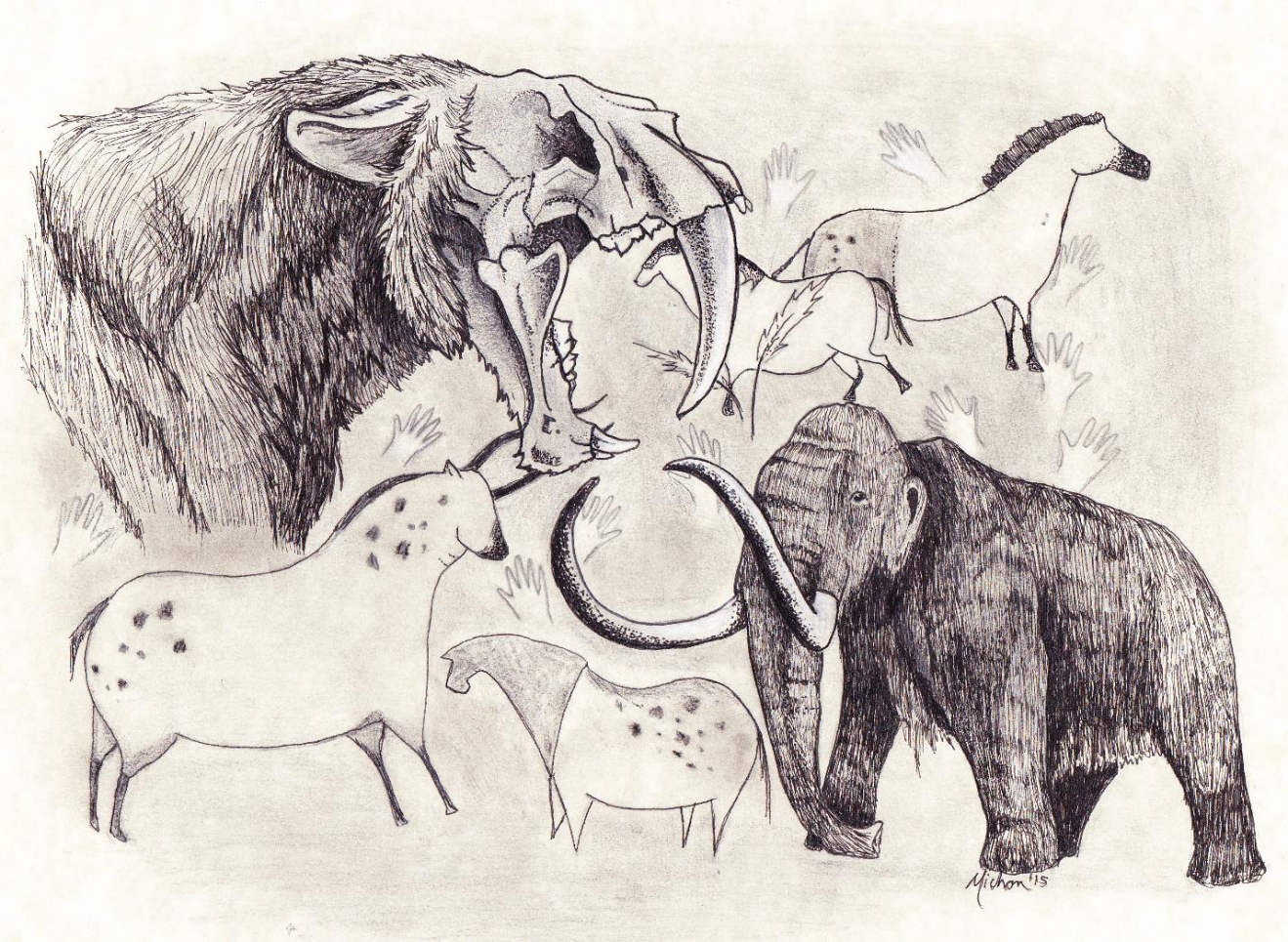


10th Annual

Berea College

Journal of Undergraduate

Research Abstracts

2015

INTRODUCTION

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

This tenth (2015) issue of the "Berea College Undergraduate Research Abstract Journal" contains 57 different abstracts representing majors from 11 different academic programs. Thirty-two (56.1%) 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 funded by academic programs and the Berea College Labor Program; most on-campus research was made possible with funds provided by Berea College's Undergraduate Research and Creative Projects Program (URCPP). Off-campus projects were funded by academic institutions and private businesses throughout the country often with assistance from Berea College's CTL Internship Program. Many of these projects were presented on-campus during the 15th Berea Undergraduate Research Symposium (BURS) on October 23, 2015. Most of these projects were subsequently presented at the 101st Annual Meeting of the Kentucky Academy of Science at Northern Kentucky University (43 presentations and 16 awards received). If known, presentations, awards received and funding sources are noted below each abstract. Images related to research projects are included if provided by the student authors or their mentors.

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 Mary Robert Garrett 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, Michon Martin (fall 2014 graduate), for the original cover art. Finally, we would like to thank all the off-campus mentors at the following universities, scientific organizations and businesses for supporting Berea students during the summer of 2015 (number of Berea students in brackets): Air Force Research Laboratory {1}, Chicago Botanical Garden {1}, Georgetown University {1}, Kentucky Academy of Science {2}, Keenesaw State University {1}, Louisiana Tech University {1}, Ohio State University {2}, M.D. Anderson Cancer Center {1}, Pepperdine University {1}, Spectra Group Limited {1}, University of Colorado, Denver {2}, University of Illinois {1}, University of Kentucky {1}, University of Nairobi {1}, University of Pittsburgh {2}, University of Ulm {1} and Vanderbilt University {8}. Special thanks to Berea alumni including Dr. Dennis Roop (University of Colorado, Denver) and 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.

TABLE OF CONTENTS

*Berea College students and faculty denoted in **bold** text.

Agriculture and Natural Resources Program:

Art and Art History Program:

Biology Program:

8. Does membrane composition affect whole-animal performance and thermal tolerance in the eastern newt (*Notophthalmus viridescens*)? **Sarah Tabor[1]**, **Sam Moody[1]**, Cameron J. World[2], Nancy J. Berner[2], **Patrick M. Mineo[1]**. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Sewanee: The University of the South, Sewanee, Tennessee, 37383.

9. Diversity of Stream Salamanders in Relation to Human Disturbance and Watershed Affiliation in Central Kentucky. **Zachary Spicer**, **Morgan Stacy**, **Jeremy Wilde**, **Roy Scudder-Davis**. Biology Program, Berea College, Berea, Kentucky, 40404.

