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INTRODUCTION

Editors: Kaitlyn C. Reasoner (Junior Biology Major); Ronald B. Rosen (Professor of Biology)

This ninth (2014) issue of the "Berea College Undergraduate (Research) Abstract Journal" contains 55 different abstracts representing majors from 11 different academic programs. Thirty-six (65.5%) of these abstracts represent research conducted on-campus with Berea College faculty mentors. The common theme to the research presented in these abstracts is that the: (1) original proposal was peer-reviewed and/or (2) work was subsequently presented by undergraduates at off-campus meetings. Several projects were non-funded capstone or independent studies; most on-campus research was made possible with funds provided by Berea College's Undergraduate Research and Creative Projects Program (URCPP), the Berea College Labor Program, and Berea's Center for Transformative Learning (CTL) – Internship Program. Off-campus projects were funded by universities and colleges throughout the country often with assistance from our Internship Program. Much of this collaborative work was presented at off-campus meetings including the 100th Annual Meeting of the Kentucky Academy of Science (45 presentations and 18 rewards received). It should be noted that Berea College had the fifth highest number of presentations of all colleges and universities in the state at this centennial meeting which also included student presentations from Kentucky's regional and flagship universities. Many of these projects were also presented on campus during the 14th Berea Undergraduate Research Symposium (BURS) on October 17, 2014. If known, presentations, awards received and funding sources are noted below each abstract. If provided by the student authors or their mentors, optional images related to their research are also included.

ACKNOWLEDGEMENTS

This publication would not have been possible without the support of many people. We would like to thank Chad Berry, Academic Vice President and Dean of the Faculty, for providing funds to print hard copies of these abstracts, Esther Livingston for arranging funding from the Berea College CTL - Internship Program and Sarah Broomfield and Megan Hoffman for coordinating the URCPP initiative on campus. Gratitude is extended to Berea College faculty for their mentorship, and of course to students whose exemplary work is reflected in this journal. Additionally, we would like to acknowledge former Biology Major, Karen Reynolds (Spring 2014 graduate), for the original watercolor cover art. Finally, we would like to thank all the off-campus mentors at the following universities, colleges and non-profit organizations for supporting Berea students during the summer of 2014 (number of Berea students in brackets): Eli Lilly & Co. {1}, Johns Hopkins University {1}, Mayo Clinic {2}, NASA Langley Research Center {1}, Ohio State University {2}, Ohio Wesleyan University {1}, Pepperdine University {1}, St. Georges University – London {1}, University of Colorado {1}, University of Georgia {1}, University of Louisville {1}, University of Pittsburgh {1}, and Vanderbilt University {5}. Special thanks to Berea alumni Dr. Dennis Roop (University of Colorado – Denver), Dr. Chella David (Mayo Clinic), and Dr. Rocky Tuan (University of Pittsburgh), and Vanderbilt University faculty Julie Hudson, Billy Hudson and Roy Zent for facilitating research opportunities at their respective institutions for Berea College students. We continue to be deeply indebted to Berea College alumnus, Dr. Hal Moses, who was instrumental in establishing our valued relationship with Vanderbilt University.

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Berea College Students and Faculty in Bold

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Exploring No-Till Roll-Down Organic Farming. Jeff Wylie, Matt Wilson, Agriculture and Natural Resources Program, Berea College, Berea KY 40404.

Abstract

The possibility of implementing organic no-till using roll-down as a sustainable method for managing cover crops was explored on the Berea College Farm during the summer, 2014. The goal is that a dense cover crop is rolled down with a roller-crimper pulled behind a tractor generating a thick mulch layer to benefit the following cash crop by negating soil structure destruction from tillage, adding organic matter, suppressing weeds, and maintaining soil moisture. The results were inconsistent due to uneven fields preventing sufficient cover-crop kill. Application of herbicides was necessary to adequately kill the cover crop of rye and vetch but the resulting mulch layer still provided other desired benefits. Observations indicate that though the roller-crimper was minimally effective it could be improved with alterations to either the field or the implement. The cover crop or mixture being rolled down is also a large factor in roll-down success. This experience suggests that no-till organic farming is possible using cover-crop roll-down to manage cover crops if it is tailored to location and climate. If roll-down and planting can be done in a single pass the cash crop that follows will then require little or no maintenance until harvest. This could improve soil quality and crop growing conditions with less reliance on machinery and fuel.

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Agricultural Sciences Section)

Funded by Berea College Office of Internships and Berea College Labor Program

The Growth Performance and Parasite Susceptibility of Goat Kids and Postpartum Performance of Does Managed in Continuous Suckling Systems at Sustainable Production Operations of Berea College and Community Producer Farms. Sydney Marshall, Cydney Hill, James Tyler Glasson, Quinn S. Baptiste, Agriculture and Natural Resources Program, Berea College, Berea, Kentucky 40404.

Abstract

This project evaluated the growth performance, milk production/consumption and intestinal parasite susceptibility of multiple breed does and kids of that were managed in continuous suckling systems at sustainable production operations of Berea College and its community. The project focused primarily on the goat herd at the Berea College Farm (**BCF**), and extended to two goat producer farms (**BBF** and **JDF**) in the wider Berea College Community. Students reviewed and utilized a letter of interest to solicit the participation of two community producers in this project. Through the use of a series of student designed questions and subsequent interviews with producers the specific nature of the continuous suckling management practices that were being utilized by producers was determined. Students determined the producer's awareness of benefits of continuous suckling strategy and discussed the nature of our study with producers. The study utilized 66 does which kidded during the 2014 Spring kidding season. The Spring-born kids (N = 67) of these 66 does were also used in this study. The growth performance and level of parasitism of goat kids reared in continuous suckling managed systems were determined by measuring fortnightly weights, calculating average daily weight gains, overall weight gain, body condition scoring (indicator of nutritional status), and FAMACHA scoring (indicator of parasite susceptibility or levels) throughout the two months period. Body dimensions of kids at **BCF** were measured at fortnightly intervals. The postpartum status and condition of does which continuously suckled kids were evaluated by measuring body condition scores, and weight changes throughout the two month period. The quality of forage feed that does and kids accessed during the trial period was determined from samples harvested upon initiation and end of the study at each farm. Students determined feeding strategies that were used at producer operations prior to and during the two months study period. Students analyzed forage Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) as indicators of forage quality in the Berea College Animal Nutrition Laboratory.

Continuously suckled goat kids of Berea College Farm grew at an average of 123 g/day and body dimension data indicates that the sternum width, hip height, shoulder height, body length and girth of kids increased by 32.34, 14.98, 16.48, 16.46 and 19.78 % between the start and end of the study. This favorable growth of these kids occurred even as milk production of the does and milk consumption by kids declined. The milk production/consumption as measured through weigh suckle weigh techniques decreased from an average of 53g to -66g per doe/kid (a 226% change) over the course of this two month study. Average daily gains of kids at producer farms were 133g/day at BBF and 181g/day at JDF. Body dimension changes were not determined at BBF or JDF. The average body condition scores of kids were (2.83 at BCF, 3.03 at

BBF and 3.24 at JDF). The growth of kids was apparently supported by the accessibility of kids to quality forage with relatively moderate NDF value (51.80%) and ADF values of (29.91%). Furthermore, the postpartum performance of does as reflected by weigh changes (36 g/day at BCF, 85g/day at BBF and 196g/day at JDF) and average body condition scores (2.70 at BCF, 3.15 at BBF and 2.93 at JDF) during the two month period were moderate. The does' performance was also partially attributable to the ability of does to access quality forage during the summer. Internal parasite burdens may have been one factor limiting performance of goats managed in continuous suckling type systems and thus warrants further investigation. Average FAMACHA scores of does (3.94 at BCF, 3.47 at BBF and 2.73 at JDF) and kids (3.42 at BCF, 3.08 at BBF and 2.55 at JDF) indicated that internal parasite burdens were potentially a problem in a significant proportion of the goats in these herds. Hence, the use of continuous suckling supports growth and development of kids during the summer period. Furthermore, the growth and development occurred as the kids apparently transitioned to consumption of quality forage. The postpartum status of does was apparently not challenged by this type rearing system. Further research should investigate the behavioral changes in grazing patterns of kids and the apparent persistence of parasite susceptibility in goats reared under continuous suckling type systems.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

Value-chain financing as a sustainable economic development solution in the developing world: case study of sesame, shea butter and dried mangoes in Burkina Faso. Ali Djire, Agriculture and Natural Resources Program, Berea College, Berea KY 40404.

Abstract

The effectiveness in promoting sustainable economic development through agriculture in developing countries was evaluated through an analysis of value chains with Root Capital in Burkina Faso during the summer, 2014. We identified the most remunerating commodities of the country, which included sesame, shea butter, and dried mangoes. Then, we examined the value chains of those commodities to assess how actors are organized and met with the main players in order to understand their reality in the industry. From there, we identified the main challenges preventing the maximum contribution of those industries to the overall economy. We found that financial need remains the primary limiting factor for all three industries. Also, it appeared that financial assistance needed to be flexible enough to accommodate the cyclical pattern of agricultural and trading activities. Coupled with this, we provided financial training to selected companies and this proved to be a crucial variant in sustaining the financial assistance to the industry. These measures resulted in an expansion of linkages and tremendous economic impact along the value chain of the selected commodities while promoting rural prosperity. The implications of this success point out the fact that economic development efforts around agriculture in developing countries should be based around value-chain financing for greater impact.

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Agricultural Sciences Section)

Funded by Berea College Office of Internships

Establishing the Past Lives of Appalachia in the Berea College Forest. Kathryn Dunn, Moondil Jahan, Justin Dean Burton, Sean Riley, Robert Horn II, Broughton Anderson, Art and Art History Program, Berea College, Berea, Kentucky 40404.

Abstract

The Berea College Forest consists of over 8,000 acres of multi-use landscape including silviculture, education, and conservation programming. However, little archaeological research has been conducted to determine the breadth of cultural resources. Our summer research investigated the potential for resources in one section of the Forest. Document research indicated our site was the home of a family who rented from a former slave, who purchased his freedom as well as large tracts of land prior to the Civil War. Excavation revealed evidence of a hearth and artifacts associated with such occupation. Artifacts also supported longstanding Native American presence in the area. We have been able, and are continuing to develop an understanding of the early inhabitants of the region. Our work contributes to the protection of and education on Native American and historic cultural resources in the forest. This poster summarizes our summer research.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

Spreading Knowledge of a Recent Gift to a Larger Community. Haley Boothe, Meghan Doherty, Art and Art History Program, Berea College, Berea, Kentucky 40404.

Abstract

During the summer of 2014, the Berea College Art Collection received a large gift of Western African art. The objects in the gift varied in style, function, geographic location, and age. Over the course of 8 weeks, I was tasked with unboxing, cataloging, and photographing nearly 300 objects. In working directly with the objects, I not only learned proper techniques for handling and clearing art, but also valuable information specific to West African artifacts. To highlight the work completed during the summer, an exhibition will take place in spring 2015 titled "Gifts of Insight: Highlights from the Hanson Collection of West African Art." I will conduct research in order to choose 30-40 objects to display. The exhibit will include objects from many tribes in West African such as Yoruba and Senufo. These objects will be divided into three sections: ritual items, masks, and figurative sculptures. By doing this I hope to bring attention to the many different tribes and countries of West Africa while highlighting the strengths of this collection. In addition to the exhibit, I will be giving a public talk discussing the overall project and exhibition-specific information, like descriptions of the objects contained therein. Through participation in the entirety of the art exhibition process, namely acquiring objects, researching them, and appropriately displaying them, I have gained valuable skills in terms of academic and professional development.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

Funded by Berea College URCPP

Ibeji Yoruba, Carved wood, shell, beads, Gift of Signe and Eric Hanson

Spreading Knowledge of a Recent Gift to a Larger Community. Haley Boothe, Meghan Doherty, Art and Art History Program, Berea College, Berea, Kentucky 40404.

Abstract

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14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

Funded by Berea College URCPP

A novel and interactive method for teaching DNA replication. Kaitlyn Reasoner, Dr. Megan Hoffman, Biology Program, Berea College, Berea, Kentucky 40404.

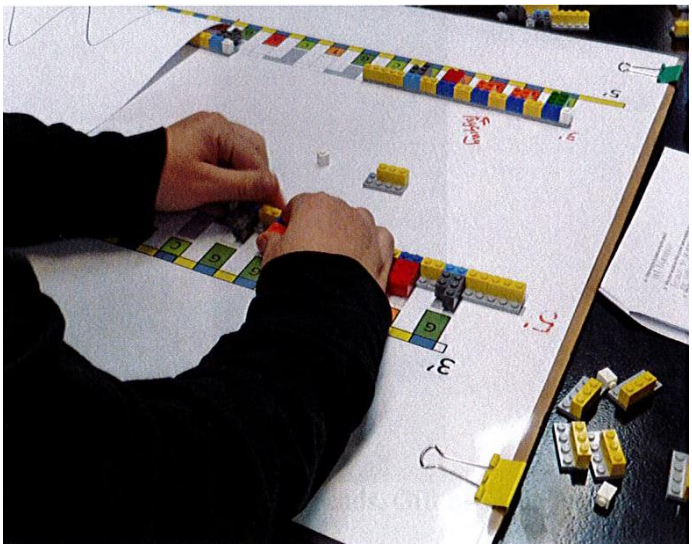
Abstract

In introductory college biology classes, many students have difficulty understanding the process of DNA replication. Like many other scientific concepts, it is traditionally taught in a lecture style format. However, significant research indicates that students learn more effectively and retain more information when taught with a small group and hands-on method. To determine the effects of interactive learning on students' conceptual understanding of DNA replication, we designed an innovative board game to teach DNA replication. Focusing on the roles of various enzymes as well as the 5'-3' directionality of DNA replication, this game is intended to help students interactively investigate and understand the process of DNA replication. The board game was tested in two different sections of Berea College's Modern Biology classes and the students' pre and post-game understandings of DNA replication were assessed and analyzed.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Science Education Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Labor Program



Comparison of Barn Owl (*Tylo alba* L.) Prey from a Silo Roost in Claiborne Co., TN.

