholderia pseudomallei*.

EMMANUEL DAVIS<sup>1</sup>, WILLIAM GROSE<sup>2</sup>, ERIC LAFONTAINE<sup>2</sup>, <sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Microbiology, University of Georgia, Athens, GA 30602.

*Burkholderia pseudomallei*, the causative agent of melioidosis is a pathogenic member of the genus *Burkholderia*. Included in this genus is *Burkholderia thailandensis*, an avirulent species closely related to *Burkholderia pseudomallei*. In the present study we attempted to characterize a potential type I secretion stem in *Burkholderia pseudomallei*. This system is comprised of the putative secreted protein BapB, the TolC-like outer-membrane protein BapA, the HlyD-like membrane fusion protein BapE, and the ABC transporter-like inner membrane protein BapD. BapC is a protein that is encoded by a gene in between *bapB* and *bapD* in the chromosome of *Burkholderia pseudomallei*. To determine the function of the individual Bap proteins, we performed a transposon mutagenesis of the plasmid pBHR.Bap, which harbors all 5 *bap* genes. We attempted on several occasions to electroporate a library of transposon mutants in *Burkholderia thailandensis* strain DW503 but were unable to recover sufficient numbers of Tri<sup>R</sup> colonies. This same library was electroporated into *E. coli* strain EC100, and many Tri<sup>R</sup> colonies were generated. PCR analysis using primers specific to each gene were used to screen for clones possessing a transposon in the gene of interest. These clones were identified by a shift of approximately 0.9 kb in the PCR product. These plasmids have been sent for sequencing to verify the position of the transposon. Current work is focused on transforming these plasmids into DW503 where expression studies will be conducted to determine what role the individual Bap proteins have on secretion of BapB.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Microbiology Section; 2<sup>nd</sup> place in undergraduate research competition)*

**University of Georgia Research Internship**

## DEPARTMENT OF BIOLOGY

The effects of humidity on the conductivity of DNA. CARMEN DIBAYA<sup>1</sup>, JOHN M. LEVERITT III<sup>2</sup>, RAY SHRESTHA<sup>2</sup>, SARAH TESAR<sup>2</sup>, and ALEXANDER L. BRUIN<sup>2</sup>,  
<sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Chemistry, Tulane University, New Orleans, LA 70118.

This study was attempted to better understand the functional properties underlying the mechanisms responsible for charge transport in dry DNA. Recent experiments demonstrated dramatic sensitivity of dry DNA conductivity to the air humidity (i.e. grows by many orders of magnitude with raising humidity from 10 to 95%). To better understand this data, we conducted our theoretical research by reviewing literatures and calculating the DNA base pair geometry. We found that conductivity is associated with the H<sup>+</sup> and OH<sup>-</sup> ions. Since the thickness of the water layer surrounding each DNA molecule grows as humidity increases, we suggested that the increase of DNA conductivity with humidity is due to lowering the water binding energy by dielectric screening. In other words, the increase of water layer thickness leads to the increase of the dielectric constant and consequently reduces water binding energy. We also suggested an electrostatic model to better account for the humidity dependent conductance of DNA assemblies. This is because the low-dimensional confinement of electric field inside the water layer is hydration dependent. According to our electrostatic model, the field confinement in the water tube formed around DNA in a humid environment increases the binding energy of ions and thus reduces ionic concentration and conductivity. Our electrostatic model explains the humidity dependence of conductance observed experimentally and suggests controlling measurements of non-linear conductance which should be extremely sensitive to the field confinement.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation –Chemistry Section; 3<sup>rd</sup> place in undergraduate research competition)*

**Tulane University Internship**

## DEPARTMENT OF BIOLOGY

Differential responses of CD<sup>4+</sup> and CD<sup>8+</sup> cells to super-antigen stimulation. MILUKA GUNARATNA<sup>1</sup>, ASHENAFI TILAHUN<sup>2</sup>, GOVINDARAJAN RAJAGOPOLAN<sup>2</sup>, and CHELLA DAVID<sup>2</sup>; <sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Immunology, Mayo Clinic, Rochester, MN 55905.

CD4<sup>+</sup> and CD8<sup>+</sup> cells are functionally and phenotypically different. It is not possible to study them in isolation of each other using conventional antigens or pathogens. Super-antigens (SAg), unlike conventional antigens, bind without processing to MHC class II. They activate T-cells only through the V $\beta$  chain making them ideal models to study these T-cells independent of each other. SAg bind with a high affinity to the human class II than mouse class II and are also highly correlated to toxic shock syndrome. Therefore, HLA class II transgenic mice were used to study the *in vivo* responses to the super-antigen staphylococcal Enterotoxin B (SEB) by chronic exposure via mini osmotic pumps and acute exposure. Results from the chronic exposure showed that the kinetics of expansion and contraction are different for CD4<sup>+</sup> and CD8<sup>+</sup> T-cells. The expression profile for the activation markers PD1 and Fas on CD4<sup>+</sup> and CD8<sup>+</sup> T cells also showed a differential expression during chronic SAg activation. In acute exposure, the expression of activation markers CD69 and CD29 in CD4<sup>+</sup>V $\beta$ 8 cells decreased over time whereas PD1 and Fas increased. It was possible to determine that there are distinct differences between CD4<sup>+</sup> and CD8<sup>+</sup> cells. Further analysis of cytokines, gene expression profile by microarray and histopathology will help us to characterize the molecular differences between CD4<sup>+</sup> and CD8<sup>+</sup> T cells.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation –Cellular and Molecular Biology Section)*

### **Mayo Clinic Research Internship**



## DEPARTMENT OF BIOLOGY

Migration of fibroblasts involved in mammary carcinoma cell metastasis. JACOB GUNNELL<sup>1</sup>, AUBIE SHAW<sup>2</sup>, ANNA CHYTIL<sup>2</sup>, MARY AAKRE<sup>2</sup>, and HAROLD L. MOSES<sup>2</sup>;

<sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Cancer Biology, Vanderbilt-Ingram Cancer Center, Vanderbilt University, Nashville, TN 37232.

One of the more troubling aspects of cancer is its ability to spread to other parts of the body from a primary tumor. Tumor metastasis begins with carcinoma cell invasiveness through the extracellular matrix at the primary site. Fibroblasts have been shown to influence mammary tumor growth and invasion and recent studies show that fibroblasts lead carcinoma cell invasion. Additionally, studies of Transforming Growth Factor- $\beta$  (TGF- $\beta$ ), have shown that it is very important in regulating fibroblast interactions. Specifically, fibroblasts lacking the TGF- $\beta$  type II receptor promote mammary tumor progression. In mice lacking expression of the type II receptor (Tgfbr2<sup>KO</sup>), implanted mammary carcinoma cells have greater levels of tumor growth, suggesting that loss of TGF- $\beta$  signaling in fibroblasts promotes tumor metastasis and invasion. This project examined migration rates of mammary carcinoma cells when combined with Tgfbr2<sup>KO</sup> fibroblasts to see if there is any noticeable effect on migration rates when the mammary carcinoma cells are plated with Tgfbr2<sup>KO</sup> cells. Since combinations of Tgfbr2<sup>KO</sup> and normal fibroblasts further promote tumor progression, we examined carcinoma and fibroblast migration with combinations of fibroblasts. We found that migration of wild-type and Tgfbr2<sup>KO</sup> fibroblasts differed when combined in various quantities as compared to migration of a pure sample. We observed that migration was increased when plated in a solution of 75% and 25% as compared to a pure sample of 11s cells. Additionally, migration of Tgfbr2<sup>KO</sup> decreased significantly when combined with Tgfbr2<sup>WT</sup>, even in a mixture containing 75% Tgfbr2<sup>KO</sup> fibroblasts.

### Vanderbilt University Research Internship

## DEPARTMENT OF BIOLOGY

Analysis of TGF- $\beta$  mediated expression of ALCAM in human prostate cancer cell lines. JAMES BRIAN HAMBLIN<sup>1</sup>, AMANDA GEORGE HANSEN<sup>2</sup>, and ANDRIES ZUJLSTRA<sup>2,3</sup>;  
<sup>1</sup>Department of Biology, Berea College, Berea, KY, 40404; <sup>2</sup>Department of Cancer Biology, Vanderbilt University, Nashville, TN 37232; <sup>3</sup>Department of Pathology, Vanderbilt University, Nashville, TN 37232.