10. Dormancy-Breaking and Germination Patterns in Seeds of *Calycanthus floridus* L. (eastern sweetshrub). **Olamide Adejumo**, **Moondil Jahan**, **Kevin Montgomery**, **Christopher A. Adams**. Biology Program, Berea College, Berea, Kentucky, 40404.

11. Engineering stress-resistant mouse Embryonic Stem (ES) cells. **Maria Anastasiadou[1]**, Wallace Chick[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Charles C. Gates Center for Regenerative Medicine and Stem Cell Biology, University of Colorado Denver, Denver, Colorado, 80204.

12. Expression and purification of transforming growth factor receptor β-II cytoplasmic tail from *E. coli*. **Kidist Ashami[1]**, Hongjun Liao[2], Ambra Pozzi[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

13. Factors influencing the abundance of non-native species in restored prairies. **Meghan Kramer[1]**, Evelyn Williams[2], Rebecca Barak[2,3], Alyssa Wellman Houde[4], Daniel Larkin[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Chicago Botanic Garden, Glencoe, Illinois, 60022. [3]Northwestern University, Evanston, Illinois, 60208. [4]University of Maryland, Baltimore County, Baltimore, Maryland, 21250.

14. Identification of lead compounds that differentially target integrin α1β1 and α2β1 I-domains for the treatment of kidney fibrosis. **Hanna Abe[1]**, Billy Hudson[2] , Kyle Brown[2]. [1]Biology Program, Berea College, Berea, Kentucky 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

15. Integrin subunits α3 and α6 mediate FGF10-dependent signaling events in collecting duct cells bound to LM511. **Sophia Toé[1]**, Tianxiang Tu[2], Olga Viquez[2], Eugenia Yazlovitskaya[2], Roy Zent[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2] Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

16. Lysyl oxidase homolog extracellular processing. **Jazmin Escamilla[1]**, Alberto J. López-Jiménez[2], Catalina B. Kretschmar[2], Roberto Vanacore[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

17. Medical 3d printing: an overview. **Michael James[1]**, Doug Neckers[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Spectra Group Limited, Millbury, Ohio, 43447.

18. pH induced compaction of the N-terminal domain of lipidated caveolin-3. **Kaitlyn Reasoner[1]**, Jonathan P. Schlebach[2], Ji-Hun Kim[2], Zhenwei Lu[2], Charles R. Sanders[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Department of Biochemistry and Center for Structural Biology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

19. Physiological Dormancy and Germination Patterns in Seeds of the Rare Yellow Gentian (*Gentiana flavida* Muhl). **Kevin Montgomery**, **Moondil Jahan**, **Olamide Adejumo**, **Christopher A. Adams**. Biology Program, Berea College, Berea, Kentucky, 40404.

20. The Bioactivity of Pericellular Matrix from Adult Stem 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.

21. The Dynamics of Immunoediting in Skin Carcinogenesis. **Chi Peng[1]**, Dennis Roop[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Charles C. Gates Center for Regenerative Medicine and Stem Cell Biology, University of Colorado Denver, Denver, Colorado, 80204.

22. The effect of Ziram on cortical neurons through E1 inhibition. **Monica Moran[1]**, Diana Neely[2], Kathleen Dennis[2], Aaron Bowman[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Department of Neuroscience, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

23. Thermal tolerance differs between terrestrial and aquatic life history stages in the eastern newt (*Notophthalmus viridescens*). **Sunaina Sherchan**, **Sarah Tabor**, **Patrick M. Mineo**. Biology Program, Berea College, Berea, Kentucky, 40404.

Chemistry Program:

24. A Simple Mechanochemical Aryl Bromination Procedure. **Katie Bragdon**, **Dorothy Coe**, **Nicholas Marshall**. Chemistry Program, Berea College, Berea, Kentucky, 40404.

25. Abnormal N-Heterocyclic Carbene Complexes. **Lyndsey J. Barker**, **Maria S. Ledesma-Alonso**, **Samuel A. Effoe**, **Benjamin R. Quesada**, **Anes Kovacevic**. Chemistry Program, Berea College, Berea, Kentucky, 40404.

26. Chemical and Physical Resistance of Guayule and Nitrile Blend Rubber Gloves. **Boubacar Cherif[1]**, Katrina Cornish[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]The Ohio State University, Columbus, Ohio, 43210.

27. Dissipative Particle Dynamics (DPD) Simulations of Hard Nanoparticle-encapsulated Polymeric Micelle Formation. **Kyaw Hpone Myint**[1], Barbara Wyslouzil[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]The Ohio State University, Columbus, Ohio, 43210.

28. Effect of FeRu Core-shell Catalysts Size on Fischer–Tropsch Reactions. **Alaina Fox**[1], Daniela Mainardi[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Louisiana Tech University, Ruston, Louisiana, 71272.

29. Examination of Phosphate Crystals by PIETA J-Coupling and PASS NMR Experiments. **Kodey Blankenship**, **Jay Baltisberger**. Chemistry Program, Berea College, Berea, Kentucky, 40404.

30. Functionalization Work on Dopamine Nanoparticles with the Incorporation of Human Serum Albumin (HSA). **Andrew Norris**[1], Sean Harvey[2], Andreas Riegger[2], Tanja Weil[2], David Ng[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]University of Ulm, Ulm, Germany.

31. Identification of factors stabilizing the 3D structure of the Goodpasture autoantigen of glomerular basement membrane. **Tatiana Mikhailova**[1], Neonila Danylevych[2,3], Billy Hudson[2-6], Vadim Pedchenko[2,3]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [3]Center for Matrix Biology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [4]Department of Biochemistry, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [5]Vanderbilt-Ingram Cancer Center, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [6]Department of Pathology, Microbiology and Immunology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

32. Mechanochemical chlorination and iodination of electron-rich aromatics. **Tyler Hutsell**, **Marco Santos**, **Nicholas Marshall**. Chemistry Program, Berea College, Berea, Kentucky, 40404.

33. New Methods to Synthesize Nickel N-Heterocyclic Carbene Complexes. **Samuel A. Effoe**, **Benjamin R. Quesada**, **Lyndsey J. Barker**, **Maria S. Ledesma-Alonso**, **Anes Kovacevic**. Chemistry Program, Berea College, Berea, Kentucky 40404.

34. Phytochemical Investigation of *Albizia shimperiana* and *Bridelia micrantha* for Cytotoxic Principles Against Drug Sensitive and Multidrug Resistant Cancer Cell Lines. **Job Limo**[1], Leonidah Kerubo[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]University of Nairobi, Nairobi, Kenya, 00100.