Moondil Jahan, Rhea P. Sharma, G. Neil Douglas, Ralph L. Thompson, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

One-hundred two barn owl (*Tyto alba* L.) pellets were collected in 1996 from the campus of Lincoln Memorial University, Harrogate, Tennessee in extreme northern Claiborne County. Species identified from 252 skulls, listed from most to least abundant, included short-tailed shrews (*Blarina brevicauda*), southern bog lemmings (*Synaptomys cooperi*), least shrews (*Cryptotis parva*), hispid cotton rats(*Sigmodon hispidus*), southeastern shrews, (*Sorex longirostris*), avian sp., deer mice(*Peromyscus sp.*), prairie voles (*Mictrotus ochragaster*), eastern harvest mice (*Reithrodontomys humulis*), pine voles (*Microtus pinetorum*),eastern cottontail rabbits (*Sylvilagus floridanus*), house mice(*Mus musculus*), one black rat (*Rattus rattus*), and one Norway rat (*Rattus norvegicus*). Cricetids and soricids comprised the majority of prey species. Chi-square 2 x 2 contingency analysis comparing 1988 (Copeland and Caldwell) to our 1996 data revealed significantly higher proportions of short-tailed shrews to least shrews and higher proportions of voles (*Microtus sp.*) to southern bog lemmings. These population dynamics could be attributed to many factors including predator preference, inter- and intraspecific competition and/or changes in season, climate and habitat. Nevertheless, negative spatial associations between southern bog lemmings and voles attributed to interspecific competition has been previously reported. Southern bog lemmings also are difficult to trap. Therefore, whether barn owl pellets could provide a better means of surveying the population dynamics of these competing species should be investigated.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Zoology Section)

Funded by Berea College URCPP

***Cotylaspis insignis* (Trematoda: Aspidogastridae): Effect of Osmolality on Adult Worm Survival, Egg Production and Rate of Development.** Hanna Abe, Kidist Ashami, Lauren Ballou, Olamide Adejumo, Kevin Montgomery, Sophia Toe, Ron Rosen, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

Cotylaspis insignis belongs to a minor group of trematodes whose life cycles show a transition from commensalism to parasitism. *Cotylaspis insignis* is found in freshwater mussels at the gill-visceral mass junction. It is not known if the osmolality of the adult worm habitat and environment for egg production and subsequent development more closely approximates stream water or mollusk hemolymph. The objectives of this study were to assess the effect of osmolality on: (1) adult worm survivorship and (2) egg production and (3) egg development. Over 14 days adult worms *in vitro* showed significantly higher survivorship in ASW (artificial snail water = mollusk hemolymph; 102 mOsm) than in APW (artificial pond water = stream water; 15 mOsm). Significantly more eggs were released by adult worms *in vitro* in ASW compared to APW on days 2 and 3 of a three day experiment. No difference was observed in the developmental rates of embryos within eggs in APW vs. ASW at 20^{o} C, but hatching only occurred in APW by day 46. Our adult worm survival and egg production results suggest that the osmolality at the gill-visceral mass junction in the mollusk host, *Lampsilas siliquoidea*, more closely approximates that of the mollusk hemolymph, while APW best supports development and hatching of eggs.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Zoology Section; 2nd Place Undergraduate Research Competition)

Funded by Berea College URCPP

Counteract antibiotic resistance of *Pseudomonas* through antibiotic combination. Sheniqua Austin[1], Yangmin Hu[2], [1] Biology Program, Berea College, Berea, Kentucky 40404, [2]St. Georges University-London, London, United Kingdom, SW17 0RE.

Abstract

The purpose of this research project was to attempt to reduce or even eliminate antibiotic resistance of *Pseudomonas* through antibiotic combination. To accomplish this, 12 pure culture strains of *Psudomonas* were created. Ten strains were selected in order to perform MIC's with tobramycin. Checkerboards assays using tobramycin and colistin, tobramyacin and aztrenam, and tobramycin and ceftriaxone and a selected tobramycin-sensitive *Pseudomonas* strain were performed in order to assay synergistic reactions between the paired drugs. A very strong synergistic relationship was found in the ceftriaxone and tobramycin combination. This finding led us to conduct time kill curve. From the time kill curve, it was found that the combination of ceftriaxone and tobramycin not only killed more *Pseudomonas* bacteria, but sometimes completely killing them in a span of 24 hours. This is significant as the single drug kill curves tended to spike up to the level of no drug control curves after 24 hours. This study suggests the drug combination of tobramycin and ceftriaxone kills most, if not all, *Pseudomonas* bacteria, thus preventing the development of antibiotic resistance.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Health Sciences Section;3rd Place Undergraduate Research Competition)

Funded by St. Georges University-London, London, United Kingdom

Creation of interactive manipulatives and educational games, and determination of their effectiveness in improving students' understanding of Anatomy and Physiology. Willie Gosnell, Chioma Amaechi, Yungpeng Xia, Kristen Lynch, Sarah Blank, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

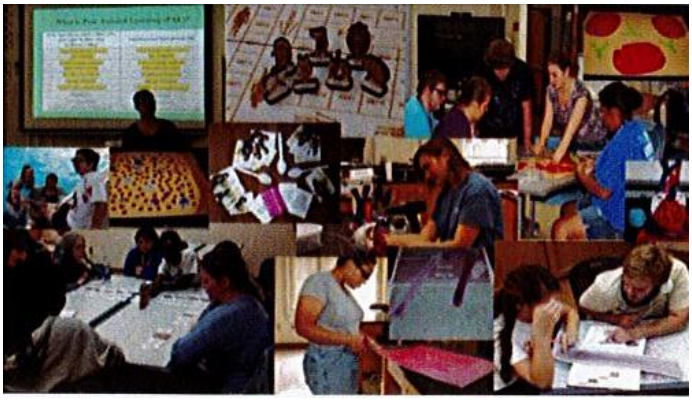
Anatomy & Physiology (A&P) I and II are gateway courses populated mostly by freshman and sophomore pre-nursing and physical education majors. Nationally and at Berea College, these courses have high attrition (> 40%), thus a Peer-Assisted Learning (PAL) Program was implemented in A&P I and II during the 2013-2014 academic year. This program was designed to assist students in learning study strategies and to provide opportunities for students to actively engage in and gain a deeper understanding of the more difficult A&P material.

The goal of this project was to create and test the effectiveness of educational games and manipulatives that are to be used in the PAL program to facilitate understanding of difficult A&P concepts. A tissue card game and an interactive integumentary manipulative were created to address traditionally difficult concepts in histology. Two blood manipulatives were created, one of which was designed to assist students in learning blood typing and understanding transfusion reactions and the other to assist students in learning the different leukocytes and blood pathologies. A heart model was modified to demonstrate active blood flow through the heart. An A&P review game is under construction and will provide students an opportunity to evaluate their cumulative A&P knowledge. A pilot review of one of the blood manipulatives by an Introductory Biology (BIO 100) class indicated that this activity assisted students in understanding antibodies, antigens and blood typing. The effectiveness of these creative activities will continue to be evaluated during the 2014-2015 academic year.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Science Education Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College URCPP



Dormancy-Breaking and Germination Requirements for Seeds of the Kentucky Endangered Yellow Gentian *Gentiana flavida* A. Gray (Gentianaceae). Caleb M. Krebs, Jacob P. McClain, Jonathon D. Terrell, Christopher A. Adams, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

Seeds of *Gentiana flavida* are dormant at maturity. Studies were conducted to determine adequate dormancy-breaking conditions to allow maximum seed germination and to determine the necessary growth medium for maximum seedling establishment. Mature seeds were placed in a 5° C incubator for varying time periods (0-12 weeks) simulating the cold stratification that seeds would receive in the field during winter. Each group of seeds was then moved to a 25° C incubator and subsequent germination was monitored. Seeds were also subjected to gibberellic acid (GA3) treatments to confirm the specific type of dormancy present. To determine ideal growth medium conditions, *G. flavida* seedlings were placed in six different soil treatments, both sterilized and non-sterilized: site soil, forest soil, and regular potting soil and then monitored for survivorship over three months. Results indicated that the 12 week cold stratification treatment produced a significantly higher percent germination (76%) than stratification at 10 (70%), 8 (44%), 6 (22%), 4 (6%), or 0 (0%) weeks. These data indicate that seeds require exposure to low temperatures to overcome seed dormancy. Seeds exposed to GA3, with no cold stratification, germinated to 78% (1000 ppm) and 70% (500 ppm), which confirmed the presence of physiological dormancy. Seedling survivorship, overall, was low; however, survivorship was significantly higher in site soil, non-sterilized (36 %) than in any other treatment (0–17%). In conclusion, for maximum germination and juvenile survivorship, seeds should receive 12 weeks of cold stratification and have exposure to parent soil with intact microbial flora.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Botany Section)

Funded by Berea College URCPP

Effect of Glucose on LOX expression in Renal Cell Lines. Amber Crabtree[1], Carolina Añazco[2], Roberto Vanacore[2], [1]Biology Program, Berea College, Berea, Kentucky 40404, [2]Vanderbilt University, Nashville, Tennessee 37235.

Abstract

Diabetic nephropathy (DN), the main cause of end-stage renal disease (ESRD), is characterized by glomerulosclerosis, a progressing scarring of the renal corpuscle (kidney's functional unit that filters urine from blood). Because there is no cure for DN, patients must begin dialysis treatment or endure a kidney transplant to stay alive.

Matrix expansion is a distinct feature of diabetic renal cells that results from an increased deposition of collagen IV in the matrix. Although excessive production of collagen IV is one of the culprits, decreased degradation resulting from increased crosslinking may also be an important contributor to matrix expansion. Resent evidence suggests that a member of the Lysyl oxidase family may be responsible for the covalent crosslinks of the collagen IV. Lysyl oxidases (LOX) have been associated with fibrotic diseases in the liver and lung, and although they may be viewed as potential candidates mediating renal fibrosis, little is known about the expression of these enzymes in the renal cells. Therefore, the aim of this study was to characterize the relative expression of lysyl oxidases in renal cell lines cultured under various physiological conditions.

Using quantitative PCR we show that the expression of LOX family members does in fact change in renal cell lines under varying conditions. Consistent with this, Western blot analysis of medium produced by renal cells also show results consistent with the previously mentioned. The significance of this is unclear at the moment and further investigations are needed to accurately define the expression of LOX family members in renal cells.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Cellular and Molecular Biology Section)

Funded by Hal Moses/Aspirnaut Research Internship, Vanderbilt University, and Berea College CTL Internship Program

Helping Students Succeed in Anatomy and Physiology I: A Study of a Peer Assisted Learning Program. Chioma Amaechi, Willie Gosnell, Yungpeng Xia, Judith Weckman, Sarah Blank, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

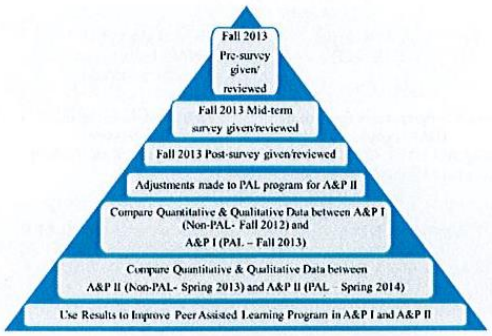
Anatomy and Physiology (A&P) I & II are difficult gateway courses and nationally have high attrition. A&P is largely populated by freshman and sophomore pre-nursing and physical education majors. In the 2013-2014 academic year, a pilot study for a Peer Assisted Learning (PAL) program was conducted in Anatomy and Physiology (A&P) I & II.

The goal of this study was to determine the efficacy of the PAL program by comparing student success and perceptions between two A&P I classes, one that was taught with PAL (Fall 2013) to one without PAL (Fall 2012). Students were required to attend two - 50 minute PAL sessions per week which were facilitated by trained PAL leaders. Attendance, preparedness, and participation determined the PAL grade which made up 8% of the students' overall course grade. The percentage of students whose final grade was C or above was 55% compared to 36.4%, the comprehensive final was 72.8% compared to 66.5% and the course GPA was 2.17 compared to 1.94 for the PAL and non-PAL classes, respectively. Also, preliminary data suggest that the PAL program may have had more positive benefits for male and African American students. Analysis of student responses on three surveys (Pre-term, Mid-term and Post-term) revealed that the majority of students thought that PAL sessions helped in learning course content and encouraged critical thinking. All A&P I students reported that the PAL program should be available in A&P II. Both quantitative and qualitative data suggest that the PAL program benefited A&P I students.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation-Science Education Section: 1st Place Undergraduate Research Competition)

Funded by Berea College URCPP



Helping Students Succeed in Anatomy and Physiology II: A Study of a Peer Assisted Learning Program. Yunpeng Xia, Chioma Amaechi, Willie Gosnell, Judith Weckman, Sarah Blank, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

The Peer Assisted Learning (PAL) program is an academic support model that helps students succeed in difficult courses with high attrition such as Anatomy & Physiology (A&P). A pilot study was designed to examine the effects of a PAL program on A&P I & II students at Berea College. Preliminary data suggest that PAL was beneficial for A&P I students.