Prostate cancer ranks as the second most common cause of death in American men. Those deaths are primarily due to prostate cancer metastasis, during which tumor cells disseminate away from the prostate to other organs (e.g. the bladder, bones, and liver) and disrupt their normal function. The molecular mechanisms that control the mobilization of tumor cells during metastasis are being investigated. The cell adhesion molecule ALCAM has been correlated with poor survival rates and increased likelihood of cancer metastasis in patients. Cleavage of ALCAM by the metalloprotease ADAM17 yields a truncated form of the cell adhesion molecule,  $\Delta$ N-ALCAM, which remains on the cell surface and confers motility to the cancer cells. The same cleavage creates sALCAM, which is shed into the interstitial fluid. TGF- $\beta$  is a cell signaling molecule that acts endogenously upon the cell, eliciting the increased co-expression of both ALCAM and ADAM17. Analysis of conditioned media and protein collected in these experiments indicates that the signaling cascade through which TGF- $\beta$  induces increased ALCAM and ADAM17 expression is PI3K-dependent, operating through both non-canonical and canonical pathways. These observations provide clinically relevant targets and define our ALCAM as a key “switch” in cancer cell motility.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Cellular and Molecular Biology Section)*

**Vanderbilt University Research Internship**

## DEPARTMENT OF BIOLOGY

Analysis in the defect of  $\beta$ -catenin in dendritic cells from NOD mice. ALISHA HOLMBERG<sup>1</sup>, SARAH PARNELL<sup>2</sup>, MICHELE KOSIEWICZ<sup>2</sup>, and PASCALE ALARD<sup>2</sup>. <sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Microbiology and Immunology, Health Science Center, University of Louisville, Louisville, KY 40292.

The autoimmune disease, Type 1 diabetes (T1D), is characterized by the destruction of insulin producing  $\beta$ -cells in the pancreas by IFN $\gamma$ -producing T cells. Studies have shown that non-obese diabetic (NOD) mice and T1D patients share similar characteristics for disease progression and the various defects that lead to disease progression. One of these defects involves dendritic cell (DC) propensity to produce elevated levels of pro-inflammatory cytokines such as IL-12, a cytokine that influences the differentiation of naïve T-cells into IFN $\gamma$ -producing T Helper 1 (Th1) cells. We have recently identified a new defect in DC from NOD mice, namely an abnormal accumulation of  $\beta$ -catenin in the DC nucleus. The purpose of the present study was to determine (1) the cause of  $\beta$ -catenin accumulation in NOD DC and, (2) the impact of  $\beta$ -catenin accumulation on the production of pro-inflammatory cytokines by NOD DC. Because GSK-3-mediated phosphorylation of  $\beta$ -catenin leads to its rapid degradation, we first examined whether downregulation of GSK-3 activity was responsible for the elevated  $\beta$ -catenin expression in NOD DC. We found that GSK-3 activity was not altered in NOD DC. We next determined the impact of  $\beta$ -catenin accumulation on the production of pro-inflammatory cytokines, and found that treatment of NOD DC with a  $\beta$ -catenin inhibitor abrogated the production of pro-inflammatory cytokines, as well as subsequent induction of IFN $\gamma$ -producing T cells. Our data suggests that  $\beta$ -catenin appears to upregulate the production of pro-inflammatory cytokines in NOD DC, leading to the induction of pathogenic Th1 cells implicated in  $\beta$ -cells destruction.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Cellular and Molecular Biology Section; 3<sup>rd</sup> place in undergraduate research competition)*

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

## DEPARTMENT OF BIOLOGY

Identification of breast tumorigenic cells in a three-dimensional bone colonization assay *in vitro*. KABINDRA KAFLE<sup>1</sup>, JOEL A. CASSLER<sup>2</sup>, AMANDA GOLEMBA<sup>2</sup>, ELLEN J. GUNN<sup>2</sup>, and JULIA KIRSHNER<sup>2,3</sup>, <sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Biological Sciences, Purdue University, West Lafayette IN 47907; <sup>3</sup>Purdue Cancer Center, Purdue University, West Lafayette IN 47907.

Breast tumors consist of very small sub-population of CD44<sup>+</sup>CD24<sup>-</sup> cancer stem cells (CSCs). The metastatic form of breast cancer colonizes different parts of the body including the bone marrow. Biological markers have been found to identify these cells but the effective therapeutics has not been yet found to target these CSCs. The colonization of the bone marrow by the metastatic breast cancer cells occurs in the bone marrow matrix niche followed by possible proliferation. The possible therapeutic intervention could be executed once the CSCs are localized in that particular niche. To study the migratory patterns of breast cancer cells and colonization of bone marrow by CSCs, a three-dimensional (3-D) tissue culture assay where human bone marrow is reconstructed *in vitro* has been created. It was hypothesized that the cells with the capacity to migrate to the bottom of the 3-D culture are the CSCs. This hypothesis was tested using non-invasive (MCF-7) and metastatic (MDA-MB-231) breast cancer cell lines, which have been previously shown to be comprised of 0.1% and 86% CD44<sup>+</sup>CD24<sup>-</sup> CSCs respectively. Consistent with the hypothesis, MCF-7 cells failed to colonize reconstructed bone marrow, while MDA-MB-231 cells rapidly and efficiently invaded the reconstructed bone marrow. Thus, to reduce the morbidity and mortality caused by breast cancer metastasis, novel therapeutics are required that can target the CSC population.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Cellular and Molecular Biology Section)*

**Purdue University Research Internship**

## DEPARTMENT OF BIOLOGY

Characterizing the anti-tumorigenic properties of K-RAS peptide inhibitors. KAYLA KINKER<sup>1</sup>, NADYA I. TARASOVA<sup>2</sup>, ALLA I. IVANOVA<sup>2</sup>, and DAVID CARBONE<sup>2</sup>, <sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Cancer Biology, Vanderbilt-Ingram Cancer Center, Vanderbilt University, Nashville TN 37232.

RAS proteins are oncogenic and play significant roles in normal cell signal transduction. Excessive amounts of RAS signaling stimulate cells to exhibit a variety of tumorigenic properties. Activating mutations, specifically in K-RAS, were identified in approximately 30% of all human malignancies. Due to these mutations, K-RAS is unable to deactivate after signal transduction is completed, which results in constitutive signaling thereby increasing proliferation and survival. Cancer patients with K-RAS mutations have little response to conventional treatments, thus the development of new therapeutic tools against activated K-RAS is warranted. Novel peptide-based inhibitors that target active K-RAS have been tested on lung cancer and mesothelioma cell lines. Our preliminary results demonstrate that the drugs reduce cell growth and migration of non-small cell lung carcinoma (NSCLC) and mesothelioma cell lines as determined by WTS-1 and trans-well migration assays. Preliminary data also shows invasion inhibition and reduced colony formation in soft agar.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Cellular and Molecular Biology Section; 1<sup>st</sup> place in undergraduate research competition)*

**Vanderbilt University Research Internship**

## DEPARTMENT OF BIOLOGY

*In vitro* retraction of the distome body of *Proterometra macrostoma* into its cercarial tail: Effect of selected ions, light, and subsequent cercarial swimming. ADAM MEADOR, KELLY NJINE MOUAPI, KRYSTINA SANDEFUR, LEE WARE, CECILIA ALBERS, ADAM CHAMBERS, and RONALD ROSEN, Department of Biology, Berea College, Berea, KY 40404.

The digenetic trematode, *Proterometra macrostoma*, possesses several unique adaptations that extend its longevity and infectivity to its centrarchid fish definitive host. Most notable is the retraction of the cercarial body into its tail prior to emergence from the snail intermediate host. This serves to protect the cercarial body from osmotic stress subsequently encountered in a hypotonic freshwater environment. Based on a previous in-vitro pilot experiment, it is known that this retraction takes place more readily in artificial snail water (ASW) than in artificial pond water (APW). The objectives of this experiment were to determine: (1) the effect of isosmotic ion replacement in ASW on cercarial retraction, (2) the effect of light intensity on cercarial retraction, and (3) possible swimming differences between retracted cercariae shed naturally from their snail host and those retracted in-vitro. No significant difference was found in the number of cercariae retracted, non-retracted or with bodies separated from tails between: (1) each ion replacement solution and the control solution or (2) the light and dark environments. A significant difference was found between the mean swimming heights of naturally and in-vitro retracted cercariae during the fourth hour following retraction. The latter may be related to higher energy reserves among the naturally retracted cercariae.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Zoology Section; 3<sup>rd</sup> place in undergraduate research competition)*

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF BIOLOGY

The role of YIaJ on the function and localization of SleB in *Bacillus anthracis*. CRYSTAL THOMAS<sup>1</sup>, CASEY V. JAKUBOWSKI<sup>2</sup>, and DAVID L. POPHAM<sup>2</sup>, <sup>1</sup>Department of Biology, Berea College, Berea, KY 40404; <sup>2</sup>Department of Biological Sciences, Virginia Polytechnic Institute and State University, Blacksburg VA 24016.