35. Rapid, electroless surface modification through surface-directed azo coupling. **Tatiana Mikhailova**, **Brennan Taylor**, **Nicholas Marshall**. Chemistry Program, Berea College, Berea, Kentucky, 40404.

36. Synthesis of Amine-Functionalized Cyclotribenzylenes (CTBs). **John Attelah[1]**, Gracia El Ayle[2], K. Travis Holman[2]. [1]Chemistry Program, Berea College, Berea, KY, 40404. [2]Georgetown University, Washington, District of Columbia, 20057.

37. The Effects of Heat Shock Preconditioning on Protein Induction and Cell Survival after Nanoparticle Exposure. **Jonah Rector[1]**, Jay Brewster[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Pepperdine University, Malibu, California, 90263.

38. TRIM24 Induces Epithelial to Mesenchymal Transition (EMT) in MCF10A Cells. **Bruce Plowshay, Jr.[1]**, Kaushik N. Thakkar[2], Michelle C. Barton[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Department of Epigenetics & Molecular Carcinogenesis, Center for Cancer Epigenetics, The University of Texas MD Anderson Cancer Center, Houston, Texas, 77030.

39. Type 1 interferon expression following small molecule inhibition of cyclic GMP-AMP synthase. **Seth Reasoner[1]**, Jessica Vincent[2], Katherine Rothamel[2], Byungil Kim[2], and Manuel Ascano[2,3]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Department of Biochemistry, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [3]Department of Pathology, Microbiology and Immunology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Computer Science Program:

40. Dashboard Management System: A Tool to Manage Data Efficiently at the Back End and to Display Data Meaningfully at the Front End. **Phyo Phyo Kyaw Zin**, **Scott Heggen**, **Matt Jadud**. Computer Science Program, Berea College, Berea, Kentucky, 40404.

41. Design and Development of a Bio-Inspired Robotic Quadruped Using Programmable Central Pattern Generators. **Bria Williams**, **Kristian Toole**, **Scott Heggen**, **Matt Jadud**. Computer Science Program, Berea College, Berea, Kentucky, 40404.

42. Developing an Affordable Traffic Counting System Using Computer Vision. **Carlos Andres Berejnoi Bejarano**, **Scott Heggen**, **Matt Jadud**. Computer Science Program, Berea College, Berea, Kentucky, 40404.

43. The Detection of Gas in Fracking Contaminated Water. **Amber Tolleson**, **Ashley Aiken**, **Scott Heggen**, **Matt Jadud**. Computer Science Program, Berea College, Berea, Kentucky, 40404.

English Program:

44. Waves of Empire: Mapping Early Imperial Oceanic Sovereignty. **Lydia Bauler**, **M. Ethan Johnson**, **T. Joseph Carrick**, **Jason E. Cohen**. English Program, Berea College, Berea, Kentucky, 40404.

Health and Human Performance Program:

45. Comparing optical heart rate monitors to a gold standard during continuous and interval cardiovascular exercise. **David Orr**, **Colin Weckman**, **A.J. Mortara**. Health and Human Performance Program, Berea College, Berea, Kentucky, 40404.

Mathematics Program:

46. Undergraduate Research in Imaging Science. **Bhawesh Mishra**, **Kayla Phelps**, **Xhafer Rama**, **Vincent Tembo**, **James Blackburn-Lynch**, **Larry Gratton**. Mathematics Program, Berea College, Berea, Kentucky, 40404.

Nursing Program:

47. Evaluating the Impact of Community Gardens in Appalachia. **Gabrielle Christian[1]**, **Lisa M. Turner[2]**. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Nursing Program, Berea College, Berea, Kentucky, 40404.

Physics Program:

48. Building a Low-Cost Atomic Force Microscope for Use in Undergraduate Physics Labs and Research at Berea College. **Nathanael Bodine**, **Troy Messina**. Physics Program, Berea College, Berea, Kentucky, 40404.

49. Designing Student Maker Spaces. **Mackenzie Ridley[1]**, **Troy Messina[1]**, Daniel Johnsen[2], **Peter Hackbert[3]**. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]LVL1 Hackerspace, Louisville, Kentucky, 40206. [3]Entrepeneurship for the Public Good, Berea College, Berea, Kentucky, 40404.

50. Differential Thermal Analysis of Bioactive Glass Material for Bone Tissue Regeneration. **Denzell Barnett[1]**, Greg Humble[2], Kisa S. Ranasinghe[2] . [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]Kennesaw State University, Kennesaw, Georgia, 30144.

51. Mapping Nearby Galaxies at APO (MaNGA). **Dadbeh Shaddel[1]**, Renbin Yan[2]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]University of Kentucky, Lexington, Kentucky, 40506.

52. Three-Step Induced-Ferroelectric Phase Transition in $(PMN)_{0.8}(PT)_{0.2}$. **Yhenew D. Kassie[1]**, Eugene Colla[2], Michael Weissman[2]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]University of Illinois Urbana-Champaign, Champaign, Illinois, 61820.

53. W/V Band Wave Propagation Through Earth's Atmosphere. **Nicholas Hubbard[1]**, Steven Lane[2]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]Air Force Research Laboratory, Kirtland Air Force Base, Albuquerque, New Mexico, 87116.

Psychology Program:

54. Arousal, Audition and Spatial Awareness: Effects on Bias and Sensitivity. **Shelby Cansler**, **Dave Porter**. Psychology Program, Berea College, Berea, Kentucky, 40404.

55. Effects of Rehearsal Styles on Learning Words in a Foreign Language. **Joscelin Rocha-Hidalgo**, **Dave Porter**. Psychology Program, Berea College, Berea, Kentucky, 40404.

56. Evidence of the Relative Contributions of Explicit and Implicit Learning of a Complex Video Game. **Kelly Smith[1,2]**, **Dave Porter[1]**. [1]Psychology Program, Berea College, Berea, Kentucky, 40404. [2]Northern Kentucky University, Highland Heights, Kentucky, 41099.

57. Young Children's Perceptions of Race and Gender. **Carmellia Jackson[1]**, **Kelly Smith[2]**, **Dave Porter[1]**. [1]Psychology Program, Berea College, Berea, Kentucky, 40404. [2]Northern Kentucky University, Highland Heights, Kentucky, 41099.

Appendix:

58. Figure 1. Berea College students and faculty during the 2015 summer Undergraduate Research and Creative Projects Program presentations.