The goal of this study was to compare student success between two A&P II classes, one taught with PAL (Spring 2014) and one without PAL (Spring 2013). Students were required to attend one -50 minute PAL session per week which was facilitated by PAL leaders. Students' attendance, preparation, and participation in PAL sessions determined their PAL grade which was calculated as 5% of the final course grade. The percentage of students who earned a final grade of C or above was 69% in the non-PAL class compared to 75% in the PAL class. Students' final grades were strongly correlated with PAL grades, and the average National Comprehensive final exam (HAPS) grade was 2.3% higher in the PAL class. Preliminary data suggest that the PAL program benefited both genders and may have had more positive benefits for African American students. Out of the 83% of students who completed the post-term survey, greater than 70% reported that PAL sessions encouraged critical thinking and helped in learning course content. These students also recommended the use of the PAL program in the future. In addition, PAL leaders reported personal benefits from participating in the PAL program.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation-Science Education Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College URCPP

Quantitative result	Qualitative result
Spring 2013 WDF: 31% Spring 2014 WDF: 25%	75.7% of students reported PAL sessions helped them learn course content.
National Comprehensive final exam (HAPS) grade Spring 2013 HAPS: 62.2% (n=26) Spring 2014 HAPS: 64.5% (n=40)	73% of students reported PAL sessions encouraged critical thinking.
PAL grade and final grade strongly correlated (Pearson Correlation Coefficient = 0.696, P <0.01)	75.7% of students reported they would recommend the use of the PAL program in the future.

***In Vitro* Egg Development in the Trematode, *Cotylaspis insignis* (Subclass Aspidogastrea).**

Lin Peng, Ericka Berg, Kaitlyn Reasoner, Ron Rosen, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

Cotylaspis insignis is an aspidogastrid trematode found in freshwater mussels at the gill-visceral mass junction. The development of the embryo within the egg of this worm has not been previously described and was the objective of this study. *Lampsilas siliquoidea* were collected from North Elkhorn Creek in Scott County, Kentucky. Eggs shed from the adult worms in mussels were isolated in plastic jars. Over 36 days at 20^{o} C, developing embryos within these eggs were photographed using interference contrast microscopy. On day 0, the ectolecithal egg showed a large, centrally located nucleus surrounded by vitelline cells. By day 7, a round embryo was visible among the vitelline cells and increased in size over the next 21 days. By day 28, a pair of eyespots was present within an elongated embryonic body. A ventral sucker and mouth (located at the opercular end of the egg) were clearly visible by day 32, and the vitelline cells were noticeably reduced in number. On day 34 larval movement was observed inside the egg, and by day 36, a portion of the eggs hatched, leaving empty shells with detached opercula. The cotylocidium larvae had two visible eyespots and three patches of posterior cilia—two lateral patches and one abopercular patch. The cotylocidium was propelled forward by its cilia and was also capable of movement by expansion and contraction.

National Conference on Undergraduate Research, April 3rd-5th, 2014, University of Kentucky, Lexington, Kentucky (Poster Presentation)

66th Annual Midwestern Conference of Parasitologists, June 5th-7th, 2014, University of Kentucky, Lexington, Kentucky (Poster Presentation: 2nd Place/Honorable Mention Research Poster Competition)

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation-Agricultural Sciences Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Labor Program

Investigating the Multipotency Potential of Chondrogenic Progenitor Cells. Hsuan Peng[1], Yangzi Jiang[2], Rocky S. Tuan[2], [1]Biology Program, Berea College, Berea, Kentucky 40404, [2]University of Pittsburgh, Pittsburgh, Pennsylvania 15260.

Abstract

Articular cartilage (AC) is an avascular tissue, which consists of an extracellular matrix and a sparsely distributed population of highly specialized cells called chondrocytes. Throughout life, these cells replace matrix macromolecules lost through degradation. However, the ability of chondrocytes to maintain and restore articular cartilage decreases with aging and thereby increases the risk of joint degeneration diseases such as osteoarthritis (OA). The avascular, aneural, low cellularity and low cell turnover status has made spontaneous healing of articular cartilage injuries particularly challenging under physiological condition. Consequently, treatments such as microfracture and Autologous Chondrocyte Implantation (ACI) have been developed and widely used for AC regeneration in clinics. Nevertheless, both of these techniques have limitations in the type of cells regenerated and treatable wound size. In recent years, the use of adult stem cells in treating cartilage defects has shown some promising results.

This study investigated the multipotency potential of chondrogenic progenitor cells(CPCs) isolated from human adult articular cartilage. The CPCs were cultured in monolayer and induced to undergo chondrogenesis, osteogenesis, or adipogenesis differentiation in tissue-specific media. Tissue specific gene expression and cell morphology were observed after 4 weeks culture.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Cellular and Molecular Biology Section)

Funded by Berea College CTL Internship Program

Isolation and characterization of plasmids from normal flora *E. coli*. Bailey Wiggins, Maria Anastasiadou, Dawn J. Anderson. Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

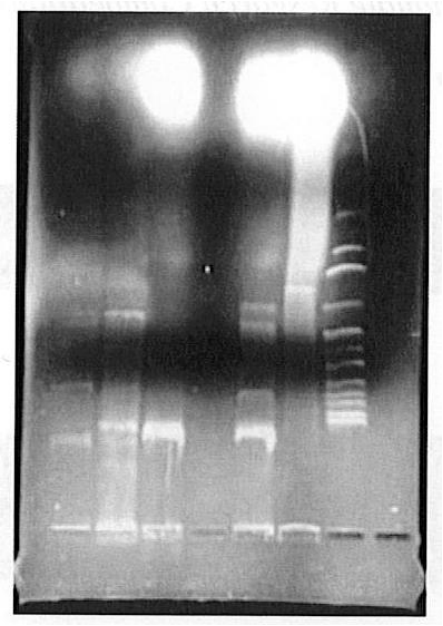
The human gastrointestinal tract contains approximately 300-1,000 different species of microorganisms. *Escherichia coli* plays a key role within this ecosystem and comprises a significant fraction of normal gut flora. Pathogenic *E. coli* strains, however, are far from beneficial and are responsible for many illnesses such as gastroenteritis and urinary tract infections. Many of these pathogenic *E. coli* possess plasmid molecules that code for virulence factors such as antibiotic resistance, toxins, invasins and adhesion factors. The plasmids contained in these pathogens have been the focus of much research. However, the plasmid populations in the non-pathogenic *E. coli* strains found in the human gastrointestinal tract have not been as widely studied.

Previous research (2013) suggested that roughly 45% of *E. coli* gut flora random sample isolates possessed plasmid molecules based electrophoretic data. In this study, plasmid extracts from similarly obtained normal gut flora samples were found to display a high degree of low and high molecular weight band similarity, which was unexpected. Our research now suggests that previous research studies may have over-estimated the prevalence of plasmids contained in *E. coli* normal gut flora population.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Microbiology Section)

Funded by Berea College URCPP



Isolation, Disturbance, and Watershed Affiliation as Factors in the Diversity and Abundance of Stream Salamanders in Central Kentucky. Michon Martin, Taylor Fagin, Brenna Goldberg, Sean Nilan, Leif Van Laar, Roy Scudder-Davis, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

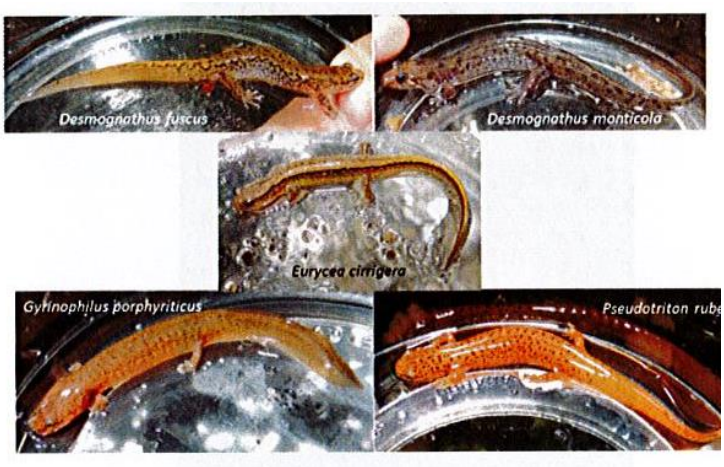
Previous studies on streams in Madison and Rockcastle Counties in Central Kentucky have indicated that salamander diversity was reduced in areas affected by human disturbance. Salamander abundance, however, showed no consistent pattern in relation to human disturbance in these same streams. A possible confounding variable that was not considered in these earlier analyses was the connection that these streams have to a particular watershed system. Three of the four streams studied in disturbed habitats flow into Silver Creek, which is part of the Kentucky River Watershed system. Both of the streams in non-disturbed habitats flowed into Roundstone Creek, which is part of the Cumberland River Watershed system via the Rockcastle River. Consequently, the salamander diversity data, up to this point, do not distinguish between effects of disturbance and effects of watershed affiliation.

Additional streams in each watershed were monitored in an effort to determine whether human disturbance or watershed affiliation had a greater effect on salamander diversity. Pairwise Jaccard similarity indices among all stream systems indicate that human disturbance is a better indicator of salamander diversity than watershed affiliation in these streams. Salamander abundance was not related to human disturbance or watershed affiliation. The factors determining salamander abundance in these streams have yet to be determined.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Ecology and Environmental Science Section: 1st Place Undergraduate Research Competition)

Funded by Berea College URCPP



Potential benefit of the T-cell migration inhibitor FTY720 in Toxic Shock Syndrome.

Jordan Butts[1],[1]Biology Program, Berea College, Berea, Kentucky 40404,[2]Mayo Graduate School, Rochester, Minnesota 55905.

Abstract

No abstract submitted.

Funded by Mayo Clinic and Berea College CTL Internship Program

Prevalence and Mean Intensity of *Cotylaspis insignis* (Trematoda: Aspidogastridae) Infections in the Fat Mucket, *Lampsilas siliquoidea* (Bivalvia: Unionidae) at North Elkhorn Creek, and Location of its Egg Development. Lauren Ballou, Hanna Abe, Kidist Ashami, Olamide Adejumo, Kevin Montgomery, Sophia Toe, Ron Rosen, Biology Program, Berea College, Berea, Kentucky 40404.

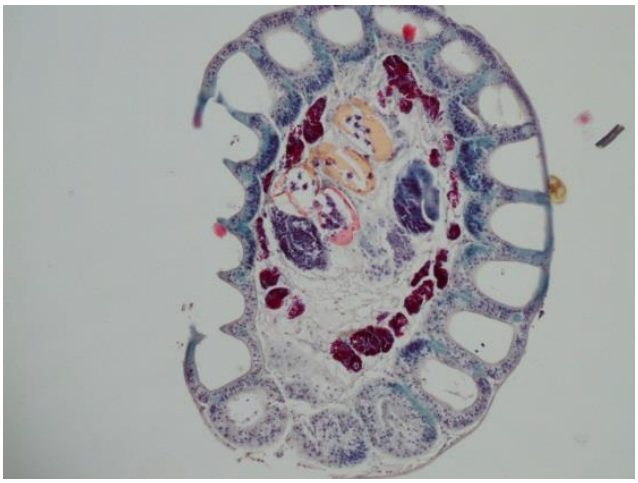
Abstract

Cotylaspis insignis belongs to a minor group of trematodes whose life cycles show a transition from commensalism to parasitism. The adult wormis found in freshwater mussels and resides externally at the gill and visceral mass junction. The objectives of this study were to: (1) determine the prevalence and mean intensity of *C. insignis* within the fat mucket, *Lampsilas siliquoidea*, at North Elkhorn Creek (2) develop a histological perspective of *C. insignis* in its host and (3) determine the location of egg development outside the worm. *Cotylaspis insignis* had a prevalence and mean intensity of 87.2% and 9.2 ± 6.9, respectively, in *L. siliquoides* (N=86). No significant differences were found in the mean intensity of infection by host sex or by host size (shell length). Histological sections revealed 19 peripheral alveoli and 19 marginal bodies in the ventral sucker; no pathology was noted in the sections with worms and host tissue. Observation of eggs released from adult worms both within and outside the host were undeveloped or in very early stages of cleavage indicating that *C. insignis* eggs develop outside of the host in the external environment and are not retained within the mussel for further development.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Zoology Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College URCPP



***Proterometra macrostoma* (Trematoda: Azygiidae): Effect of Serotonin on Redial Movement and Emergence of Cercariae from Rediae and Snails, *Elimia semicarinata* (Gastropoda: Pleuroceridae).** Olamide Adejumo, Kevin Montgomery, Sophia Toe, Hanna Abe, Kidist Ashami, Lauren Ballou, Kaitlyn Reasoner, Ron Rosen, Biology Program, Berea College, Berea, Kentucky 40404.