*Bacillus anthracis* is a spore-forming bacterium and, as such, makes decontamination efforts difficult. SleB is a germination-specific lytic enzyme that helps to degrade the specialized peptidoglycan of the spore cortex, a step that is necessary for germination to occur. The purpose of this study was to investigate the possible role YIaJ plays on the function and localization of SleB by creating an in-frame deletion of *ylaJ* in the *B. anthracis* chromosome. In this study, *ylaJ* was successfully amplified and inserted into plasmid pBKJ236. Future plans include creating an in-frame deletion of *ylaJ* that will be introduced and integrated into the *B. anthracis* chromosome. A better understanding of germination and the proteins involved will facilitate decontamination efforts.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation –Microbiology Section; 2<sup>nd</sup> place in undergraduate research competition)*

**Virginia Polytechnic Institute and State University Research Internship**

## DEPARTMENT OF CHEMISTRY

Normal and abnormal carbene complexes. CLARIN ELLARD, SAMUEL M. ROSOLINA, JUSTIN BALDWIN, and ANES KOVACEVIC, Department of Chemistry, Berea College, Berea, KY 40404.

This research reports solvent dependent room temperature reaction leading to formation of normal and abnormal carbene complexes.  $[\text{Ir}(\text{H})_2(\text{PPh}_3)_2(\text{OCMe}_2)_2] \text{BF}_4$  is reacted with widely popular pyridine-substituted imidazolium salts, in this case with an n-butyl wingtip group, in tetrahydrofuran or dichloromethane. Reaction in tetrahydrofuran leads to formation of abnormal carbene, while reaction in dichloromethane leads to formation of normal carbene.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13–14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation –Chemistry Section)*

**Berea College (Short Term ; CHM 317: Organometallic Complexes)**



## DEPARTMENT OF CHEMISTRY

Analysis of alpha-galactosidase from *Aspergillus niger*. LAUREN LANE and MATTHEW J. SADERHOLM, Department of Chemistry, Berea College, Berea, KY 40404.

Alpha-galactosidase is an enzyme purified from the fungus *Aspergillus niger*. It is commonly used to treat digestive issues, and is found in products such as Beano.  $\alpha$ -galactosidase is a good model for enzyme kinetics because it is somewhat purified, stable, and inexpensive. Using UV-Vis spectrophotometry, we measured  $\alpha$ -galactosidase's activity with the chromophoric substrate  $\alpha$ -4-nitrophenylgalactopyranoside. At the optimal pH of 7.0,  $V_{\max}$  was 0.004 mol/sec and  $K_M$  was 0.369 mol. We also ran the samples of Beano on SDS-PAGE and native PAGE to estimate molecular weight and purify the protein. We also started proteomics studies on  $\alpha$ -galactosidase using in-gel tryptic digests and sequencing via mass-spectrometry.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation –Chemistry Section)*

**Berea College (Chemistry Department Research Funds)**

## DEPARTMENT OF CHEMISTRY

The synthesis of proline-containing peptides. MATTHEW METER and MATTHEW J. SADERHOLM, Department of Chemistry, Berea College, Berea, KY 40404.

Peptides with C-terminal prolines are difficult to synthesize via solid-phase peptide chemistry due to the formation diketopiperazine. Several approaches were attempted to produce peptides with C-terminal prolines using Fmoc (fluorenylmethoxycarbony) chemistry and two different solid-phase resins (Wang and 2-chlorotrityl). The challenges confronted by each of these methods are described along with possible routes to synthesize proline-containing peptides in the future.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13–14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation –Chemistry Section)*

**Berea College (Chemistry Department Research Funds)**

## DEPARTMENT OF CHEMISTRY

A system for quantifying MutYh-mediated repair activity in mammalian cells using luminescence assays. OLIVER MUNYARADZI<sup>1</sup>, ALAN RAETZ<sup>2</sup>, and SHEILA S. David<sup>2</sup>,  
<sup>1</sup>Departments of Biology and Chemistry, Berea College, Berea, KY 40404; <sup>2</sup>Department of Chemistry, University of California-Davis, Davis, CA 95616.

MutYh associated polyposis (MAP) is an autosomal recessive condition characterized by numerous polyps (5-100) within the colon with an attendant predisposition to colorectal cancer. MAP is the result of germ-line mutations within the MutYh gene resulting in a loss of function. Under cellular conditions, reactive oxygen species (ROS) oxidize guanine in DNA to 7,8-*Dihydro-8-oxoguanine* (8-oxoG), a lesion which causes mutation due to the pairing of 8-oxoG with adenine during replication, with subsequent insertion of thymine opposite this adenine during the next replication cycle. MutYh “rescues” 8-oxoG lesions in DNA after the first replication cycle by removing the adenine paired to 8-oxoG, after which cytosine is inserted at the abasic site, allowing OGG1 to recognize the OG:C mismatch and excise 8-oxoG ultimately *preventing a potential G:C to T:A point mutation*. While previous work has studied the repair activity of MAP variants in the bacterial MutY homolog as well as in cell lines derived from MAP patients via OG:A repair assays, the repair activity of MAP variants in mammalian cells has not been explored quantitatively. Therefore, the ultimate aim of our work is to quantitatively determine the repair activity of different MAP variants in mammalian cells with an isogenic MutYh -/- background to control for other factors. For this project, we developed an assay in mammalian cells using a luciferase-expressing plasmid that was modified to contain a defined OG:A lesion such that repair of the lesion would convert a stop codon to the wild-type codon, allowing luciferase expression. We present initial data from transfection experiments that characterizes the sensitivity and accuracy of this approach.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Cellular and Molecular Biology Section)*

**University of California-Davis Research Internship**

## DEPARTMENT OF CHEMISTRY

Study of the influenza A M2 transmembrane peptide and C-terminal chain by solid-state NMR. THEINT THEINT<sup>1</sup>, SARAH D. CADY<sup>2</sup>, and MIE HONG<sup>2</sup>, <sup>1</sup>Department of Chemistry, Berea College, Berea, KY 40404; <sup>2</sup>Department of Chemistry, Iowa State University, IA 50011.

The M2 protein channel of influenza A plays important role for viral infection and replication. The M2 channel is pH sensitive and opens at acidic pH. Amantadine drugs were widely used to treat influenza A virus. However drug resistance rate in human, birds and pigs has reached more than 90%. Knowing the drug binding site in the channel can aid in the understanding of channel mutations and mechanism of drug resistance. Here we use solid-state NMR to examine changes in channel conformation upon drug binding by observing chemical shift of apo and amantadine –bound transmembrane peptides.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation –Chemistry Section)*

**Iowa State University Research Internship**

## DEPARTMENT OF CHEMISTRY

Mapping *clk-3* in the nematode *Caenorhabditis elegans*. KHUSCHBU PATEL<sup>1</sup>, EFUA WILMOT<sup>2</sup>, and JIM LUND<sup>3</sup>, <sup>1</sup>Department of Biology, Western Kentucky University, Bowling Green, KY; <sup>2</sup>Department of Chemistry, Berea College, Berea, KY 40404; <sup>3</sup>Department of Biology, University of Kentucky, Lexington, KY 40506.

The *clk-3* mutant in the nematode *C. elegans* has a lifespan 30% longer than wild type worms. *clk-3* worms also lay eggs over a longer period than normal worms, move slowly, and exhibit other slow ultradian rhythms. *clk-3* was previously mapped between *rol-1* and *eat-2*, a region of 2 Mb containing over 400 genes. We used SNP markers with PCR RPLPs between the N2 and Hawaiian strains to refine the mapping of *clk-3*. A search of WormBase identified six suitable SNPs in the region. A backcross between *clk-3* and the Hawaiian strain was used to generate recombinants. Cross progeny were scored first with flanking SNP markers *pkp2111* and *pkp2160* and nine strains were identified with a recombination in the region of interest. These strains were scored with the remaining four SNP markers and assayed for *clk-3* using an egg-laying assay. The position of *clk-3* was refined to a 300 kb region containing 52 genes. We also examined the effect on lifespan of knocking out *clk-3* related genes. Previous microarray experiments identified genes with decreased expression in *clk-3* worms. We used RNAi to knock out expression of eighteen of these genes in a wild type or *clk-3* strain. We identified two genes that further extended lifespan in *clk-3* worms.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Cellular and Molecular Biology Section)*

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

## DEPARTMENT OF EDUCATION STUDIES

The development of a summer science inquiry institute. JON SADERHOLM, JESSICA CARNES, AMY JONES, and CHRIS YALUMA, Department of Education Studies, Berea College, Berea, KY 40404.