59. Figure 2. Berea College students and faculty at the Berea Undergraduate Research Symposium on October 23rd, 2015.

60. Figure 3. Berea College students and faculty at the Kentucky Academy of Science annual meeting on November 13th-14th, 2015 at Northern Kentucky University.

Effects of Supplementing Protein on the Growth Performance, Parasite Susceptibility, and Grazing Behavior of Goats Reared in a Continuous Suckling Production System During the Spring Period at the Berea College Farm. Jane Hostomsky[1], Sydney Marshall[1], Marlon Knights[2] and Quinn. S. Baptiste[1]. [1]Agriculture and Natural Resources Program, Berea College, Berea, Kentucky, 40404. [2]West Virginia University, Morgantown, West Virginia, 26506.

Abstract

This research project focused primarily on the productivity of goats as affected by management systems within a specific forage based production environment. Specifically, the effects of protein supplementation on the parasite susceptibility, growth performance, and grazing behavior of continuously suckled kids and lactating does were investigated in the Berea College Farm goat herd during an eight week period. The herd was divided into a treatment and control group. The treatment and control groups grazed pasture together throughout the study. The treatment group received a protein supplement daily but the control group did not. To determine effects of protein supplement on parasite susceptibility, fecal egg counts and parasite levels were monitored, and recorded biweekly in all does and their continuously suckled kids. Likewise, growth performance was observed through bi-weekly measurements of body dimensions, body condition and live-weights in does and kids. Visual observations of grazing behavior were made and recorded. The results indicated positive effects of feeding protein on growth performance and parasite susceptibility **(Figure 1)** of goats early on in the study (mid-spring). However, during the latter half of the study (late-spring) the positive effects were not as apparent. The absence of positive effects of protein supplementation during the onset of the summer period was attributed to changing environmental conditions and increasing levels of parasite within the production environment of these goats. In addition, the increases in grazing activity, as well as the reduced variety, quality and availability of forage inevitably contributed to increasing parasite susceptibility in both does and their continuously suckled kids. Arguably, there is a need for increasing the availability of dietary protein for lactating does and growing kids in this type of production environment prior to the summer period.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

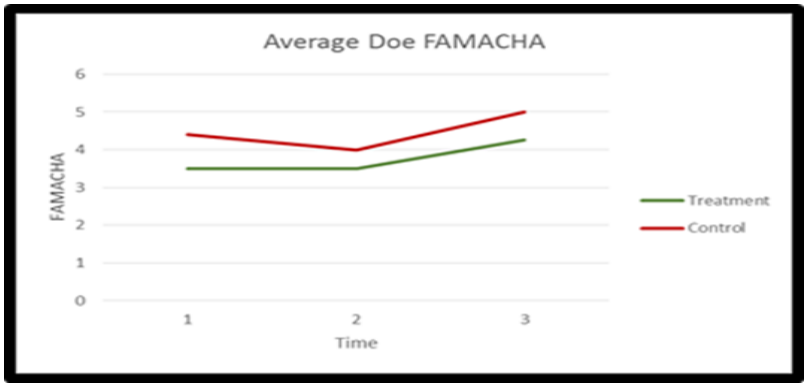


Figure 1. The effect of supplementing protein (treatment) on changes in parasite level (FAMACHA) of postpartum doe goats during the late spring to early summer (Times 1, 2 and 3) period of 2015.

Soil Quality at the Berea College Farm. Lillian Setters, Amanda Burns and Mary Parr. Agriculture and Natural Resource Program, Berea College, Berea, Kentucky, 40404.

Abstract

Soil quality is the ability of a soil to perform the 6 main soil functions. Soil quality is affected by different agricultural practices such as tillage, animal activity, and cropping. In this study we sampled 19 fields at the Berea College Farm varying in management strategy and measured soil function in terms of soil bulk density, water infiltration, organic matter content, microbial respiration and aggregate stability. Soils with a history of pig production had significantly reduced water infiltration compared to cropped fields. However, microbial respiration was increased in fields with pig production compared to other histories. These preliminary data suggest that while pig production on pastures does affect soil function, the overall effect on quality is yet to be determined.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

Lawn Care. Chad Repp, Tamara Pacheco, David Battoe, Madelaine Collet and Daniel Feinberg. Art and Art History Program, Berea College, Berea, Kentucky, 40404.

Abstract

As society continues to shift toward technologies that perform tasks independent of human interaction, one assumption might be that humans will eventually cast aside all labor in favor of perpetual leisure time. *Lawn Care* offers an alternate assumption that such technological advances will eliminate the labor-leisure binary. It proposes that though the ability to perform labor without human interaction is available, humans will continue to perform the labor anyway, albeit with a different motivation than currently exists. This labor system would open up new aesthetic opportunities for labor practices whose aesthetics have largely been dictated by an agenda to maximize productivity. *Lawn Care* is a performance project that provides a glimpse into this type of labor dynamic. A team of fifty-four will maintain lawns using specially constructed *shear-shoes* — highly stylized size-20 basketball shoes retrofitted with height-adjustable scissors that a person with average-sized feet can wear comfortably. The scissors clip with every step, allowing the wearer to cut grass while walking. The performers will also rest in seating modeled after iconic mid-century modern furniture pieces, such as the Mies van der Rohe Barcelona chair, the Le Corbusier Chaise Longue, the Eames Lounge chair, and the Eero Aarnio Bubble chair — all of which were established as symbols of the future, but are now symbols of extravagance. Reframing these chairs as a means of rest during what we currently consider a hard day of blue-collar work moves toward reassessing what the labor itself represents. The chairs have been redesigned to fold up and fit into carrying cases, akin to military campaign furniture. The cases are modeled after Louis Vuitton hard-sided valises and also transport the shear-shoes.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

The Student Built Kiln: Exploring Sustainable Practices in the Ceramics Studio. Noah Broomfield, Lindsey Harper, Felicia Flesch and Philip Wiggs. Art and Art History Program, Berea College, Berea, Kentucky, 40404.

Abstract

The focus of this creative project was the design, building, and firing of a 40 cubic foot wood-fired bourry-box style ceramic kiln by students and the Resident Potter in the kiln yard of the Ceramics Studio at Berea College. During this kiln-building project, participants studied several wood-fired kiln designs, and chose the bourry-box kiln for its economy and simplicity to fire. Issues of sustainability in firing practices, the knowledge of the safe use of tools in building ceramic kilns, and the creative implementation of kiln design were all explored during this project. This kiln will continue to be used by future students and faculty at the Berea College Ceramics Studio.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

A Preliminary Species Identification for an Isolated Population of Salamanders of the *Plethodon glutinosus* Complex. Morgan Stacy, Jeremy Wilde, Zachary Spicer and Roy Scudder-Davis. Biology Program, Berea College, Berea, Kentucky, 40404.