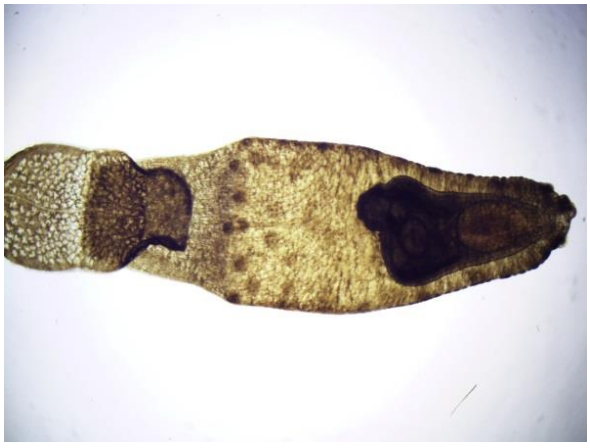
Abstract

Proterometra macrostoma is a digenetic trematode that parasitizes a snail intermediate host (*Elimia semicarinata*) and a centrarchid fish definitive host. Dark conditions acting as an exogenous trigger initiate the release of *P. macrostoma* cercariae from snails. The internal or endogenous trigger for release of this cercaria has yet to be determined. The neurotransmitter, serotonin, promotes the release of daughter sporocysts from mother sporocysts in *Schistosoma mansoni*; this molecule also shows diurnal rhythms in snail hemolymph. An ELISA test confirmed the presence of serotonin in *E. semicarinata*. The purpose of this study was to evaluate the effect of serotonin on *P. macrostoma* redial movement and cercarial release from rediae *in vitro*, and the release of cercariae from snails *in vivo*. Serotonin dissolved in ASW (artificial snail water) at four concentrations (0.01, 0.001, 0.0001 and 0.00001 g/L) significantly increased the frequency of muscular contractions/min of rediae at 5 min and 120 min post exposure, but not the proportions of cercariae released from rediae when compared to the controls. No significant difference was observed in the proportion of snails which released cercariae in APW (artificial pond water) and APW plus serotonin over four days under dark conditions, though there was a trend for enhanced release.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Health Sciences Section)

Funded by Berea College URCPP



Proximal NPxY motif of integrin beta1 is important for the regulation of growth factor dependent cell signaling. Ray Mirembo[1], Roy Zent[2], [1]Biology Program, Berea College, Berea, Kentucky 40404, [2]Vanderbilt University, Nashville, Tennessee 37235.

Abstract:

Development of the kidney involves the reciprocal interaction between the metanephric mesenchyme and the ureteric bud. This complex developmental process requires cell-extracellular matrix (ECM) interactions, which are mainly regulated by the surface receptors integrins. Other major factors that are important during kidney development are the growth factors dependent cell signaling pathways. Deletion of integrin β1 affects the signaling pathways in epithelial cells and kidney development (Zhang et al., 2009). Talin is one of the most important cytosolic proteins that bind to integrin β1. Talin binding to integrin β1 leads to integrin activation. But the roles of talin in kidney development and functions are widely unknown. Here we describe the role of integrin-talin interactions on cell signaling pathways that are modulated by growth factors FGF-10 and GDNF, which have been found to be involved in the kidney development process. We disrupted talin-integrin β1 interactions by mutating the proximal NPxY motif of integrin β1. Mutating the tyrosine to alanine decreased the integrin β1 activation. More importantly this also affected the activation of FAK, ErK and AKT in response to growth factor activation. This data suggests that integrin β1-talin interactions play an important role during kidney development and function.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

Funded by Hal Moses/Aspirnaut Research Internship, Vanderbilt University, and Berea College CTL Internship Program

Role of IFNγ in Experimental Autoimmune Encephalomyelitis. Alyssa Hubbard[1], Chella David[2],[1]Biology Program, Berea College, Berea, Kentucky 40404,[2]Mayo Graduate School, Rochester, Minnesota 55905.

Abstract

Multiple sclerosis (MS) is an inflammatory, demyelinating disease of the central nervous system (CNS) of presumed autoimmune origin. Of all the genetic factors linked with MS, MHC class-II molecules have the strongest association. Generation of HLA class-II transgenic (Tg) mice has helped to elucidate the role of HLA class-II genes in MS. Utilizing HLA class-II Tg, it has been shown that IFNγ may actually have a protective role in MS and experimental autoimmune encephalomyelitis (EAE). To further confirm the role of IFNγ in protection, we generated DRB1*0301.DQ8 mice lacking IFNγ (DRB1*0301.DQ8. IFNγ -/-). Immunization of FNγ deficient mice with PLP91-110 peptide led to development of atypical EAE characterized by ataxia, head tilting, and gait problems. IFNγ deficient mice with atypical EAE showed severe inflammation and demyelination in the brain with no/mild spinal cord pathology. In contrast, IFNγ sufficient mice develop classical paralytic EAE with spinal cord pathology. This study attempted to determine why IFNγ deficient mice developed atypical EAE with brain pathology. Therefore, in this study we compared chemokine/cytokine profiles and the cellular profile in the brain between the IFNγ deficient and sufficient mice. Previously, monocytes and IL-17 have been shown to play an important role in the disease pathogenesis, therefore, we depleted monocytes using liposomes and neutralized IL-17 using Anti-IL17 antibody to investigate their effect on pathogenesis. Chemokine and cytokine expression were analyzed by RT qPCR of brain RNA from both IFNγ sufficient and deficient mice. The presence of different cells types in the mice were determined by immunofluorescence. We observed that IFNγ deficient mice had an increased expression of the Th17 cytokine/chemokine profile and had increased levels of microglia in regions with pathology. Depletion/neutralization studies indicate that monocytes and IL-17 are important for pathology, as both suppressed development of EAE.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Cellular and Molecular Biology Section: 3rd Place Undergraduate Research Competition)

Funded by Mayo Clinic and Berea College CTL Internship Program

SCN Prevents HOBr-mediated Formation of Sulfilimine Crosslinks in Collagen IV Scaffolds. Chi Peng[1], Christopher F. Cummings[2], Billy Hudson[2], [1]Biology Program, Berea College, Berea, Kentucky 40404, [2]Vanderbilt University, Nashville, Tennessee 37235.

Abstract

Collagen IV scaffolds are critical to the support of epithelial tissue architecture, and their disruption provides the basis for tissue-level pathologies. Thiocyanate ions (SCN-) have been shown to perturb these scaffolds by inhibiting the formation of novel sulfilimine crosslinks which stabilize the scaffolds. Moreover, systemic SCN- are known to be elevated in certain patient populations with increased risk of experiencing tissue degenerative disorders - SCN- being a plausible pathogenic culprit. In an effort to determine how SCN- prevents sulfilimine formation, we show here that SCN- quenches the reaction intermediate with the enzymatically-catalyzed crosslinking mechanism. Preliminary data suggests that SCN- may also prevent the formation of NC1 hexamers. Thus, SCN- appears to be an efficient and versatile inhibitor of collagen IV sulfilimine crosslinking. This inhibitory activity may be important for certain individuals with chronically elevated SCN- levels.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Physiology and Biochemistry Section: 2nd Place Undergraduate Research Competition)

Funded by Hal Moses/Aspirnaut Research Internship, Vanderbilt University, and Berea College CTL Internship Program

Seedling survival after novel drought-induced germination in *Ceanothus megacarpus.*

Amanda Burns[1], Stephen D. Davis[2], [1]Biology Program, Berea College, Berea, Kentucky 40404, [2]Pepperdine University, Malibu, California 90263.

Abstract

As California is experiencing what is believed to be the worst drought in 500 years, monitoring the change of vegetation is of utmost importance. This spring we observed novel germination of *Ceanothus megacarpus* seedlings. Germination was novel in that seeds typically require a fire heat cue but in this particular case, germination was likely due to excessive soil temperatures resulting from drought-induced canopy reduction. This is a phenomenon not well known to science as *Ceanothus megacarpus* seedlings are typically not found between fire events. We believe this results from increased soil temperatures due to greater openings in the canopy after adult die back. We hypothesized that there would be higher quantities of seedlings adjacent to trails more exposed to sunlight than off trails. To test this hypothesis, sixty-seven 1 m^2 plots, were established to monitor seedling survival along trails and compare seedling densities to adult stands, assessed by point quarter sampling off trails. We also measured percent shade, leaf area index, volumetric water content, and soil water potential. There was no correlation found between any of these measurements and seedling survival. However, survival was correlated with maximum rooting depth of seedlings. Dead seedlings had < 20 cm rooting depths whereas surviving seedlings had > 20 cm. This corresponded to mean soil water potentials of -7 MPa which is less negative than critical levels of hydraulic dysfunction in *C. megacarpus* seedlings, -11 MPa. We conclude that severe drought, fostered canopy cover, increasing soil temperatures that promoted novel seed germination.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Ecology and Environmental Science Section)

Funded by Pepperdine University

Towards inhibition of tumor angiogenesis through disruption of collagen IV scaffold assembly by anti-NC1 antibodies. Jenna Rufer[1], Vadim Pedchenko[2], Billy G. Hudson[2], [1]Biology Program, Berea College, Berea, Kentucky 40404, [2]Vanderbilt University, Nashville, Tennessee 37235.

Abstract

Type IV collagen is the major component required for structural integrity and function of basement membranes. Tumor growth is critically dependent on the formation of new vasculature (angiogenesis), which requires the formation of the vascular basement membrane as a key step. Finding inhibitors of angiogenesis might be useful for cancer therapy. We explore the possibility of using monoclonal antibodies to inhibit assembly of collagen IV. First, we showed that purified H22 antibodies and their Fab fragments targeted recombinant α2 NC1 domain, but did not interact with α112 NC1 hexamers. A further experiment provided evidence that the antibodies were able to inhibit the formation of NC1 hexamers via binding to α2 NC1 monomers. In conclusion, anti-NC1 antibodies are candidate angiogenic inhibitors for cancer treatment. Further studies are required to determine the ability of antibodies to perturb the formation of collagen IV scaffolds *in vivo*.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Cellular and Molecular Biology Section)

Funded by Hal Moses/Aspirnaut Research Internship, Vanderbilt University, and Berea College CTL Internship Program

Understanding the Role of Myc In Squamous Cell Carcinoma. Lin Peng[1], Enrique Torchia[2], Mikayla Peterson[2], [1]Biology Program, Berea College, Berea, Kentucky 40404, [2]University of Colorado-Denver, Denver, Colorado, 80204.

Abstract

Myc belongs to the Myc protein supefamily (c-Myc, N-Myc, L-Myc and Myc's 'second-cousins' S- and B-Myc), which are basic helix–loop–helix leucine zipper transcription factors. Functional Myc protein regulates cell proliferation and differentiation. Previous studies have shown amplified "gain-of-function" mutated p53 protein correlates with an overexpression of Myc, presumably promoting aggressive and metastatic skin cancer. In this study, human embryonic kidney cells (293FT) were transfected with *myc*-containing lentivirus, which were later collected. The *myc*-containing viruses were then used to transfect the non-aggressive squamous carcinoma line *Colo16* and the immortalized keratinocyte line *HaCat* in an effort to obtain stable transformants. Further studies will test our hypothesis that non-aggressive *Colo16* carcinoma cells and *HaCat* immortalized keratinocyte will demonstrate an overexpression of Myc protein and signs of conversion into more aggressive cancer cell lines.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Cellular and Molecular Biology Section)

Funded by University of Colorado-Denver and Berea College CTL Internship Program

Water Level and Feeding Regimen as Factors Promoting Metamorphosis in Laboratory-Reared Southern Two-Lined Salamanders, *Eurycea cirrigera*. Taylor Fagin, Brenna Goldberg, Michon Martin, Sean Nilan, Leif Van Laar, Roy Scudder-Davis, Biology Program, Berea College, Berea, Kentucky 40404.

Abstract

The relationships between water level and metamorphosis, and feeding regimen and metamorphosis were examined in the Southern two-lined salamander, *Eurycea cirrigera*, in a laboratory setting. Nineteen salamanders per treatment were exposed to one of four treatments: low water/low food, low water/high food, high water/low food, and high water/high food. In general, salamanders exposed to low water levels or high food levels metamorphosed sooner than those exposed to high water levels or low food levels. Feeding regimen had a lesser effect in promoting metamorphosis than water level resulting in high to low numbers of individuals attaining metamorphosis in the following order of treatments: low water/high food, low water/low food, high water/high food, high water/low food. Although *E. cirrigera* is known to remain in the larval state for up to two years, the current study indicates that larvae of this species possess a great deal of plasticity in regard to time of metamorphosis.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Zoology Section)

Funded by Berea College URCPP

Asymmetric Catalytic Synthesis of β-Ketoesters through Ketene Intermediation. Michael H. McCann, Mary Robert Garrett, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

β-ketoesters are used as building blocks for natural products and pharmaceuticals. The currentsynthesis of β-ketoesters is wasteful, toxic, and expensive with almost no stereospecificity. Ketenes can be generated at such low costs, but have never been used to synthesize β-ketoesters. Reactions of ketenes and Cinchona alkaloid derivatives readily form zwitterionic enolates that are able to attack esters in a Claisen-like Condensation reaction.