The National Science Education Standards and Kentucky's Program of Studies call for students to formulate their own questions, design methods to answer them, and defend their results using logic and reason in a community of inquiry. Creating environments in which students engage in these behaviors is the most challenging science instruction method because it requires management of physical and temporal resources while honoring the initiative and autonomy of diverse students. Yet, it is in such environments that science can be best understood as it is practiced, and in which science is engaging to the broadest spectrum of students. This presentation describes a professional development experience providing teachers with authentic science inquiry experiences during summer institutes. Additionally, participants will work with science education faculty discussing the cognitive and affective nature of their personal journeys through the research, the nature of science, and changes they can make in their classroom practice. Social science research training will enable participants to effectively assess the impact of their innovations, potentially leading to greater generalizability. During intervening academic years teachers will participate in a professional learning community working with the science education faculty creating innovations to enhance the inquiry their students experience. Participants will communicate electronically, visit each other's classrooms, and attend seminars where they will share experiences and collaborate in their evaluation research. This presentation will describe the associated professional development curriculum and its development process, as well as the research-base supporting this as an innovative concept. The sustainability of this concept will be discussed.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Science Education Section; 2<sup>nd</sup> place in undergraduate research competition)*

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF ENGLISH, THEATRE, AND SPEECH COMMUNICATION

Arthur Miller's *The Last Yankee*—Preparing a new edition. BRITTNEY MORRIS and KATHERINE EGERTON, Department of English, Theatre, and Speech Communication, Berea College, Berea, KY 40404.

Arthur Miller's *The Last Yankee* (1993) highlights conflicts between men and women, between the working class and those who have left labor behind, and between exterior appearances and interior realities. Set in a New England state mental hospital in the early 1990's, *The Last Yankee* creates spaces in which the four characters, in shifting dialogic pairings, grapple with definitions of health and of success. *The Last Yankee* relies heavily on an awareness of the American landscape, both social concepts and vernacular ways of speaking, to propel the characters through the play. In preparing a new edition of *The Last Yankee* for Methuen (to be published in 2011), we faced several challenges in creating a student reading edition to be published outside of the United States. While defining and explaining the play's American context for a world-wide audience, we discovered riches in the text that many American readers might also overlook. Our notes and commentary to be published by Methuen include plot analysis, character studies, essays on the play's historical and medical contexts, textual comparison of previously published editions, and textual annotations.

*Public presentation TBA.*

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

Mathematical problems in super-resolution image reconstruction. TICHAONA  
CHIWANDAMIRA, SARA EVANS, and LARRY GRATTON, Department of Mathematics and  
Computer Science, Berea College, Berea, KY 40404.

The goal in super-resolution image reconstruction is to obtain a single, high-resolution image from a sequence of low-resolution views which capture the same scene but are shifted with respect to one another by a subpixel transformation. The reconstruction process has two parts; the low-resolution data is first mapped into a common reference frame by image registration techniques, and sampling theory is then used to resolve frequency aliasing and reconstruct the high-resolution image. Techniques for image registration and reconstruction are presented along with numerical results and a discussion of the mathematical challenges inherent in the problem.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Mathematics Section 3<sup>rd</sup> place in undergraduate research competition)*

**Berea College (URCPP Funded Research)**



## DEPARTMENT OF PHYSICS

Magnetic shielding for neutron EDM experiment. RAMESH ADHIKARI<sup>1</sup>, D. WOODS<sup>2</sup>, and B. PLASTER<sup>2</sup>, <sup>1</sup>Department of Physics, Berea College, Berea, KY 40404; <sup>2</sup>Department of Physics, University of Kentucky, Lexington, KY 40406.

To measure the electric dipole moment (EDM) of a neutron, it is required that the study is done in an environment where the background magnetic field is very small and uniform across the measurement region. Various ferromagnetic substances with very high permeability in different geometries can be used as magnetic shields that would attenuate the background magnetic field to the level of  $10^4$  gauss. In the prototyping work this summer, a square Helmholtz coil was an effective way to create a very small and uniform magnetic field along its center. When the ferromagnetic shields are kept at about the center of this coil, the background field can be lowered to the scale of  $10^6$  gauss. Our study concentrates on such methods to shield and create very small and uniform magnetic field that would assist in future experiments for the measurement of the neutron EDM.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Physics and Astronomy Section)*

**University of Kentucky Research Internship**

## DEPARTMENT OF PHYSICS

A study of ultra-cold atoms in the strongly interacting regime. BRANDON BROWN and MARTIN VEILLETTE, Department of Physics, Berea College, Berea, KY 40404.

We studied properties of a superfluid state made of fermionic atoms. We present a method for finding the critical temperature at which a gas of interacting fermions goes into a superfluid state in the unitary regime at low density using the Fermi-Hubbard model. We find agreement between the behavior of density from theoretical considerations and from the Fermi-Hubbard model.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Physics and Astronomy Section)*

**Berea College (Research Corporation Funded Research)**

## DEPARTMENT OF PHYSICS

Mid-infrared observations of IC133. HODARI-SADIKI JAMES, EMILY WORINKENG, and TRACEY HODGE, Department of Physics, Berea College, KY 40404.

We have re-examined mid-infrared images of the giant HII region (GHR) IC 133 in the nearby galaxy M33. These images were obtained with the Infrared Space Observatory (ISO) mid-infrared camera utilizing the circular variable filter (CVF). The Highly Processed Data Product (HPDP) consists of a data cube of 151 spatially resolved ( $\sim 5'$ ), moderate resolution ( $R \sim 35$ ) spectral images between 5.1 and 16.5 microns. This wavelength range spans the ubiquitous “unidentified infrared bands” (UIRs) between 6 and 8 microns, as well as atomic emission lines of [Ne II], [Ne III], and [S IV]. The extracted spectral images allow us to compare the extent of the dust emission to the ionized gas. Integrated emission line intensities are used to calculate the ionization parameters of the nebula.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Physics and Astronomy Section)*

**Berea College (Departmental Funds)**

## DEPARTMENT OF PHYSICS

The transition between the normal, superfluid, and the FFLO states in Fermi gas. WILLIAM D. NORRIS and MARTIN VEILLETTE, Department of Physics, Berea College, Berea, KY 40404.

We investigate ultra cold atoms and their quantum properties. Our study focuses on Fermionic atoms with spin imbalance at zero Kelvin. At zero Kelvin we find the fermions pair to make a Bose-Einstein Condensate (BEC) for small spin imbalance. For large spin imbalance the interactions between fermions are insufficient to create Cooper pairs and the system stays normal. At an intermediate spin imbalance we find that a new state in which the fermions form Cooper pairs with momentum. This new state of matter called Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) is investigated as a function of interaction strength and spin imbalance.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Physics and Astronomy Section)*

**Berea College (Research Corporation Funded Research)**

## DEPARTMENT OF PHYSICS

Etching on single layer graphene. JIMMY ROP<sup>1</sup> and DOUGLAS STRACHAN<sup>2</sup>, <sup>1</sup>Department of Physics, Berea College, Berea, KY 40404; <sup>2</sup>Department of Physics, University of Kentucky, Lexington, KY 40506.

Graphene is a carbon based material with thin ribbons of carbon (one atom thick) arranged hexagonally. Graphene exhibits excellent electronic properties when incorporated into a transistor. My summer research was based on creating etching on a single layer graphene. This was done by a process known as mechanical exfoliation. Iron particles were deposited on the surface of a graphite substrate using IPA solution. The graphite substrate was then placed in a heat chamber while running Hydrogen and Argon gases through. Hydrogen gas acts as a catalyst to facilitate the emission of carbon particles from the substrate to react with methane, thus resulting in etching (zigzag edges). Argon is just an inert gas, which balances the flow of Hydrogen gas.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Physics and Astronomy Section; 2<sup>nd</sup> place in undergraduate research competition)*

**University of Kentucky Research Internship**

## DEPARTMENT OF PHYSICS

A re-examination of mid-infrared ISOCAM images of HII regions in M33. EMILY WORINKENG, HODARI-SADIKI JAMES, and TRACY M. HODGE, Department of Physics, Berea College, Berea, KY 40404.

We have recently re-examined mid-infrared ISOCAM imaging spectroscopy of three HII regions in the nearby galaxy M33. These images were part of the Highly Processed Data Product (HPDP) release of Boulanger et al (2005) and consist spatially resolved ( $\sim 5''$ ) data cubes spanning a wavelength range of 5-16.5 micron with a spectral resolution of  $R = \lambda/\Delta\lambda \sim 45$ . This region of the infrared spectrum includes atomic fine-structure lines of neon and argon, as well as several “unidentified infrared bands” between 6-8 microns typically attributed to polycyclic aromatic hydrocarbons (PAHs). We present contour images comparing the extent of the dust emission to the ionized gas. We also have obtained integrated line fluxes of both the atomic species and the dust features.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Physics and Astronomy Section)*

**Berea College (Departmental Funds)**

## DEPARTMENT OF PHYSICS

Mössbauer study of iron rich cereal and iron supplement. AMER S. LAHAMER, MATTHEW M. BAILY, and MOHAMMED H. YUSUF, Department of Physics, Berea College, Berea, KY 40404.