Abstract

An isolated population of salamanders exists on the edge of Fee Glade in the interior of the Berea College campus. The salamander is obviously a member of the *Plethodon glutinosus* complex which consists of as many as 16 species. The two species of the complex that occur in close proximity to Berea are the slimy salamander, *Plethodon glutinosus*, and the Cumberland Plateau salamander, *Plethodon kentucki*. Seven body measurements were made on adult specimens from Fee Glade and from specimens of *P. glutinosus* and *P. kentucki* collected from nearby populations. The seven measurements were used to determine eight body ratios (e.g. head length to body length). *Plethodon glutinosus* and *P. kentucki* differed significantly in five of the eight ratios. The Fee Glade specimens and *P. kentucki* differed significantly in seven of the eight ratios. The Fee Glade specimens and *P. glutinosus* differed significantly in only one of the eight ratios. The results indicate that the Fee Glade salamander has a greater affinity with *P. glutinosus*. The small sample size for each species (4 *P. glutinosus*, 3 *P. kentucki*, 8 Fee Glade) prevents us from making a definitive identification for the Fee Glade salamander. More specimens from multiple populations of *P. glutinosus* and *P. kentucki* need to be included in the analysis before proceeding to the next step (genetic analysis) in determining the species identity of the Fee Glade salamander.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation- Zoology Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College URCPP

Figure 1. Salamanders in Fee Glade.

Comparison of Dormancy States and Germination Patterns in Seeds of *Calycanthus floridus* L. (Eastern Sweetshrub). Moondil Jahan, Kevin Montgomery, Olamide Adejumo and Christopher A. Adams. Biology Program, Berea College, Berea, Kentucky, 40404.

Abstract

Calycanthus floridus is a shrub of the Calycanthaceae native to eastern U.S. forests from New York to Florida. Many fruits are not dispersed following maturation and may remain on the plant until the next year's flowering commences. Prior research has determined that seeds possess physical dormancy, and the seed coats must be made permeable to water before germination can occur. Seeds in fruits that are retained on the mother plant can be exposed to various dormancy-breaking mechanisms. Furthermore, it has been determined, in the last decade, that some species with physical dormancy can exhibit a dormancy cycling process if their seeds break physical dormancy but are prevented from germinating. The purpose of this study was to determine if seeds retained on the mother plant have their dormancy broken while in the fruit and, thus, exhibit different germination patterns from those seeds in fruits dispersed soon after maturity. Seeds were subjected to various scarification methods to break physical dormancy and then incubated at 25°C as were freshly matured seeds dispersed soon after maturation. Seeds with delayed dispersal germinated to significantly higher percentages in the following treatments: wet heat with vibration (27% vs. 18%) and buried seeds under burned soil (8% vs. 5%). In all other treatments, however, seeds germinated to significantly lower percentages or at approximately the same percentages as dispersed seeds. Thus, at least some seeds may have physical dormancy broken while still within the fruits. It is not clear, however, as to whether other seeds are undergoing dormancy cycling or simply have not broken physical dormancy.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Botany Section: 3rd Place Undergraduate Research Competition)

Funded by Berea College URCPP

Comparisons Between Prey Species in Barn Owl (*Tyto alba*) Pellets Collected in 1988, 1996, and 1997 From a Silo Roost in Harrogate, TN. Geri Mitchell, Sean Nilan, Jessica Vinson, G. Neil Douglas and Ralph L. Thompson. Biology Program, Berea College, Berea, Kentucky, 40404.

Abstract

Barn Owl (*Tyto alba*) pellets collected in 1997 from the campus of Lincoln Memorial University in Harrogate, Tennessee contained 311 individual prey. Vertebrate prey remains identified, from most to least abundant, included short-tailed shrews (*Blarina brevicauda*; 39.5%), least shrews (*Cryptotis parva*; 14.5%), southern bog lemmings (*Synaptomys cooperi*; 12.9%), hispid cotton rats (*Sigmodon hispidus*; 8.4%), pine voles (*Microtus pinetorum*; 3.9%), deer mice (*Peromyscus* spp.; 3.5%), eastern harvest mice (*Reithrodontomys humulis*; 2.6%), house mice (*Mus musculus*; 2.3%), prairie voles (*Mictrotus ochrogaster*; 1.9%), eastern cottontails (*Sylvilagus floridanus*; 1.9%), avian spp. (1.2%), and *Sorex* spp. (0.3%). Three Norwegian rats (*Rattus norvegicus*; 1.0 %) were identified also. Unlike pellets collected in 1996, black rat (*Rattus rattus*) remains were absent. Compared to Copeland and Caldwell (1991), pellets from the same silo roost analyzed in the current study contained increased ratios of *Blarina brevicauda* to *Cryptotis parva* ($\chi^2 = 10.1$, d.f. = 1, $P < 0.05$, 3.84) and *Synaptomys cooperi* to *Microtus* sp. ($\chi^2 = 16.7$, d.f. = 1, $P < 0.05$, 3.84). Prey taken by Barn Owls can be affected by owl hunting preference, habitat, climate, interspecies competition, and population dynamics. Nonetheless, owl pellet analysis remains a good indicator of the presence of species, especially those difficult to trap like *Synaptomys cooperi* and *Cryptotis parva*, within a particular area during a specific timeframe.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Zoology Section)

Funded by Berea College URCPP

Does Membrane Composition Affect Whole-Animal Performance and Thermal Tolerance in the Eastern Newt (*Notophthalmus viridescens*)? Sarah Tabor[1], Sam Moody[1], Cameron J. World[2], Nancy J. Berner[2] and Patrick M. Mineo[1]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Sewanee: The University of the South, Sewanee, Tennessee, 37383.