46th Annual Southeast Undergraduate Research Conference, January 30th-31st, 2014, University of Tennessee, Knoxville, Tennessee (Poster Presentation-Organic Chemistry Section: Honorable Mention Undergraduate Research Competition)

Funded by Berea College URCPP

Combining an extended Czjzek model with spinning sideband simulations of magic-angle turning (MAT) experiments on phosphate glasses. Kyaw Hpone Myint[1], Solomon Tesfamichael[1], Brennan Walder[2], Pyae Phyo[1], Philip Grandinetti[1], Jay Baltistberger[1], [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]Ohio State University, Columbus, Ohio 43210.

Abstract

Solid-state nuclear magnetic resonance (SSNMR) spectroscopy was used to examine the local structure in phosphate glasses. To accomplish this, a series of phosphate glasses containing zinc, cesium, tin, and cadmium were studied using the magic-angle turning (MAT) experiment which correlates the isotropic chemical shift for each site with the sideband pattern arising from the chemical shift anisotropy. These sideband patterns were extracted from the two-dimensional datasets and were simulated using a computer program written in C and developed prior to and over the course of this research period. The newest version of this program includes the capacity to simulate sites with an extended-Czjzek model that significantly reduces the number of free parameters needed to model the data. This extended-Czjzek model has only previously been used to simulate quadrupolar-coupling constants in aluminate samples and seems to work quite well in the case of chemical shift anisotropy. The lack of prior work with this model is probably tied to the computational complexity which we solved using a Monte Carlo sampling algorithm. The results indicate that the identity of the cation modifier has a significant impact on the chemical shift anisotropy (much larger than the impact on the isotropic shift). No clear trend has yet been established but we plan to do GAUSSIAN03 calculations to model how local bonding geometry will impact the chemical shift anisotropy and use these to interpret phosphate glass structural differences that will ultimately be correlated with glass composition, preparation, and macroscopic physical properties.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Analytical/Physical Section: 3rd Place Undergraduate Research Competition)

Funded by Berea College URCPP

Design and synthesis of sterically unhindered functional monomers for Kumada catalyst-transfer polycondensation. Garrett Cairo, Nicholas Marshall, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

It has been proposed that Kumada catalyst-transfer polycondensation (KCTP) is strongly limited by the steric bulk of substituents adjacent to the metallated position in the monomer. To test this hypothesis, we synthesized a series of KCTP monomers in the family of 1,4''-dihalo-2',5'-dialkoxy-p-terphenyls. Attempts to synthesize this family of compounds by directly halogenating the 2',5'-dialkoxy-p-terphenyls were unsuccessful due to oxidative dealkylation of the starting material. To prepare the premonomers, 2,5-dialkoxy-1,4-benzenediboronic acids were reacted with 4-halobenzenediazonium salts in a Suzuki coupling reaction. The resulting dihalide compounds were polymerized from surface-bound initiators and in solution, and the resulting alternating functionalized polyphenylenes characterized.

The 66th Southeastern Regional Meeting of the American Chemical Society, October 16th - 19th, 2014, Sheraton Music City Hotel, Nashville, Tennessee (Undergraduate Research Symposium)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Organic/Inorganic Section)

Funded by Berea College URCPP

Entirely green synthesis of substituted poly(*p*-phenylenes). Nchong Ebai, Nicholas Marshall, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

Conjugated polymers have many important applications in modern materials science including electroluminescent devices, transistors, solar cells, etc. The conventional synthesis of these polymers uses a number of toxic and hazardous materials We report an alternative procedure for the synthesis of poly(1,4-dialkoxy)-*p*-phenylenes starting from hydroquinone with application of the principles of green chemistry to each step. A solvent-free, microwave-heated alkylation was developed to construct the 1,4-dialkoxybenzene core, followed by a green diiodination step in water/ethanol or methanol to make the diiodide premonomer. The monomer was magnesiated by Mg/I exchange using commercially available iPrMgCl in the green solvent 2-methyltetrahydrofuran, without additional solvent, and polymerized *in situ* by Kumada catalyst transfer polycondensation (KCTP) using catalytic Ni(dppp)Cl_2. This work is also the first reported synthesis of polymers using KCTP on aryl iodides.

The 66th Southeastern Regional Meeting of the American Chemical Society, October 16th - 19th, 2014, Sheraton Music City Hotel, Nashville, Tennessee (Poster Presentation - Undergraduate Research Symposium: Organic Chemistry I).

Funded by URCPP

Immobilization of Flavin Adenine Dinucleotide at Indium Tin Oxide Surfaces through Azo Coupling. Tatiana Mikhailova, Nicholas Marshall, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

Flavin adenine dinucleotide (FAD) modified surfaces have applications in biotechnology and electronics. We report two novel ways to modify indium tin oxide (ITO) surfaces with FAD through azo coupling of a catechol monolayer. Voltammetry was used to confirm the presence of redox-active flavin on the surface of ITO slides modified by these techniques. FAD under low pH (pH 1-5) rapidly adsorbs on ITO surfaces through self-assembly of phosphonate groups, but does not adsorb at neutral pH (7.0). FAD was covalently bonded to catechol on ITO surface by coupling of diazotized FAD under neutral pH. Catechol monolayers on ITO were also reacted with a bisdiazonium salt to create a diazonium-terminated monolayer, a previously unreported surface reaction. FAD was then bound on the surface with through azo coupling of the diazonium endgroup with the C8 position of FAD-adenine. Control experiments without active monolayers showed no attachment of flavin groups to the surface.

The 66th Southeastern Regional Meeting of the American Chemical Society, October 16th - 19th, 2014, Sheraton Music City Hotel, Nashville, Tennessee (Oral Presentation - Undergraduate Research Symposium: Organic Chemistry I).

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Chemistry: Organic/Inorganic Section)

Funded by Berea College URCPP

Infrared Photodissociation Spectroscopy of Metal Carbonyls. Mikiyas Kurabachew Assefa[1], Michael A. Duncan[2], [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]University of Georgia, Athens, Georgia 30602.

Abstract

Infrared spectroscopy of metal carbonyl clusters in the gas phase is used to probe fundamental bonding and interactions in small molecules. Metal-ligand interactions, molecular structure and vibrational frequencies of metal carbonyls of the form $M(CO)_n^+$, along with their corresponding rare gas atom "tagged" analogs are investigated. Ions are produced in a Smalley type cluster source through supersonic expansion and studied by mass-selected infrared photodissociation spectroscopy in the carbonyl stretching region. The number of infrared active bands, their relative intensities, and frequency positions provide information about the bonding patterns and electronic structures of the complexes. The 18 electron rule, which is ubiquitous in Inorganic Chemistry, was tested, in which the formation of unexpected six and seven-coordinated carbonyls of vanadium and scandium gave insight to the rule's limits. The $Y(CO)_8^+$ cation was produced and characterized. This complex is the first eight-coordinate homoleptic transition metal carbonyl observed in the gas phase. Cobalt pentacarbonyl and manganese hexacarbonyl cations are compared to isoelectronic iron pentacarbonyl and chromium hexacarbonyl neutrals. In addition, Density Functional Theory calculations using B3LYP, BP86, M06, M06L and MP2 methods were implemented on twenty-eight metal carbonyl ions and neutrals for the derivation of scaling factors. The constant deviations and multiple outliers present in the MP2 calculation suggest that it is not a particularly preferable method to use for the study of transition metals.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Chemistry: Organic/Inorganic Section)

Funded by University of Georgia

Layer-by-layer formation of conjugated thin films through diazonium chemistry. Brennan L. Taylor, Tatiana Mikhailova, Nicholas M. Marshall, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

We present a method for making conjugated thin films using a unique layer-by-layer approach. In this method, benzene(bisdiazonium) hexafluorophosphate reacts with a self-assembled monolayer of catechol on indium tin oxide (ITO) to form an azo-coupled monolayer terminated with a diazonium endgroup. Once the diazonium monolayer is formed, a layer-by-layer technique involving benzene(p-bisdiazonium) ion and ferrocene or catechol was used to iteratively form a thin azobenzene or ferrocene-containing film. The layers were characterized by voltammetry and IR/UV-Vis spectroscopy.

The 66th Southeastern Regional Meeting of the American Chemical Society, October 16th - 19th, 2014, Sheraton Music City Hotel, Nashville, Tennessee (Poster Presentation - Undergraduate Research Symposium).

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Organic/Inorganic Section)

Funded by Berea College URCPP

Leaded paint as a source of soil lead in Berea, Kentucky. Michael S. Oxendine, Rachele S. Johnson, Bishnu Kafley, Paul C. Smithson, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

Lead (Pb) is a potent neurotoxin, and exposure early in life can result in permanent learning deficits and violent behavior. A major source of environmental Pb is from leaded paint used prior to the 1960s. In May and June 2014 we sampled the top 2.5 cm of soil at the base (front and back) of 40 Berea College campus buildings. We extracted 2.0 g air-dried, sieved (2 mm) soil for 1 hour with 20 mL 1M HNO_3, filtered and analyzed the extracts for Pb by atomic absorption spectroscopy. Lead levels at the base of buildings were relatively low, but were higher around pre-1950 buildings (N = 26, mean 160 ± 230 SD mg Pb/kg) than newer buildings (N = 14, mean 98 ± 170 SD mg Pb/kg). A t-test on log-transformed Pb data showed a significant difference by building age at P = 0.05. Considering all 40 buildings (mean 138 ± 210 SD mg Pb/kg), a t-test on log-transformed data showed a highly significant difference (P = 0.001) from background Pb levels (N = 47, mean = 38 ± 25 SD mg Pb/kg, based on samples taken well away from roads and buildings). Eleven of the 40 buildings had Pb levels 100 to 300 mg/kg (indicating low to moderate health concern) two were between 300 and 400 mg/kg (moderate to high concern) and two exceeded 400 mg Pb/kg, which many states consider as the level indicating a high level of concern.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Ecology and Environmental Science Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College URCPP

Phase-incremented Echo Train Acquisition (PIETA) experiments to measure J-coupling in new phosphate glasses. Solomon Tesfamichael[1], Kyaw Hpone Myint[1], Pyae Phyo[1], Brennan Walder[2], Philip Grandinetti[2], Jay Baltisberger[1], [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]Ohio State University, Columbus, Ohio 43210.

Abstract

The scalar (J) couplings were measured in a series of phosphate glasses using the newly developed ^{31}P magic-angle spinning (MAS) phase incremented echo train acquisition (PIETA) method. In other systems these J-couplings may be used to measure structural parameters such as molecular bond angles, in our case we hope to measure the P–O–P bond angle distribution in these glasses. Samples of the pyrophosphate ($P_2O_7^{4-}$) composition were prepared with tin (II), lead (II), zinc (II), cadmium (II), barium, and cesium counter cations and were quenched rapidly from 1000˚C. After grinding and packing samples in dry air box, the J-coupling distributions were measured with PIETA and then simulated using a C computer program written at Berea College. The results indicate that the size of the cation is much less important than the group membership. This indicates the overall chemical bonding present is more of a structural determinant than the size of the cation (as you might expect from simple Pauling ionic radii rules). At this point we cannot distinguish if the distribution of bond angles is controlling the average J-coupling or if the average J-coupling is dependent upon the degree of ionic bonding between the cations and the phosphate units. In the future, calculations will be performed using GAUSSIAN03 to model the effects of bond-angle and cation type in these glasses and deconvolute this problem.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Analytical/Physical Section)

Funded by Berea College URCPP

Photocatalyzed Benzylic Fluorination: An Alternative Approach through Radical Cations.
Michael H. McCann[1], Thomas Lectka[2]*, [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]The Johns Hopkins University, Baltimore, Maryland 21218.

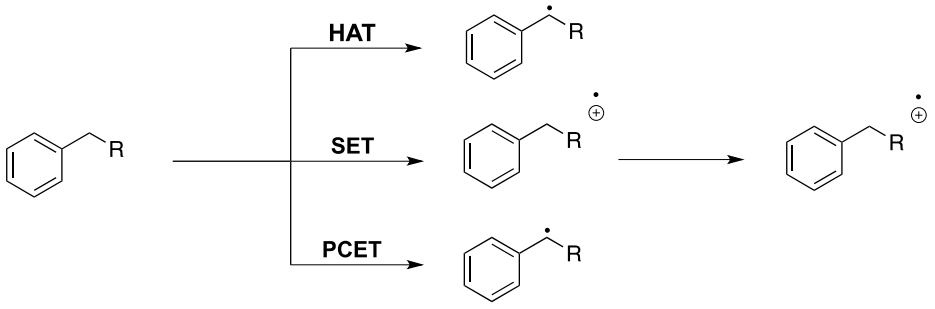
Abstract

The synthesis of benzylic fluorides has proved to be challenging in the field of organic chemistry. Traditional fluorination uses harmful compounds such as fluorine gas, which leads to little to no selectivity. Photocatalytic oxidation using 1,2,4,5-tetracyanobenzene with Selectfluor converts benzylic compounds into mono-fluorinated products with high selectivity. This system is metal free, the reagents are commercially available, and the conditions are mild, leading to a desirable reaction.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Chemistry: Organic/Inorganic Section:2nd Place Undergraduate Research Competition)

Funded by The Johns Hopkins University



Purification and reassembly of oxidized Collagen IV NC1 domains. Kaamilah Wilson[1], Carl Darris[2], Billy Hudson[2], Paul Voziyan[2], [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]Vanderbilt University, Nashville, Tennessee 37235.