Mössbauer spectroscopy and X-ray diffraction measurements were performed on an iron rich cereal at room temperature. X-ray diffraction patterns of the raw cereal showed it to be more of an amorphous compound. The Mössbauer spectra of the raw cereal showed about 81% of the iron to be in the ferric phase, 18% to be in the metal form, and less than 1% of the ferrous phase. However, the Mössbauer spectra of the extracted iron from the cereal showed about 29% to be in the ferric phase, 70% to be in the metal phase, and less than 1% ferrous phase. On the other hand, Mössbauer spectra of iron supplement showed 100% of the iron to be in the ferrous phase.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Physics and Astronomy Section)*

**Berea College (Departmental Funds)**

## DEPARTMENT OF PHYSICS

Measuring coronal magnetic twist injected by photospheric rotation. A. MALANUSHENKO<sup>1</sup>, M. YUSUF<sup>2</sup>, and D. W. LONGCOPE<sup>1</sup>, <sup>1</sup> Department of Physics, Montana State University, Bozeman, MT 59717; <sup>2</sup>Department of Physics, Berea College, Berea, KY 40404.

Measuring the twist of the coronal magnetic field is important for understanding and predicting solar flares. The studies of instabilities in the past decades suggest a relation between solar flares and instabilities, such as the external kink mode, driven by excessive twist. We study the buildup of twist in an emerging and rapidly rotating active region (AR 9002) using the technique developed by Malanushenko. This uses EUV coronal images, from TRACE, and line-of-sight magnetograms, from MDI, to infer properties of the coronal magnetic field, including its local twist parameter  $\alpha$ . We find that the twist of AR 9002 does not change with time, while twist of emerging AR 9004 starts left handed and becomes, after 70 hours, right handed. We compare the change rate of twist for AR 9004 to the predicted rate given the simple model of braiding and spinning flux tube and demonstrate the general agreement of the two. We also characterize the coronal twist of the flux interconnecting the two regions which is produced through reconnection.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Physics and Astronomy Section 3<sup>rd</sup> place in undergraduate research competition)*

**Montana State University Research Internship**



## DEPARTMENT OF PSYCHOLOGY

The effects of physical attractiveness, gender, and job-type on personnel selection.

BOZHIDAR BASHKOV, Department of Psychology, Berea College, Berea, KY 40404.

The purpose of this study is to investigate the influence of physical attractiveness, applicant's gender, and job-type on personnel selection. Fifty-three college students rated eight different applicants for two different jobs. Attractive applicants were rated higher than less attractive ones, and women were more likely to be hired than men. A significant interaction between job-type and applicant's gender showed that women were rated as better candidates than men for the male-stereotyped job, while applicant gender did not appear to affect ratings for the female-stereotyped job. Findings from this study are discussed, and suggestions for future research offered.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Psychology Section; 3rd place in undergraduate research competition)*

**Berea College (PSY 424 Class Project)**

## DEPARTMENT OF PSYCHOLOGY

An examination of achievement goal types and academic self-efficacy. DEBRA BLAACKER, ROBERT SMITH, HOPE REUSCHEL, and ALYSSA SEIBERS, Department of Psychology, Berea College, Berea KY 40404.

This study examined the relationship between self-reported academic self-efficacy and academic goal orientation. As part of a larger study, 37 adolescents, ranging in age from 11 to 18 years, were grouped according to high and low self-reported academic self-efficacy scores. Differences between these groups on measures of goal orientation (performance-mastery, performance-approach or performance-avoidance) were examined. Results showed a significant group difference in terms of mastery goals and performance-avoidance goals, suggesting that students who are more academically inclined appear to set different goal types for school than their less academically inclined peers. Implications for the role of goal types as predictors of academic self-efficacy and achievement are discussed.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Psychology Section)*

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF PSYCHOLOGY

The effects of personality and preparedness on group work. CHRISTINE M. MORRIS,  
Department of Psychology, Berea College, Berea, KY 40404.

This study looks at the effects of personality and preparation on group processes and products. All subjects completed an introversion-extroversion instrument. Eight groups of 5 participants were then provided with the group activity “Lost at Sea”, where they were required to rank 15 items based on importance to their survival. Members in four of the groups were given 5 minutes and a piece of paper to write down their answers individually before the task started, while the other four groups simply proceeded with the task. Afterward, a group satisfaction survey was administered individually. Personality did not appear to affect any of the outcomes, however preparation appeared to increase contribution balance, reduce time required and increase solution accuracy.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation – Psychology Section)*

**Berea College (PSY 424 Class Project)**

## DEPARTMENT OF PSYCHOLOGY

Linking creative self-efficacy with academic outlook in adolescents. HOPE I. REUSCHEL, DEBRA BLAACKER, ALYSSA SEIBERS, and ROBERT SMITH, Department of Psychology, Berea College, Berea, KY 40404.

This study focused on creative self-efficacy and indices of students' interpretations of their academic environments, including their attitudes toward coursework, instructors, and school as measured by the Adaptiveness Index of the Survey of Academic Orientations (SAO). As part of a larger study, 71 adolescents (44 female) responded to items on a questionnaire assessing their approaches to academic situations (e.g., "Learning new things is thrilling."). Students were grouped into high and low creative self-efficacy groups based on their individual responses to a series of three questions asking about their subjective impressions of their own creative abilities. Significant group differences were found on the Creative Expression subscale and for the overall Adaptiveness Index, underscoring the fact that individuals who have high creative self-efficacy tend to have greater abilities in expressing themselves creatively and tend to be better equipped in managing various aspects of academic environments than those who have low creative self-efficacy. No other significant differences were found which may suggest that the significance for the Adaptiveness Index is better accounted for by the high significance of the Creative Expression subscale. Results are discussed in addressing how learning environments may be affected by students' own beliefs and expectations in their creative abilities.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Psychology Section)*

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF PSYCHOLOGY

Read'n, 'Rite'n, and Residue: Using the Cloze procedure to explore the persistence of memory. MEGAN ROGERS, Department of Psychology, Berea College, Berea, KY 40404.

Reading and writing are foundations of education. However, it is not clear that these activities leave behind the same cognitive residue (i.e., memory). This study used the Cloze procedure to measure subjects' memory after they had read and written samples (of about 197 words) after one week and five weeks. Fourteen Berea College freshmen in a single section of a required general studies course participated. It was found that students were better able to fill in removed words when they had written the sample rather than when they had only read it. Also, the participants scored higher on the samples after one week compared to five weeks. An interaction was found showing that participants could correctly produce missing words for the samples they had written with minimal decay even after five weeks. However, for the read-only samples, scores indicated memory had decayed to baseline within five weeks. Cognitive and educational implications as well as potential applications for detecting academic dishonesty are discussed.

**Berea College (PSY 424 Class Project)**

## DEPARTMENT OF PSYCHOLOGY

Success through creativity: How academic orientations are affected by creative self-efficacy.  
ALYSSA SEIBERS, ROBERT SMITH, DEBRA BLAACKER, and HOPE REUSCHEL,  
Department of Psychology, Berea College, Berea, KY 40404.

This study investigated the differences in motivational and academic beliefs and the classroom experiences of adolescents who perceive themselves as either high or low in creativity. A total of 71 adolescents (44 females), aged 11-18, were grouped into high and low categories of self-reported creative self-efficacy. Independent samples t-tests found significant differences between high and low creative self-efficacy groups in performance-approach scores and supportive feedback from teachers. These differences suggest that students with higher levels of creative self-efficacy tend to adopt more performance-approach goal orientations for learning, perceive greater levels of supportive feedback from their teachers, and hold more positive beliefs about their own academic abilities. Implications for the importance of fostering creativity in education are discussed.

*95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13—14, 2009, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation – Psychology Section)*

**Berea College (URCPP Funded Research)**

## DEPARTMENT OF TECHNOLOGY AND INDUSTRIAL ARTS

The exploration of digital infrared and black and white photography. ALAN MILLS, BRITTANY ADAMS, and CALEB WETMORE, Department of Technology and Industrial Arts, Berea College, Berea, KY 40404.

The purpose of this creative project was to explore the art of digital infrared and black and white photography. A Nikon D100 camera was modified and used to record infrared photographs. After modifications, the camera captured infrared light while blocking out visible light. A Nikon 300 camera with a resolution of 12 million pixels was used to record black and white photographs. All of the photographs were captured in color and then converted to black and white images using Photoshop. During the project we learned how to convert infrared images to black and white and then bring back color to selected areas of the photographs. Photographs were selected and organized into a digital photo gallery. Twelve photographs were selected and printed using an Epson 2880 archival printer. These photographs were then matted and framed using archival materials. Each participant designed and published an 11" x 13" hardbound book using an online printing service called BLURB. The quality of the books was excellent and this proved to be a very creative way to display the photographs from this project.