Abstract

To maintain membrane function at low temperature, many ectotherms that live in temperate climates incorporate more polyunsaturated fatty acids (PUFAs) into their membranes during winter. The eastern newt (*Notophthalmus viridescens*) uses thermal acclimation to remain active throughout the year. Winter-acclimated newts swim faster at low temperature and have higher activities of metabolic enzymes in skeletal muscle compared to summer-acclimated newts. The muscle membranes of winter-acclimated newts also have higher PUFA contents compared to summer-acclimated newts, and northern populations have muscle membranes with higher PUFA contents than southern populations. However, it is not clear how seasonal membrane remodeling and differences in membrane composition between populations affects whole-animal performance. To determine if the remodeling of membranes affects thermal tolerance and the thermal dependence of swimming performance, we manipulated membrane composition independent of acclimation temperature. Newts were separated into four diet regimes: high saturated fatty acid (SFA), high monounsaturated fatty acid (MUFA), high omega-3 PUFA, and high omega-6 PUFA for 12 weeks. All newts were housed at 20°C (12L:12D). Next, we measured the swimming speed of newts at a range of temperatures between 6-33.5°C. We also measured the lower critical temperatures (CT min) and upper critical temperatures (CT max) of newts.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Physiology and Biochemistry Section)

Funded by Berea College URCPP

Diversity of Stream Salamanders in Relation to Human Disturbance and Watershed Affiliation in Central Kentucky. Zachary Spicer, Morgan Stacy, Jeremy Wilde and Roy Scudder-Davis. Biology Program, Berea College, Berea, Kentucky, 40404.

Abstract

The headwater streams to the east and north of Berea are part of the Kentucky River watershed. Those to the south are part of the Cumberland River watershed. Headwaters of the two watersheds come to within 0.8 miles of each other at the closest point. The current study compared the diversity of stream salamanders in headwater streams near Berea Kentucky in relation to habitat disturbance and watershed affiliation.

A total of eleven creeks were sampled: six in the Kentucky River watershed and five in the Cumberland River watershed. Four of the six creeks in the Kentucky River watershed and two of the five creeks in the Cumberland River watershed were in disturbed habitats as established by proximity to man-made structures and the presence of invasive plant species such as the tree of heaven, *Ailanthus altissima*. Streams in non-disturbed habitats had either four or five salamander species. Streams in disturbed habitats had predominately a single species, the southern two-lined salamander, *Eurycea cirrigera*. Each of the two non-disturbed streams of the Kentucky River watershed had the same four salamander species, while the streams of the Cumberland River watershed had the same four species as in the Kentucky River watershed with the addition of the seal salamander *Desmognathus monticola*. The reasons for *E. cirrigera* being the only species present in disturbed habitats, and for *D. monticola* being absent from the streams of the Kentucky River watershed have yet to be determined.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Ecology and Environmental Science Section)

Funded by Berea College URCPP

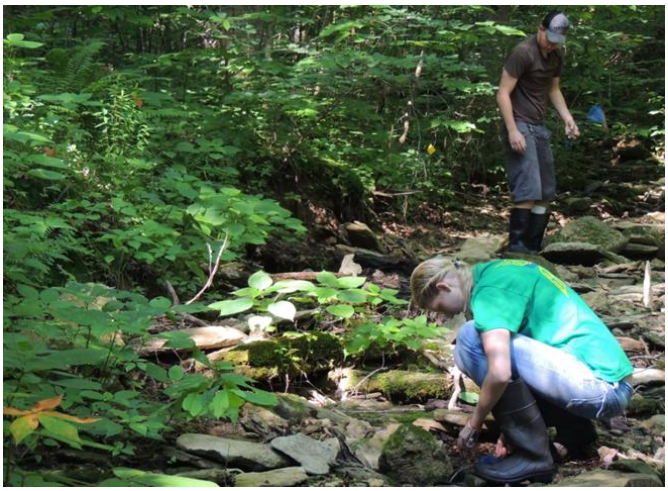


Figure 1. Collecting Stream Salamanders.

Dormancy-Breaking and Germination Patterns in Seeds of *Calycanthus floridus* L. (Eastern Sweetshrub). Olamide Adejumo, Moondil Jahan, Kevin Montgomery and Christopher A. Adams. Biology Program, Berea College, Berea, Kentucky, 40404.

Abstract

Calycanthus floridus is a shrub of the Calycanthaceae native to eastern U.S. forests from New York to Florida. Dormant seeds are produced in dry, leathery capsules that mature in late fall. The literature contains no studies dealing with seed dormancy-breaking and germination patterns for this species. The purposes of this study were to (1) determine the type of dormancy possessed by seeds of *C. floridus* and (2) determine the most effective method of breaking the specific dormancy type. Using an imbibition curve study, it was determined that seeds possess physical dormancy, that is, the seed coat is impermeable to water at seed maturity; the coat must be made permeable to water before germination can occur. Seeds were subjected to various scarification methods known to break physical dormancy including mechanical scarification, submersion in acid, exposure to freeze/thaw cycles, a combination of heat with vibration, and exposure to fire. Seeds were then placed in an incubator at 25°C and germination was recorded daily. Mechanical scarification of the seed coat was the most effective method, producing 92% germination after 20 days of incubation. Other methods, except seeds exposed to surface fire (0%), produced at least some germination after 20 days of incubation. Thus, seeds of *C. floridus* possess physical dormancy and mechanical scarification appears to be the most effective method of breaking dormancy and promoting germination.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation).

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Botany Section)

Funded by Berea College URCPP

Engineering Stress-Resistant Mouse Embryonic Stem (ES) Cells. Maria Anastasiadou[1] and Wallace Chick[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Charles C. Gates Center for Regenerative Medicine and Stem Cell Biology, University of Colorado Denver, Denver, Colorado, 80204.

Abstract

In many animal models such as fruit flies, mice, and worms, stress resistance has been previously shown to be a surrogate marker for longevity. Therefore, by causing oxidative stress to mouse embryonic stem cells we were able to mutagenize them and uncover novel genes/pathways that impart stress resistance. Using a transposon-based gene trapping technique, we were able to mutate and identify the disrupted genes that mediate increased stress resistance, without having to engineer live mice. Instead, we put the mouse embryonic stem cells through oxidative stress, and identified the insertion site of the mutagen. Finally, we were able to successfully mutate 5 genes in total, one of which has been previously linked to cataracts, which are a sign of senescence.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation).