Abstract

The Collagen IV network is responsible for providing structural integrity to the basement membrane of the extra cellular matrix in all animal cells. The growth of epithelial cells and the anchoring of tissues is maintained via hexameric complexes within the noncollagenous-1 (NC1) domains of the Collagen IV network. Dissociation of these hexamer subunits can cause a loss of tissue integrity, characterized by conditions associated with oxidative stress such as diabetes, Alzheimer's Disease, atherosclerosis and cardiovascular disease. Previously our lab has shown that oxidative environments cause structural modifications to collagen IV. Presently, we aim to investigate the molecular mechanism by which oxidative stress affects tissue integrity by determining whether oxidation of the Collagen IV NC1 domains affects their assembly.

Un-crosslinked hexameric NC1 domains were isolated from bovine lens basement membranes via a collagenase digestion procedure. Collagen IV hexamers were successfully purified and isolated from Bovine lens basement membranes. Fractions were collected using an ion exchange column and purity of the samples were detected using Fast Protein Liquid Chromatography (FPLC) and gel electrophloresis. Collagen IV NCI hexamers were treated with hypohalous acid, concomitant with oxidized environments. Control and treated hexamers were placed under conditions for dissociation and assessed for reassembly using FPLC. There were no significant changes in the levels or rate of reassembly in oxidized Collagen IV NCI hexamers when compared to controls. Under these experimental conditions, oxidation does not have an effect on hexamer reassembly. Further experimentation will be conducted to examine the mechanical strength of the Collagen IV matrix.

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Cellular and Molecular Biology Section)

Funded by Hal Moses/Aspirnaut Research Internship, Vanderbilt University, and Berea College CTL Internship Program

Quantification of Local Bonding Environments in Cesium Silicate Glasses Using Si-29 Magic–Angle Flipping NMR. Pyae Phyo[1], Jay Baltisberger[1], Kevin Sanders[2], Eric Keeler[2], Philip Grandinetti[2], [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]Ohio State University, Columbus, Ohio 43210.

Abstract

Cesium silicate glasses were studied using Si-29 magic-angle flipping NMR spectroscopy. The chemical shift anisotropy parameters were extracted for each glass with a variety of $Q^{(4)}$ and $Q^{(3)}$ sites. The $Q^{(4)}$ site increases in width as the amount of cesium is increased. This is consistent with an increasingly disordered environment around these sites as the neighboring sites have more non-bridging oxygen atoms. Two distinct $Q^{(3)}$ sites are seen with very different anisotropies at the low cesium content and become more similar as cesium is added. Previous work has shown that larger anisotropies correspond to short non-bridging Si–O bond distances for $Q^{(3)}$ sites. Leading to a general interpretation that the large anisotropy site arises from an increasing number of coordinating cesium cations near that site. The other $Q^{(3)}$ site with increasing anisotropy with increasing cesium content must arise from either a smaller number of coordinating cations or a reduced local microscopic density to increase the Si-O bond lengths as cesium is added. This model indicates a microscopically phase separated mixture of isolated cesium cations scattered throughout the silica matrix, as well as some channels filled with clustered cesium cations. No macroscopic evidence for phase separation is seen in these glasses, however the degree of homogeneity of the melt is difficult to quantify given that samples were quenched from 1200˚C. Smaller cations such as sodium, rubidium, and potassium have been studied in silicate glasses with no evidence of multiple $Q^{(3)}$ sites.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Oral Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Oral Presentation- Chemistry: Analytical/Physical Section: 1st Place Undergraduate Research Competition)

53rd Eastern Analytical Symposium, November 18-20th, 2014, Somerset, NJ (Poster Presentation: Award in Undergraduate Poster Competition).

Funded by Ohio State University and Berea College CTL Internship Program

Synthesis of Fluorinated Homoallylic Compounds via Ring-Opening Nucleophilic Fluorination of Methylene Cyclopropanes (MCP). Anthony Boateng[1], Gerald B. Hammond[2], [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]University of Louisville, Louisville, Kentucky 40292.

Abstract:

Methylene cyclopropanes (MCPs) are useful synthetic intermediates in organic synthesis. Due to the strain in their structures, they are very reactive towards nucleophiles such as H_2O, $-CO_2H$,-SH, Cl^-, and Br^-. However, there has not been any reported nucleophilic fluorination of MCPs to the best of our knowledge. This may be due to the weak nucleophilicity and low acidity of the existing hydrogen fluoride based reagents. We thus present the first nucleophilic fluorination of MCPs catalyzed by a Lewis acid using a novel nucleophilic reagent developed in the Hammond laboratory.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Organic/Inorganic Section: 2nd Place Undergraduate Research Competition)

Funded by University of Louisville

Synthesis of Fluorogenic Peptide Substrates for the Peptidase Neurolysin. D'Angela Townsend-Brooks, Tyller Culver, Jonah Rector, Matthew Saderholm, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

The peptidase neurolysin is an important regulatory protein. It is implicated in deactivating a range of neuropeptides that control such diverse things as blood pressure and mood. One of neurolysin's main targets is the 13-residue neuropeptide neurotensin, cleaving it between residues Pro10 and Tyr11. To probe its specifity, we synthesized internally-quenched fluorogenic peptide analogs of neurotensin, neurolysin's preferred substrate. We synthesized variants of neurotensin with a combination of solution-phase organic and solid-phase peptide chemistry, changing residues at positions 10, 11, and 12. Several of these fluorogenic peptides were cleaved with neurolysin and the kinetic parameters were determined by quantifying the products using fluorescence.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Organic/Inorganic Section)

Funded by Berea College URCPP

Synthesis, Purification, and Structural Characterization of Organic Processing Impurities.

Seth Reasoner[1], Ryan Memmber[2], Andrea Frederick[2], Michael Kobierski[2], [1]Chemistry Program, Berea College, Berea, Kentucky 40404,[2]Small Molecule Design & Development, Eli Lilly and Company, Indianapolis, IN 46285.

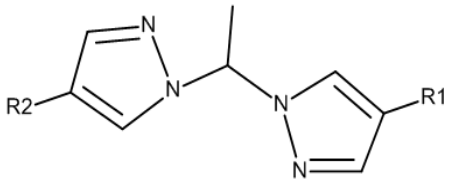
Abstract

In an effort to simplify one step of a multi-step synthesis, an alternative method has previously been developed to deprotect a pyrazole ring through the removal of an ethyl vinyl ether (EVE) group. While this method is sufficient to effect the desired transformation, certain impurities are produced even under optimal reaction conditions. In this project, reaction conditions were sought that would produce significant amounts of these impurities for further analysis. The reaction products were analyzed quantitatively, using mass spectrometry and HPLC (high performance liquid chromatography). The primary impurities were produced in sufficient quantities, isolated, and purified. These impurities were then introduced into the subsequent reaction step in spiking studies to understand their fate and removal in downstream processing. Production and investigation of these impurities provided vital information to assess the viability of the deprotection method.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Organic/Inorganic Section)

Funded by the Indiana Clinical and Translational Science Institute



General Impurity Structure

The Solid-Phase Organic Synthesis of a Fluorescence-Quenching Analog of Lysine.

Andrew Norris, Matthew Saderholm, Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

The synthesis of fluorogenic peptides requires both a fluorescent group and a fluorescence-quenching group like 2,4-dinitroaniline. To attach this fluorescence-quenching group to peptides, typically a dinitrophenyl (DNP) group is added to a free amino group on an appropriate amino acid in a solution-phase reaction. This labeled amino acid is purified and then incorporated into a peptide via solid-phase peptide synthesis (SPPS). In order to increase yields and shorten synthesis times, a procedure for the solid-phase organic synthesis (SPOS) of Fmoc-lysine(DNP) was pursued. The developed SPOS procedure involves attaching Fmoc-Lys(Mtt)-OH to Rink amide resin, removing the temporary sidechain protecting group (Mtt), and then reacting the lysine's free e-amino group with 1-fluoro-2,4-dinitrobenzene. The reaction conditions used do not remove the a-amino Fmoc protecting group or cleave the lysine from the resin. Since Fmoc-Lys(DNP) is the first residue added, the resin generated can be utilized immediately for SPPS of fluorogenic peptides. This synthesis was used to make a fluorogenic variant of the neuropeptide neurotensin. FRET assays completed with the neuropeptidase neurolysin confirm that the synthesis was successful.

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100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Organic/Inorganic Section: 1st Place Undergraduate Research Competition)

Funded by Berea College URCPP

Using Phase Incremented Echo Train Acquisition (PIETA) Experiments to Measure Homonuclear ^{31}P J-Couplings in Phosphate Glasses. Pyae Phyo[1], Dr. Jay Baltisberger[1], Dr. Philip Grandinetti[2], [1]Chemistry Program, Berea College, Berea, Kentucky 40404, [2]Ohio State University, Columbus, Ohio 43210.

Abstract

By studying the local structures in amorphous materials we may attempt to understand how microscopic properties control bulk properties. Phosphate glasses are used in a variety of applications similar to silicate glasses including biocompatible materials and radioactive waste confinement. Using the newly invented two-dimensional Phase Incremented Echo Train Acquisition (PIETA) nuclear magnetic resonance experiment under fast magic-angle spinning (MAS) conditions, we measured the homonuclear ^{31}P two-bond J-couplings in various phosphate glasses modified by zinc, barium, and lead. These PIETA measured J-coupling distributions were compared with the traditional Hahn-echo and Carr-Purcell-Meiboom-Gill (CPMG) methods. It was seen that PIETA is equal in speed and sensitivity to CPMG but without the zero-frequency artifact that obscures the J-couplings under CPMG conditions. The PIETA method is fully equivalent to the traditionally used Hahn-echo method but much faster for the same sensitivity. Our observations suggest that the modifier cation has a significant impact on the measured range of J-couplings across the P–O–P bonds and we are investigating how to map this distribution of J-couplings into a distribution of bond-angles in these glasses, acting as a direct measure of medium range order in these samples. Also by using a two-dimensional approach we are able to separate overlapping sites in a glass using the J-resolved dimension (such as distinguishing between closed-ring and open-chain structures that overlap in a standard MAS experiment). There are no other techniques able to give this level of detailed local structural distribution information in these kinds of systems.

46th Annual Southeast Undergraduate Research Conference, January 30th-31st, 2014, University of Tennessee, Knoxville, Tennessee (Oral Presentation-Physical Chemistry Section: Honorable Mention Undergraduate Research Competition)

Funded by Ohio State University and Berea College CTL Internship Program

Gathering the Stories of Appalachian Foodways: An Oral History Research Project.

Barbara Hollstein, Meghan Doherty, Child and Family Studies Program, Berea College, Berea, Kentucky 40404.

Abstract

My research project done this summer through Berea College focused on the study of Appalachian Foodways through oral histories. I collected oral histories of older Appalachians through recorded interviews and then transcribed the interviews so they can be placed in the Berea College Sound Archives. The questions asked were about gardening, farming, food preparation, and preservation methods, looking at both earlier memories from childhood up to current practices, enabling us to see the changes occurring within the foodways. I had previously taken a course entitled *Appalachian Foodways* that introduced me to the information that I gathered in the interviews. This enabled me to ask intelligent questions about Appalachian foodways and gave me an understanding of Appalachian history in relation to food. Before collecting the oral histories, I read other materials on Appalachian foodways, learned about the ethics of oral histories, and learned how to properly ask ethnographic questions. The actual interviews were conducted with just one interviewee at a time in order to allow each person to explain his or her own experience. They were all recorded and some interviewees provided pictures and/or recipes. I transcribed the interviews, and the recording, transcription, photographs and recipes will be placed in the Archives.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP and the Appalachian College Association's Colonel Lee B. Ledford Research Award.

Tom Long, Frank Long, Ruby Long, Allen Turner; 1957
Courtesy of Ruby Long

Focus on African Americans in Elementary Social Studies. Sara O'Neal, Althea Webb, Education Studies Program, Berea College, Berea, Kentucky 40404

Abstract

This project reviewed the literature on African Americans in Kentucky history, collected photographic images of African Americans in Kentucky, and prepared lesson plans and supplemental materials for teachers to use in teaching fourth grade social studies in Kentucky. Elementary school teachers teach content in six areas: reading, language arts, science, mathematics, practical living, and social studies. Social studies covers five subdomains: historical perspective, geography, economics, government and civics, and culture and societies. The focus for this project was fourth grade social studies as state history is taught at this grade level. A review of the literature revealed that there are many sources of information on African Americans in Kentucky history. A content analysis of textbooks confirmed that African Americans are still depicted in stereotypical and predictable ways, i.e. during enslavement, as newly Emancipated people, and during the 1960s Civil Rights Movement. Interviews with teachers outlined the difficulties teachers have under current teaching conditions to provide in-depth study on topics, not currently regarded as "test" subjects. In response to what was learned, lesson plans were developed to help teachers add scope and depth into fourth grade social studies by adding content on the many contributions of African Americans in Kentucky's history.

Funded by Berea College URCPP

A Comparison of the Metabolic Costs of Elliptical Training Versus Treadmill Running.

Cassie Bodenstein, Tyler Huff, A.J. Mortara, Health and Human Performance Program, Berea College, Berea, Kentucky 40404.