*Display Of Matted Photographs In Hutchins Library*

**Berea College (URCPP Funded Research)**

# APPENDIX

## Summary 2006—2009

Over the last four years (2006—2009), 204 (with some repeats) Berea College undergraduates have submitted 145 research abstracts to the Journal (Figure 1). Sixty-five students (all from the Departments of Biology, Chemistry, and Physics) have received research internships at 25 different institutions across the country (Table 1). One-hundred and thirty-nine students from 18 academic departments have submitted 81 different abstracts based on their on-campus projects (Table 2). Departments represented include Art, Agriculture and Natural Resources, Appalachian Studies, Biology, Chemistry, Education Studies, English, Theatre, and Speech Communication, General Studies, History, Mathematics and Computer Science, Music, Physical Education and Health, Philosophy and Religion, Physics, Psychology, Sociology, Technology and Industrial Arts, and Women's Studies.

Based on the information in Tables 1 and 2, there has been a credible balance between the number of on-campus (68.1%) and off-campus (31.9%) student participants. Notably, 58.0% of the on-campus abstracts submitted have been supported by the Undergraduate Research and Creative Projects Program (URCPP; Table 2). Not surprisingly, the URCPP has also supported the majority of students (68.3%) engaged in on-campus research (Table 2). The URCPP was established in 1998 to provide funds for on-campus undergraduate research with Berea faculty. Faculty submit research proposals following established guidelines which are then peer-reviewed by an on-campus committee. The 2008-2009 endowment for the URCPP was approximately five million dollars, with around \$100,000 dollars available from the interest to support various projects on campus (personal communication, Jim Strand, Senior Administrative Assistant to the Academic Vice President and Provost).

The majority of all abstracts submitted were from students affiliated with departments in the Science Division (Figure 2), with students from the Departments of Biology, Chemistry, and Physics accounting for the greatest contribution from this division (Figure 3). Participation by faculty with undergraduates in these three departments has ranged from 50% (Biology) to 100% (Chemistry and Physics) over the last four years.

Students from the Agricultural and Natural Resources, Biology, Chemistry, Mathematics and Computer Science, Physics, and Psychology Departments have presented 113 oral or poster presentations at the Annual Meetings of the Kentucky Academy of Science between 2006—2009 (Figure 4). Thirty-seven of the 2007--2009 presentations (37.8%) received first, second or third place awards in competition with undergraduates from the other private colleges, regional universities and flagship universities within the state (Figure 5). No records were kept regarding placement in 2006. Images of students and their poster presentations at the Annual Meeting of the Kentucky Academy of Science and the Annual Berea College Research Presentations are provided in Figures 6—8.

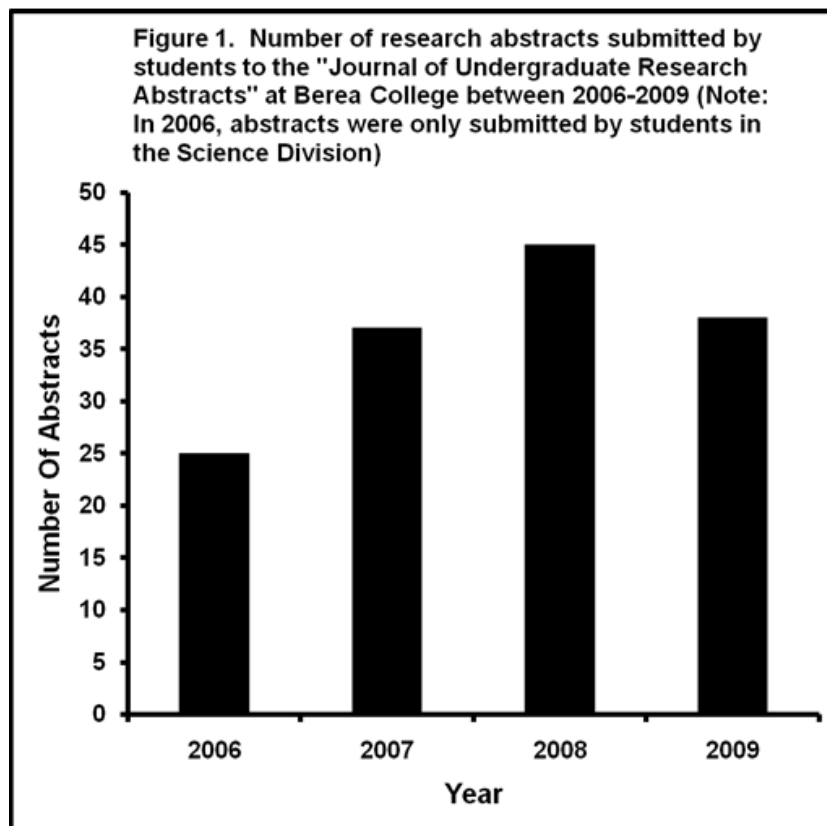


**Table 1. List of off-campus institutions supporting undergraduate research internships for Berea College students between 2006—2009.**

| <b>Institution</b>                                  | <b># Students</b> | <b>Student Department(s)</b> |
|---|-------------------|------------------------------|
| Argonne National Lab                                | 2                 | BIO & CHM                    |
| Georgia State University                            | 1                 | PHY                          |
| IBM Almaden Research Center                         | 1                 | PHY                          |
| Iowa State University                               | 1                 | CHM                          |
| Kansas State University                             | 1                 | BIO                          |
| KBRIN (Universities of Kentucky & Louisville)       | 16                | BIO & CHM                    |
| Mayo Clinic   | 6                 | BIO & PHY                    |
| Miami University (Ohio)                             | 1                 | BIO                          |
| MIT   | 1                 | BIO & PHY                    |
| Montana State University                            | 1                 | PHY                          |
| Purdue University                                   | 1                 | BIO & CHM                    |
| State University of New York at Stony Brook         | 1                 | CHM                          |
| Tulane University                                   | 1                 | CHM                          |
| University of Arkansas                              | 1                 | PHY                          |
| University of California - Davis                    | 1                 | BIO & CHM                    |
| University of California - Santa Cruz               | 1                 | BIO & CHM                    |
| University of Georgia                               | 1                 | BIO                          |
| University of Kentucky                              | 4                 | BIO & PHY                    |
| University of Minnesota                             | 1                 | CHM                          |
| University of Southern California Los Angeles-      | 1                 | CHM                          |
| University of Utah                                  | 1                 | BIO                          |
| University of Wisconsin                             | 2                 | BIO & PHY                    |
| Vanderbilt University                               | 15                | BIO & CHM                    |
| Virginia Polytechnic Institute and State University | 2                 | BIO & CHM                    |
| Zoological Society of San Diego                     | 1                 | BIO                          |

**Table 2. Categories of on-campus undergraduate research internships for Berea College students between 2006—2009.**

| <b>Project Category</b>           | <b># Abstracts Submitted</b> | <b># Students</b> |
|-----------------------------------|------------------------------|-------------------|
| <b>Berea Term Abroad</b>          | <b>1</b>                     | <b>1</b>          |
| <b>Class Projects</b>             | <b>15</b>                    | <b>17</b>         |
| <b>Externally Funded</b>          | <b>2</b>                     | <b>2</b>          |
| <b>Special Projects</b>           | <b>2</b>                     | <b>4</b>          |
| <b>Unknown/Departmental Funds</b> | <b>14</b>                    | <b>20</b>         |
| <b>URCPP</b>                      | <b>47</b>                    | <b>95</b>         |