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Cellular and Molecular Biology Section)

Funded by Berea College Office of Internships and University of Colorado Denver

Expression and Purification of Transforming Growth Factor Receptor β-II Cytoplasmic Tail From *E. coli*. Kidist Ashami[1], Hongjun Liao[2] and Ambra Pozzi[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

Transforming growth factor-β (TGF-β) mediates both the development and the progression of kidney fibrosis via activation of Type II TGF-β receptor (TβRII). The laboratory of Dr. Pozzi has recently identified tyrosine residues within the cytoplasmic tail of TβRII (TβRIICT) to be able to activate downstream signaling and that they are essential for TβR-dependent fibrotic signaling cascade. However, it is unclear how these tyrosine residues are phosphorylated, since TβRII lacks tyrosine kinase activity. To screen for tyrosine kinases that can directly phosphorylate the TβRIICT, we subcloned, expressed, and purified the recombinant TβRIICT from *E. coli*. To do this, we subcloned TβRIICT cDNA in PGEX-6P-1 and the correct 'in frame' insertion was verified by partial DNA sequencing and restriction enzyme digestion. Then, we transformed the newly generated constructs into the *E. coli* line BL21. Following an overnight culture, we induced TβRIICT protein expression by treating the culture with Isopropyl-1-thio-β-D-galactopyranoside (IPTG) at 18°C. Glutathinoe-S-Transferase (GST)-tagged-TβRIICT was then purified through a Glutathione-Agarose column and GST was removed by TβRIICT site specific HRV 3C protease cleavage. We verified successful cleavage by Coomassie and Western blot analysis, and the purified protein was now ready for Kinase screening through the Kinase Fiber Service. Finding the tyrosine kinases involved in TβRIICT phosphorylation will significantly contribute to our studies aimed to understand how TβRIICT tyrosine phosphorylation controls fibrosis.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster Presentation)

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Health Sciences Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College Office of Internships, Hal Moses/Aspirnaut Research Internship and Vanderbilt University

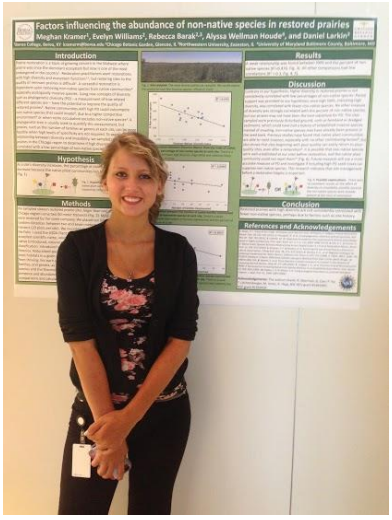
Factors Influencing the Abundance of Non-Native Species in Restored Prairies. Meghan Kramer[1], Evelyn Williams[2], Rebecca Barak[2,3], Alyssa Wellman Houde[4] and Daniel Larkin[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Chicago Botanic Garden, Glencoe, Illinois, 60022. [3]Northwestern University, Evanston, Illinois, 60208. [4]University of Maryland, Baltimore County, Baltimore, Maryland, 21250.

Abstract

Restoration efforts of prairie ecosystems have increased as prairies have moved from a once dominant landscape to one of the most endangered. High quality restorations are desired to match the remnant prairies that are now being protected. New concepts, such as phylogenetic diversity (PD), have the potential to improve the quality of restored prairies. We hypothesized that native communities are able to better resist invasive species as their diversity increases. We sampled sixteen restored prairies in the Chicago region to examine our proposed hypothesis that sites with high diversity were correlated with a lower abundance of non-native species. I calculated the Shannon-Weiner Diversity Index, number of species, genera, and families at each site as well as the correlation between diversity measures and the percent of non-native species. A weak relationship was found between the Shannon-Weiner Diversity Index and the percent of non-native species at each site. Contrary to our hypothesis, higher diversity restored prairies were not consistently correlated with low percentages of non-native species, perhaps due to other factors such as site history. Future research will use a more accurate measure of PD and investigate if including high PD seed mixes can suppress non-native species. This research indicates that site management before installing a restoration is important.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by NSF grant #1354426 and NSF REU grant #1461007



Identification of Lead Compounds That Differentially Target Integrin α1β1 and α2β1 I-Domains for the Treatment of Kidney Fibrosis. Hanna Abe[1], Billy Hudson[2] and Kyle Brown[2]. [1]Biology Program, Berea College, Berea, Kentucky 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

Kidney fibrosis is the accumulation of extra cellular matrix (ECM) proteins, primarily collagen, often resulting in organ failure. Integrins are transmembrane receptors that interact with the ECM and regulate collagen production and turnover. Collagen binding to integrin α2β1 initiates collagen production while collagen binding to integrin α1β1 initiates collagen turnover. This study specifically focuses on subdomains of integrins called I-domains that are responsible for ligand binding and initiation of signal transduction. Ligand adhesion to the I-domain is contingent on a metal ion dependent adhesion site (MIDAS). This study investigates if small molecules have agonistic or antagonistic effects on the binding of calcium and magnesium ions to integrin α1β1 and α2β1 I-domains, in turn inhibiting collagen binding. Three classes of compounds, inorganic, antibiotic, and vasodilators, were screened to test differential inhibition of collagen binding. Competitive solid phase binding ELIZA assays were used to measure the effect of compounds on binding. We observed that Diltiazem, a vasodilator, produces a 4-fold increase in collagen binding to the α1 I-domain, but not the α2 I-domain. We anticipate that the identification of lead compounds that differentially affect integrin α1β1 vs. α2β1 I-domains' collagen binding will aid in the development of therapies in the treatment of kidney fibrosis.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Physiology and Biochemistry Section)

Funded by Berea College Office of Internships, Hal Moses/Aspirnaut Research Internship and Vanderbilt University

Integrin Subunits α3 and α6 Mediate FGF10-Dependent Signaling Events in Collecting Duct Cells Bound to LM511. Sophia Toé[1], Tianxiang Tu[2], Olga Viquez[2], Eugenia Yazlovitskaya[2] and Roy Zent[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2] Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