Abstract

The *purpose* of this project is to compare the energy costs of quadra-pedal elliptical cross training and treadmill running. *Method:* subjects performed VO2 testing protocols on both elliptical trainers and treadmills. The treadmill protocol was a modified Bruce protocol; speed was constant with a steadily increasing incline. The elliptical protocol involved a steadily increasing stride rate, initially at 80 spm; and a steadily increasing resistance, initially at level 1. Both protocols were terminated upon volitional fatigue of the subject. Heart rate, respiratory exchange ratio, and breath by breath analysis were measured continuously throughout the test via a Quark CPET. Rate of Perceived Exertion was monitored at the end of each stage. Paired T-tests were used to compare mean values for each variable. *Results:* significant differences were found for the following: max VO2, heart rate, respiratory exchange ratio, rate of perceived exhaustion, and total test duration. *Conclusion:* Results indicate that VO2 max is higher on the treadmill than on the quadra-pedal elliptical trainer. However, respiratory exchange ratio was found to be higher on the elliptical, possibly due to the increased work rate of the upper extremities on the elliptical than the treadmill.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

"Humanitarian Interventions" & "Capital Punishment": Towards Two Encyclopedia Articles. Brent Coffey and Dr. Robert W. Hoag, Philosophy Program, Berea College, Berea, Kentucky 40404.

Abstract

The Internet Encyclopedia of Philosophy publishes peer-reviewed articles "written by experts but not *for* experts," analogous "to the way the *Scientific American* magazine is written by scientific experts but not primarily for scientific experts." The *Encyclopedia* editor specifically invited submission of two lengthy articles (12-15,000 words each), one on humanitarian interventions and one on capital punishment. Each article should "be understood by undergraduates majoring in philosophy and other scholars who are not working in the field covered by the article," including a select bibliography for readers. The aim is not to argue for a particular position or in other ways offer novel findings or conclusions, but to "present information accepted by colleagues,...important distinctions, the main results, and the main points of view on controversial issues." Our collaborative summer work - research, discussion, and writing about the philosophic literature on these two topics – resulted in submitting to the *Encyclopedia*'s editorial staff a 14,000 word article, "Humanitarian Interventions." This article invokes the tradition of "just war" theory to deal with myriad questions about the ethics and legalities of using armed military force to defend people's basic human rights in situations where genocides, crimes against humanity, or "ethnic cleansing" occur in other nations. Our collaborative work on capital punishment resulted in compilation of a bibliography, basic literature survey, and outline for subsequent drafting of an article addressing philosophic questions such as: What are the justifiable purposes of any punishment at all – deterrence, retribution (but not vengeance), rehabilitation, communal self-defense? Is the possibility or inevitability of mistakes, caprice, or (racial) discrimination in sentencing a morally acceptable risk or sufficient grounds for abolition? On what grounds is death the capital punishment, rather than, say, a life at hard labor? For what crimes is death a justifiable punishment: multiple murders, serial rapings, genocide, assassinations? And by what authority does an organization – the state, the Church, even – have the right to punish at all?

Funded by Berea College URCPP

Boron Nitride Nanotube Composite Aerogels. Laura Abelquist[1], Sang-Hyon Chu[2], Catharine Fay[3],[1]Physics Program, Berea College, Berea, Kentucky 40404,[2]National Institute of Aerospace, Hampton, Virginia 23666, [3]NASA Langley Research Center, Hampton, Virginia 23681.

Abstract

Aerogel, the lightest solid on earth, is synthesized from the deliquification of hydrogel and consists of a nanoporous structure. Silica aerogel on its own displays excellent thermal resistance and surface area but lacks mechanical strength. Boron nitride nanotubes (BNNTs) were added to silica aerogels with the ultimate aim of increasing the aerogels' mechanical strength and flexibility without degrading their thermal stability and surface areas. First conceived in 1994 and synthesized in 1995, boron nitride nanotubes are an attractive candidate because of the nature of boron-nitrogen (BN) bonds, which display valuable material properties including extreme thermal resistance, excellent radiation shielding capabilities and high tensile strength. High purity BNNTs produced in the NASA high power laser rig are mixed in solution with tetraethoxysilane, water and ethanol, and a base catalyst. The aerogels were synthesized using supercritical drying techniques. and characterized using nitrogen adsorption, thermogravimetric analysis and SEM. Preliminary analysis shows that the addition of nanotubes does not degrade useful thermal and porosity properties. The predicted applications for such a material are numerous, including radiation shielding, heat shielding, water purification, thermal insulation, athletic equipment, and military grade armor.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Chemistry: Analytical/Physical Section

Funded by KY-NASA

How Hub Cells Hijack Neuronal Networks. Brandon Schurter[1], Chris Fink[2], [1]Physicas Program, Berea College, Berea, Kentucky 40404, [2]Ohio Wesleyan University, Delaware, Ohio 43015.

Abstract

Highly connected neurons, called hub cells, are thought to contribute to certain forms of epilepsy and have also been shown to orchestrate synchrony in the hippocampus of developing rats. How hub cells are capable of hijacking networks to synchrony is not well understood. We hypothesize that the excitability type of hub cells may be an important factor. In general, neuronal excitability (which characterizes how neurons respond to input) falls into two categories, Type I and Type II, with networks of only Type II neurons synchronizing very well, and networks of only Type I neurons synchronizing rather poorly. We used computer simulations to investigate the synchronization properties of networks with a mixture of Type I and Type II neurons. We were particularly interested in the effect of placing Type II neurons as hub cells in the network. The results of these simulations show that relatively few Type II neurons are capable of hijacking the network to synchrony when they are placed as hub cells, but not otherwise, indicating that Type II cells could play a role in generating epileptic seizures.

14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

Funded by National Science Foundation Research Experiences for Undergraduates.

Spied Eyes: The Effect of Model's Pupil Size & Gender on Product and Person Preference.

Sophia Al-Maamary, Dave Porter, Psychology Program, Berea College, Berea, Kentucky 40404.

Abstract

Previous research has shown that pupil dilation affects attractiveness ratings. This study examined how pupil dilation, model gender, and questions designed to elicit alternative types of cognitive processing influenced preferences. Fifty-four females' viewed 12 picture pairs of a model (Six male and six female models) holding two different products. In each pair of pictures one showed the model's pupils dilated holding one product and the other picture with the same model's pupils constricted holding a similar product. Order of presentation and location were counterbalanced. Subjects were asked two questions: one question eliciting a System 1 (intuitive) response and the other required greater involvement of System 2 (conscious processing). Pupil dilation was found to increase favorability ratings but had a much greater effect for the System 1 question. The gender of the model did not affect favorability ratings.

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Psychology Section: 1st Place Undergraduate Research Competition)

No Funding (Senior Psychology Capstone Class Project)

Working Memory: The Effect of Practice and Task Type on Working Memory Components. Sophia Al-Maamary, Dave Porter, Psychology Program, Berea College, Berea, Kentucky 40404.

Abstract

Many psychologists have assumed that while an individual's crystalized intelligence can be increased by practice and experience, their fluid intelligence, which reflects the activities of working memory, is largely immutable. However, recent studies have challenged this assumption. Our study used three relatively simple games from *Lumosity*, to examine twelve students' development of several cognitive skills over nine sessions in a six week period of deliberate practice. Their performance was analyzed to identify distinct characteristics of improvement in performance. Between subjects analyses showed that task type explained slightly more variance in performance than practice level. The results show that subjects' performance on the three tasks reflects distinctive development of different cognitive capacities associated with working memory. These results suggest that cognitive skills developed using these games differ, and subjects may benefit from practice focused on particular needs.

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Psychology Section)

Funded by Berea College Labor & Educational Technology Programs (Independent Study)

Healthy, Hunger-Free Kids?: Results from an Elementary School Lunch Program Evaluation. Sydney Henderson, Tiffany Estep, Andrea Woodward, Sociology Program, Berea College, Berea, Kentucky 40404.

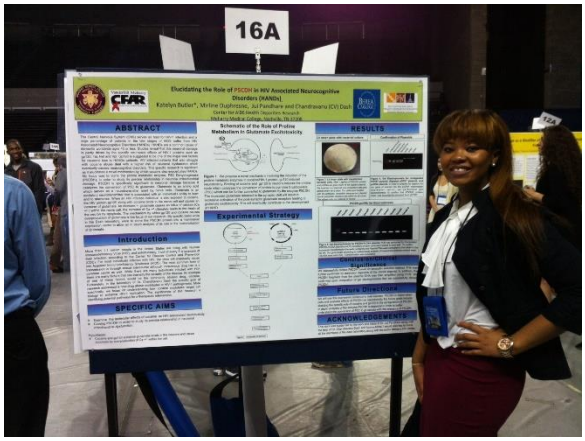
Abstract

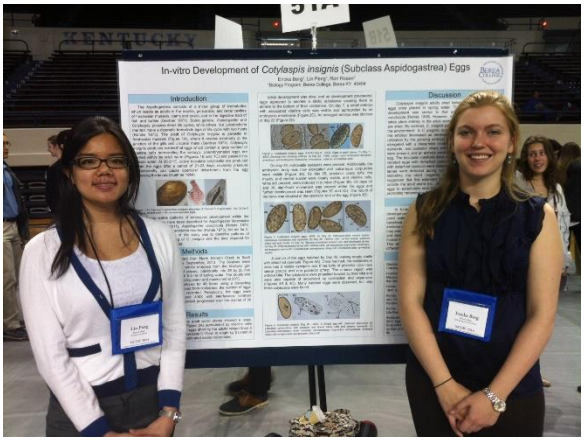
New federal guidelines for school lunches have required calorie limits on meals, banned 2% and whole milk, mandated a transition to 100% whole grains, and increased serving sizes of fruits and vegetables. While these changes have been welcomed by reform advocates concerned about nutrition in schools, they have also raised concerns among critics about whether students will find the changes palatable enough to stay nourished in school. In response to these concerns, we collected and analyzed data from a plate waste study, surveys and focus groups with students, in-depth interviews with cafeteria staff, and ethnographic observations in the school cafeteria. Our analysis revealed that students and staff were most opposed to the calorie limits, increases in vegetable servings, and changes to skim and 1% low-fat milk. They were less dissatisfied about the whole grain products in their lunches, which could be an encouraging sign that students are adapting to change as time goes on. Our research concludes with recommendations to schedule recess before lunch, extend the lunch period by 5 to 10 minutes, creatively market fruits and vegetables, conduct taste tests, and educate students about plate waste.

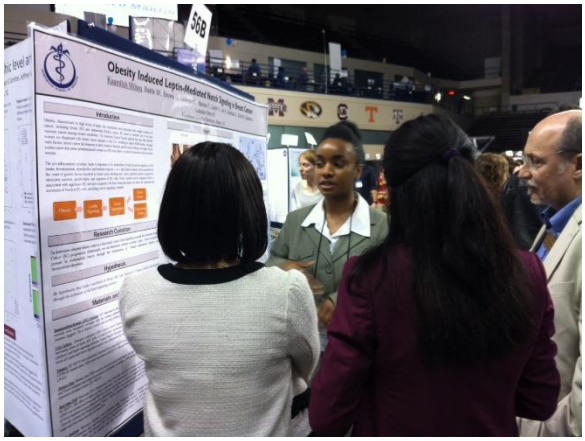
14th Annual Berea College Undergraduate Research Symposium, October 17th, 2014, Berea College, Berea, Kentucky (Poster Presentation)

100th Annual Meeting of the Kentucky Academy of Science, November 14-16th, 2014, Lexington Convention Center, Lexington, Kentucky (Poster Presentation- Anthropology and Sociology Section)

Funded by Berea College URCPP







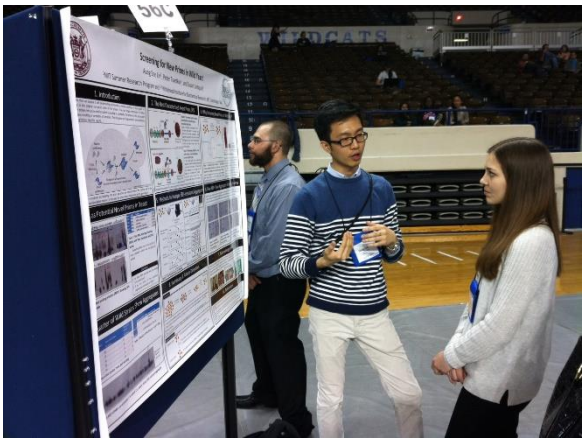
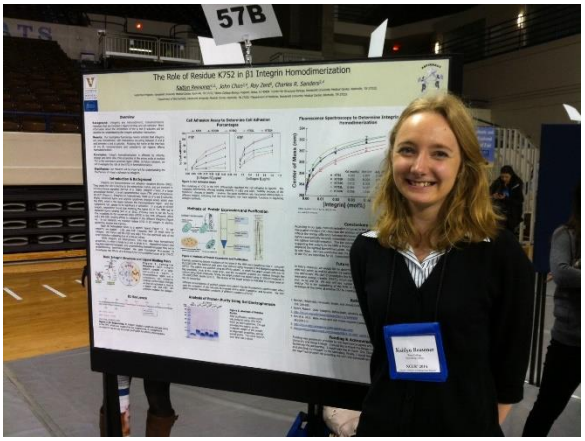


Figure 1. Berea College students at the 2014 National Conference on Undergraduate Research, Lexington, Kentucky on April 3rd-5th, 2014.