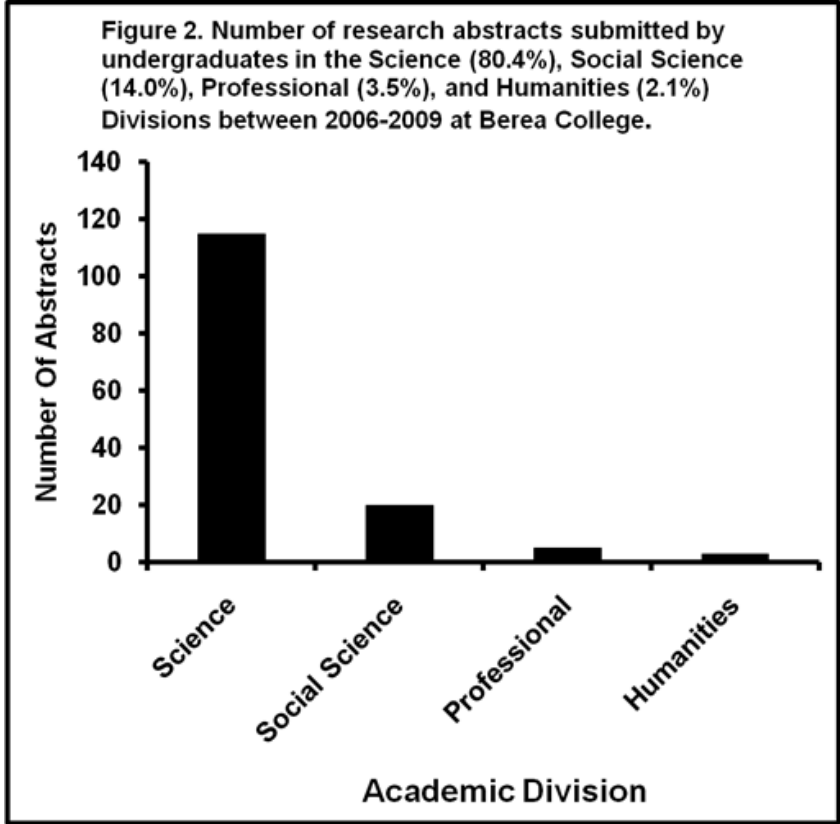
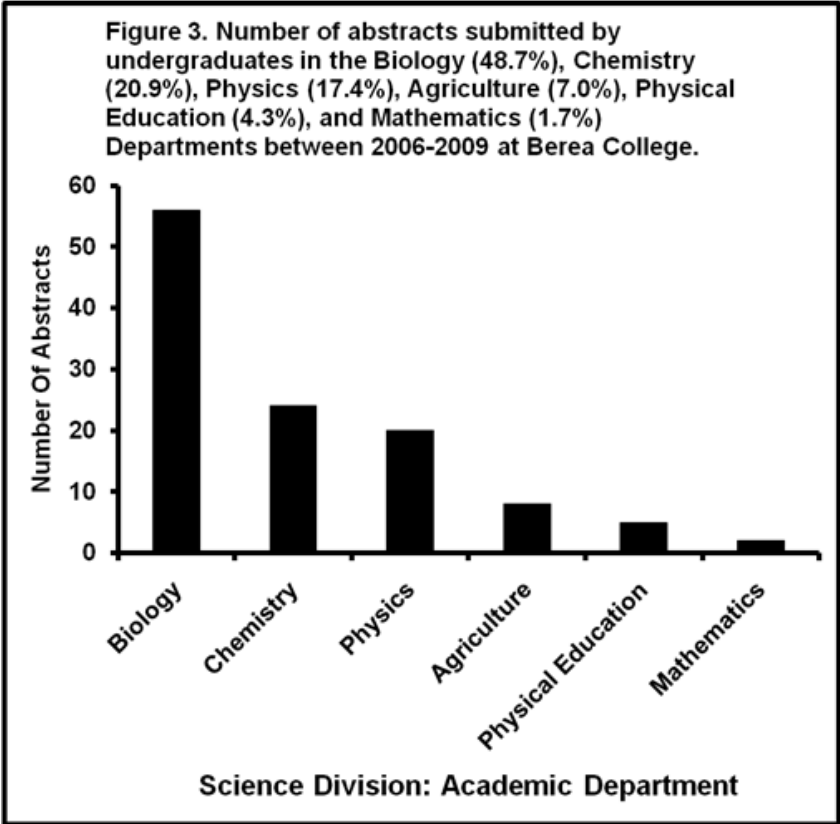


Figure 4. Number of Berea College student oral & poster presentations at the 2006-2009 Annual Meetings of the Kentucky Academy of Science.

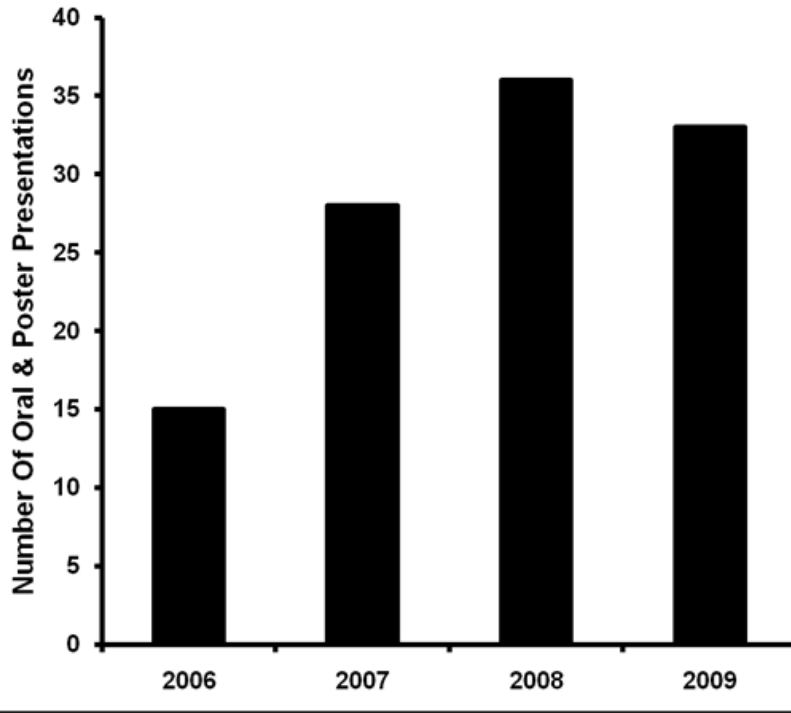
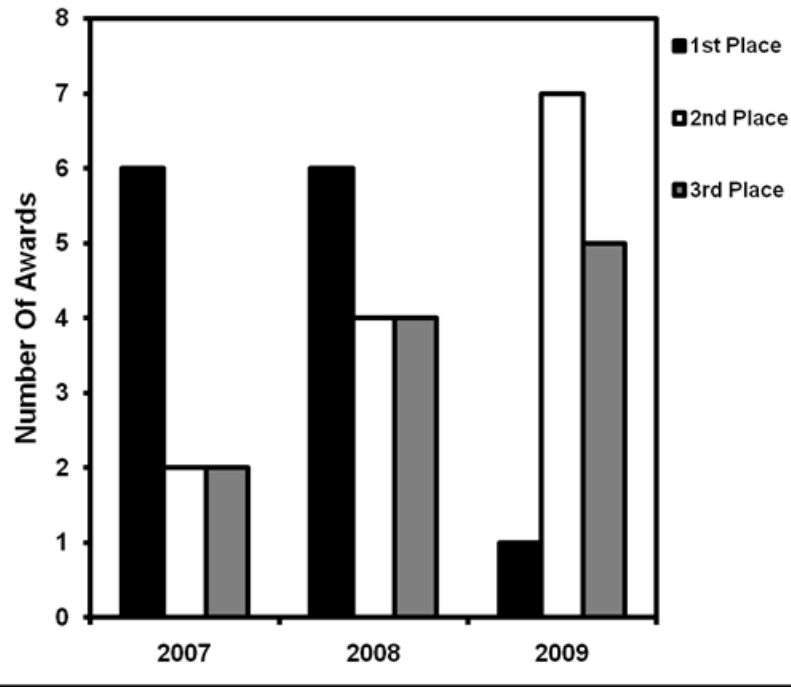
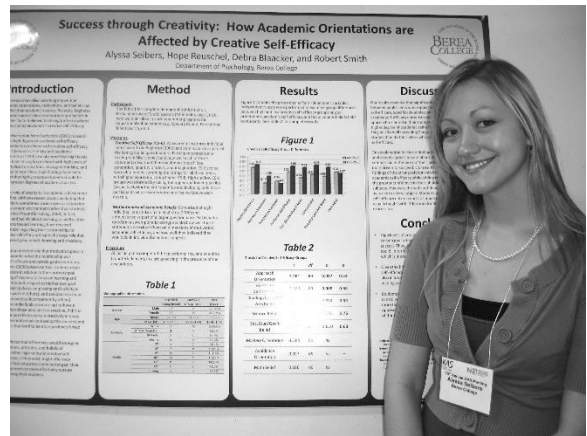
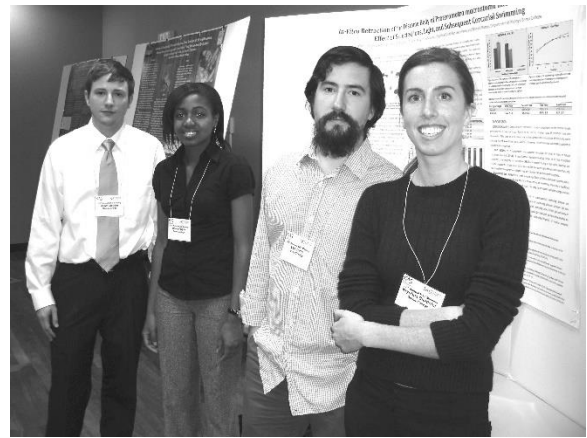
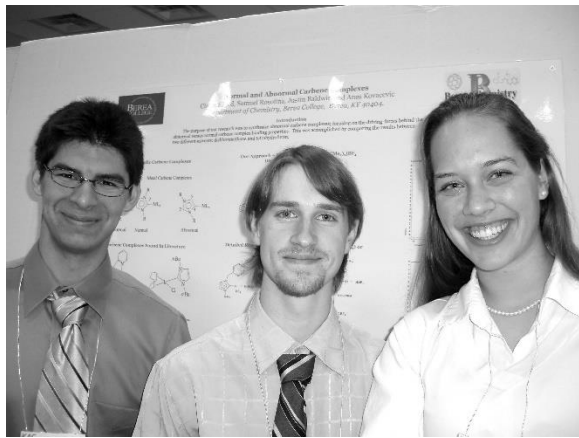
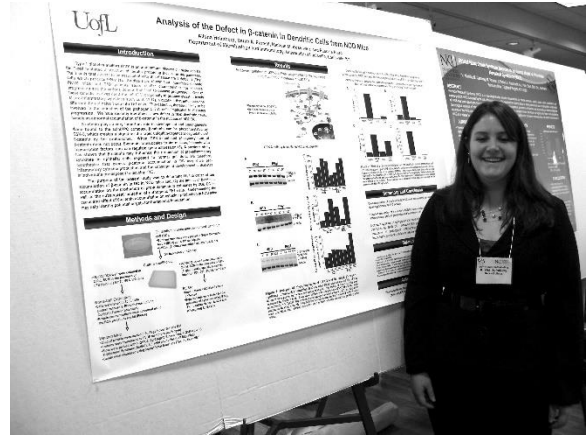
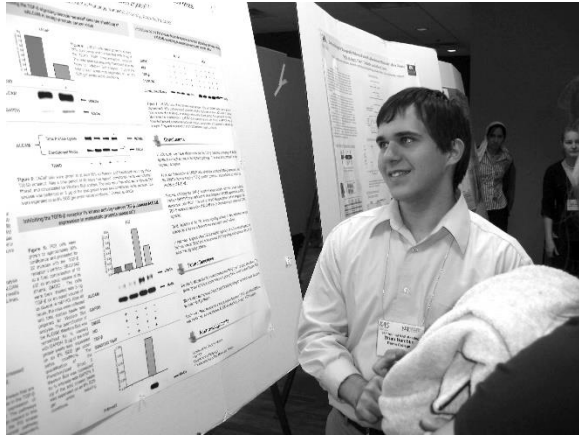
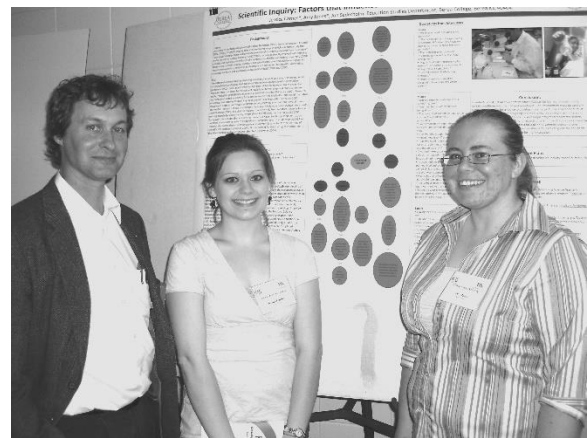
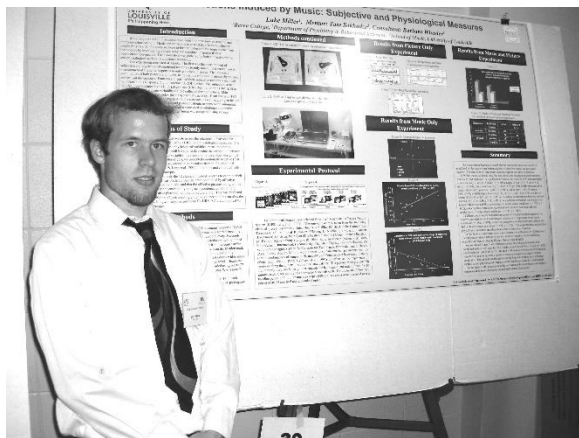
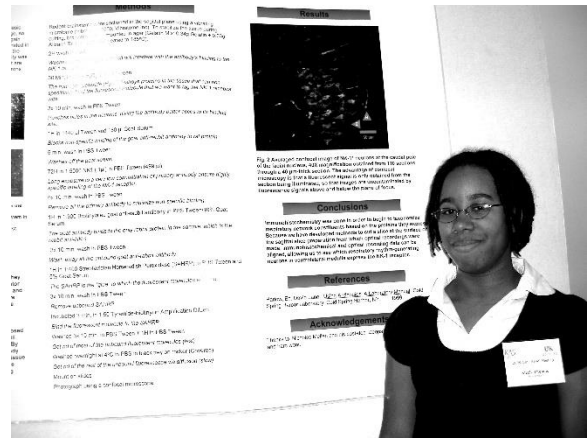
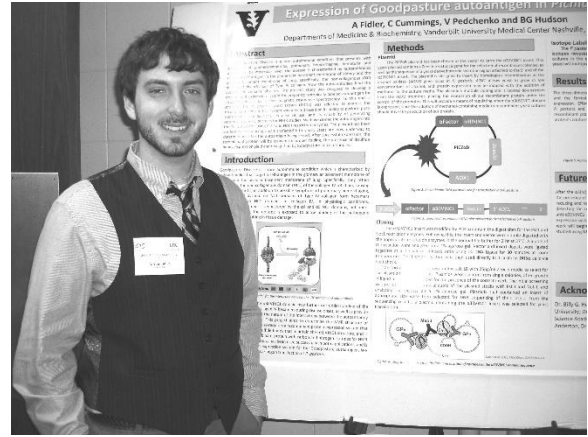
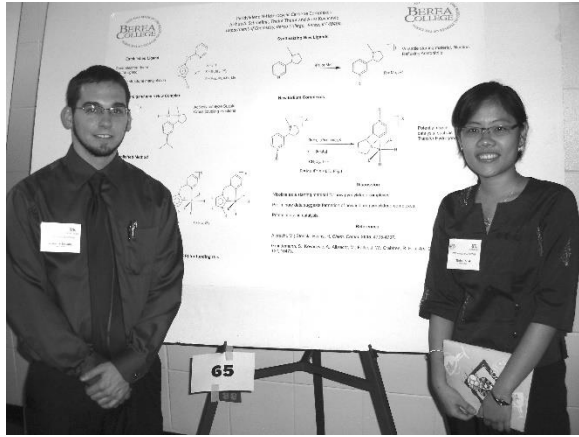


Figure 5. Number of awards received by Berea College students for oral and poster presentations at the 93rd, 94th, and 95th Annual Meetings of the Kentucky Academy of Science (2007-2009).

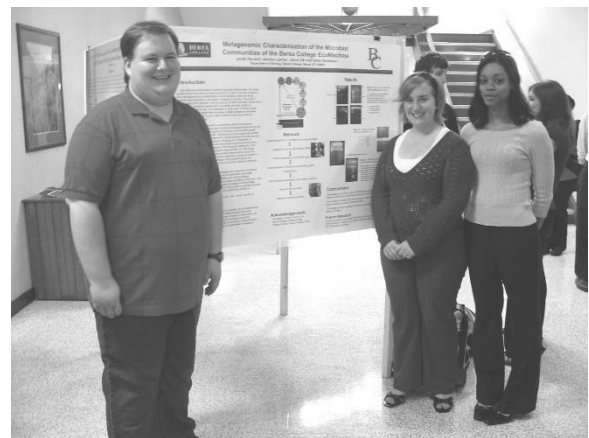
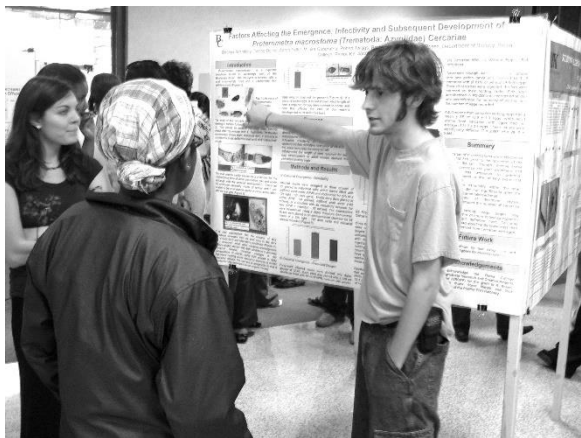




**Figure 6. Berea College student presentations at the 95<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, November 13-14, 2009, Northern Kentucky University.**



**Figure 7. Berea College student presentations at the 94<sup>th</sup> Annual Meeting of the Kentucky Academy of Science, October 31 & November 1, 2008, University of Kentucky.**



**Figure 8. Berea College student presentations at the 8<sup>th</sup> Annual Berea College Research Presentations, October 2007.**