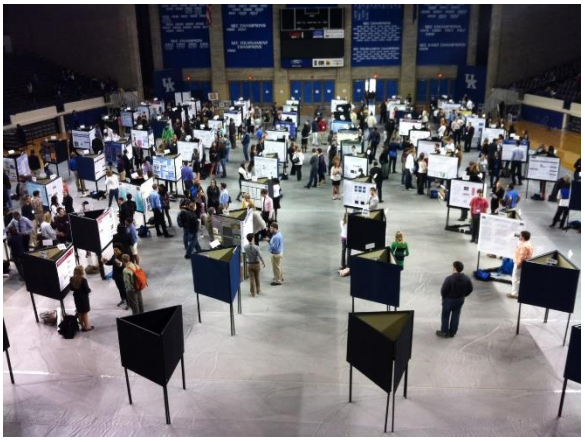


Figure 2. Berea College students at the 2014 National Conference on Undergraduate Research, Lexington, Kentucky on April 3rd-5th, 2014.

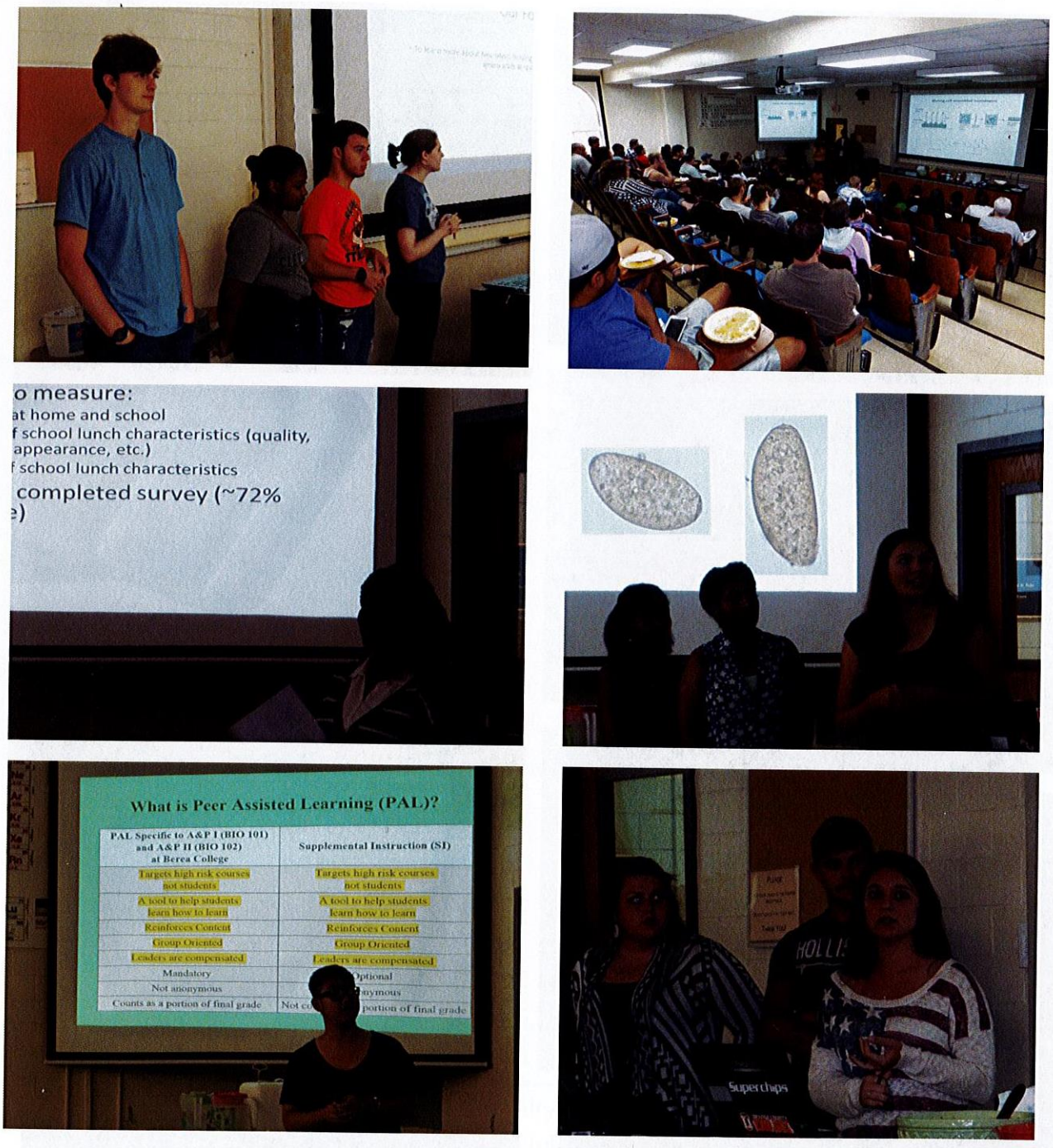


Figure 3. Berea College students and faculty during 2014 Undergraduate Research and Creative Projects Program summer presentations.

Figure 4. Berea College students and faculty during 2014 Undergraduate Research and Creative Projects Program summer presentations.

Figure 5. Berea College students and faculty at the Berea Undergraduate Research Symposium on October 17th, 2014.

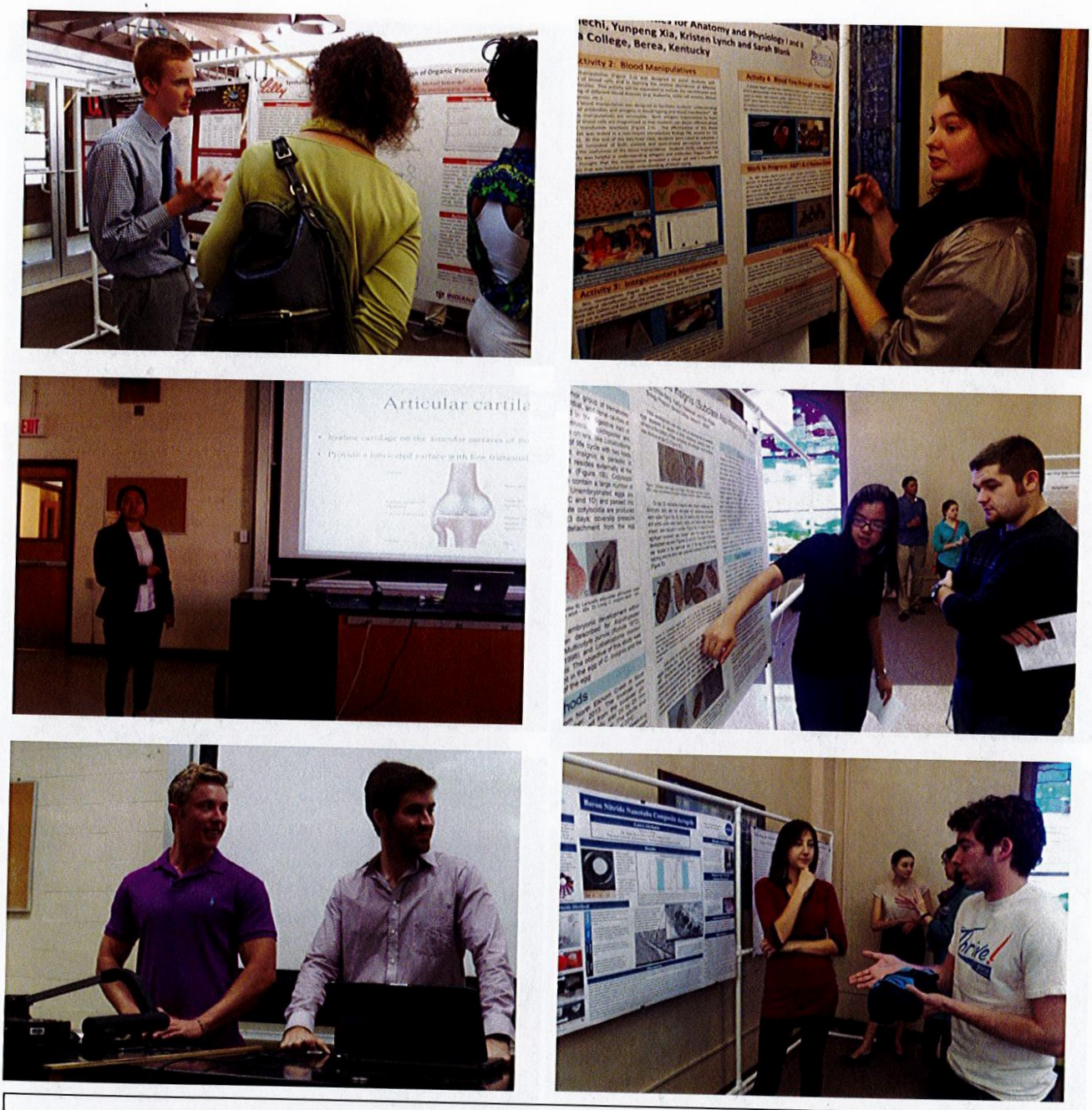


Figure 6. Berea College students and faculty at the Berea Undergraduate Research Symposium on October 17th, 2014.

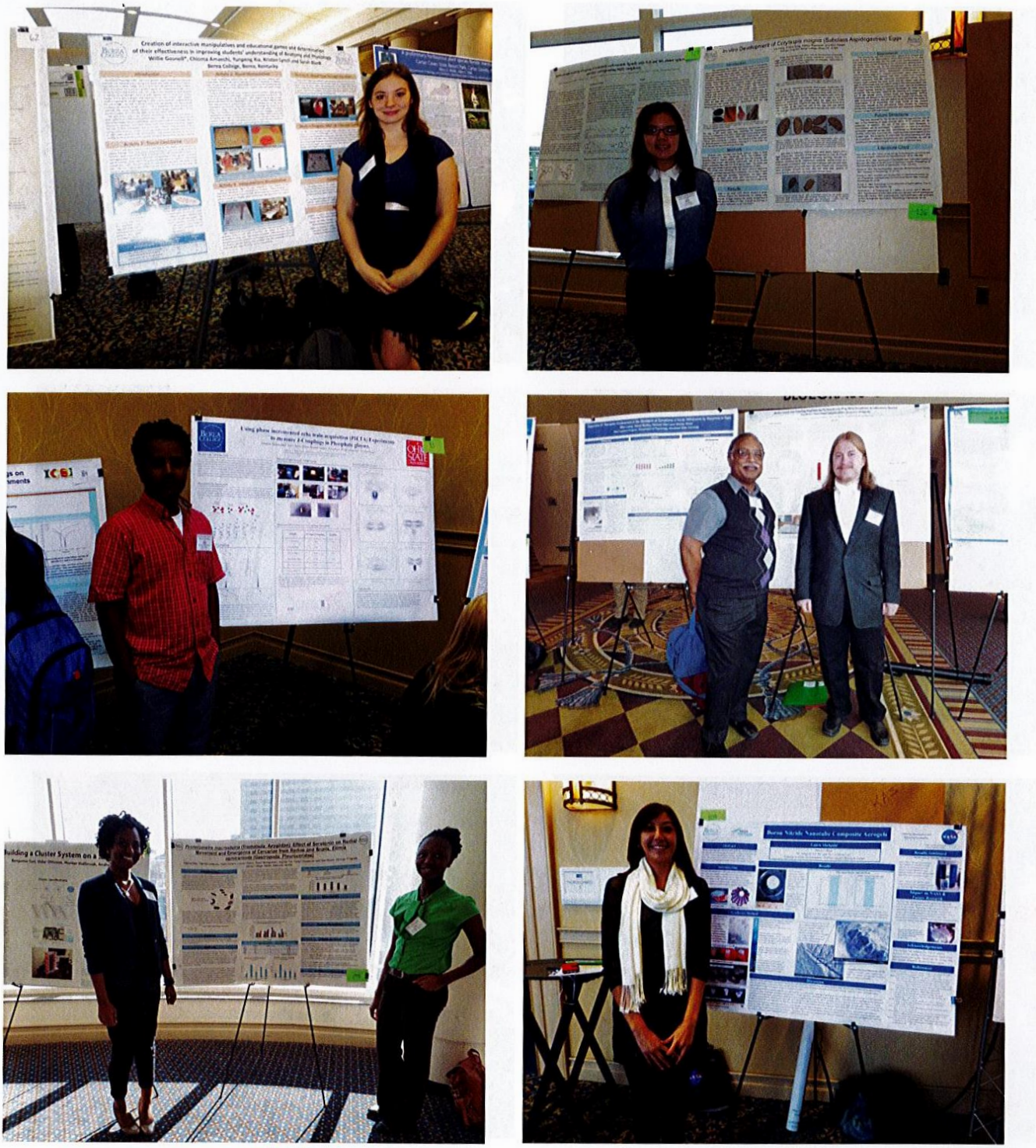


Figure 7. Berea College students and faculty at the Kentucky Academy of Science meeting in Lexington, Kentucky, November 14th-16th, 2014.

Figure 8. Berea College students and faculty at the Kentucky Academy of Science meeting in Lexington, Kentucky, November 14th-16th 2014.