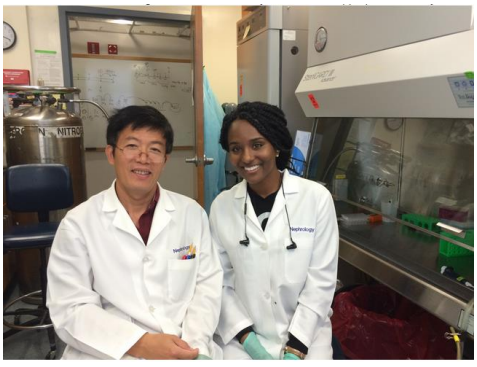
The collecting system of the kidney develops from the ureteric bud (UB), which undergoes branching morphogenesis, a process regulated by multiple factors, including cell–extracellular matrix (ECM) interactions. Integrins are the principal cell receptors for ECM and the laminin (LM)-binding integrins (Itg) α3β1, α6β1 and α6β4 are essential in this process. In addition, fibroblast growth factors (FGFs) are involved in the cell signaling pathways in this developmental process. The role of laminin-binding integrins α3β1, α6β1 and α6β4 in FGF10-dependent signaling events that regulate renal branching morphogenesis has not been investigated. In this study, we used collecting duct cells (CD) which lack specific integrin subunits to identify these interactions. Itgα3$^{f/f}$α6$^{f/f}$ and Itgα3$^{-/-}$α6$^{-/-}$ CD cells were plated on LM511, treated with FGF10 and then assessed for spreading. In addition, CD cell lysates were immunoblotted to determine Akt activation. Itgα3$^{-/-}$α6$^{-/-}$ CD cells showed reduced spreading and Akt activity. Akt activity was also reduced in Itgα3$^{f/f}$α6$^{f/f}$ CD cells treated with Akt Inhibitor IV. This data suggests that the interactions of integrin α3β1 and all α6 subunit containing integrins with LMs regulate FGF10-dependent activation of Akt signaling which mediates CD cell spreading. Thus, the interaction of FGF10 with LM binding integrins α3β1, α6β1 and α6β4 may play a role in UB branching morphogenesis.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster Presentation)

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Cellular and Molecular Biology Section)

Funded by Berea College Office of Internships, Hal Moses/Aspirnaut Research Internship and Vanderbilt University



Lysyl Oxidase Homolog Extracellular Processing. Jazmin Escamilla[1], Alberto J. López-Jiménez[2], Catalina B. Kretschmar[2] and Roberto Vanacore[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

Glomerulosclerosis, the final common pathway for all glomerular diseases including diabetic nephropathy, is characterized by an accumulation of excessive amounts of cross-linked collagen IV and other extracellular matrix (ECM) proteins in the glomerulus leading to a sustained and progressive decrease of kidney function. Our previous research suggests that a lysyl oxidase homolog (LOH) promotes crosslinking of collagen IV. Although LOH function is important for maintaining ECM integrity, its deregulation may lead to excessive crosslinking and fibrosis. LOH is found as a full-length form (~100kDa) and processed form (~65 kDa), indicating that the enzyme undergoes proteolytic processing that may be important for LOH-mediated crosslinking of collagen IV. Because the enzyme responsible for processing the homolog has not been identified, the purpose of this study was to test an *in-silico* predicted subtilisin-like cleavage site that may drive LOH processing. Using site directed mutagenesis PCR, we introduced specific mutations on the predicted subtilisine-like cleavage site designed to modulate processing of the LOH. Vectors containing the mutated cDNAs were transfected into a human cell culture model to express the proteins. Immunoblotting detection of LOH in the cell culture media demonstrated that the predicted cleavage site is responsible for the generation of the (~65 kDa) form. However, further work is required to characterize the role of proteolytic processing in LOH activation and collagen IV crosslinking.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster Presentation)

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Cellular and Molecular Biology Section)

Funded by Berea College Office of Internships, Hal Moses/Aspirnaut Research Internship and Vanderbilt University

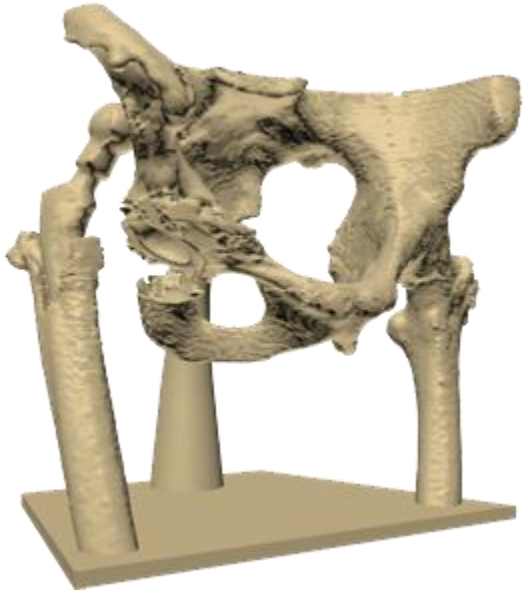
Medical 3D Printing: An Overview. Michael James[1] and Doug Neckers[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Spectra Group Limited, Millbury, Ohio, 43447.

Abstract

As 3D printing advances, it becomes capable of greater and greater feats of creativity and engineering. As part of an internship with Spectra Group Limited, Dr. Doug Neckers tasked me with researching the known uses of 3D printing in relation to medical applications, and with successfully producing 3D medical models given MRI and CT data. Using Berea College library resources, personal contacts, and contemporary 3D printing news, a list of uses for medical 3D printing including medical education, surgical planning, and medical product development was created. After some time, medical data in DICOM format was obtained and successfully used to create digital models, made using Slicer and refined using Autodesk's 3ds Max. Finally, a consumer grade stereolithographic 3D printer was used to print the models, and experiments were conducted to test methods for highlighting visual information on the printed models.

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Science Education Section: 2nd Place Undergraduate Research Competition)

Funded by Spectra Group Limited



pH Induced Compaction of the N-Terminal Domain of Lipidated Caveolin-3. Kaitlyn Reasoner[1], Jonathan P. Schlebach[2], Ji-Hun Kim[2], Zhenwei Lu[2] and Charles R. Sanders[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Department of Biochemistry and Center for Structural Biology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

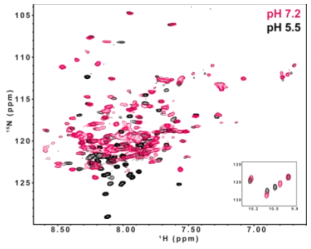
Caveolae are 50-100 nm omega-shaped invaginations in the plasma membrane that are involved in cellular signaling and trafficking. Caveolar biosynthesis and stabilization are dependent upon caveolins, which are 21-24 kDa scaffolding proteins in the plasma membrane. Caveolin-3 (Cav3), the member of the caveolin family that is expressed in muscle tissue, has been implicated in the pathology of muscular and cardiac disorders. Structural characterization of Cav3 is necessary to determine the molecular basis of these diseases. Cav3 is characterized by its intramembrane horseshoe turn which facilitates cytoplasmic localization of both the N and C terminal domains. Our initial research has indicated that at low pH, the N-terminus of Cav3 weakly binds to the membrane interface, which may enhance oligomerization. The purpose of this study was to continue to determine how pH influences the structural and topological characteristics of Cav3. Cav3 was expressed in *E. coli*, and purified with affinity chromatography. Solution NMR was used to probe the structural characteristics of Cav3 at varying pH. Transverse relaxation-optimized spectroscopy (TROSY) and nuclear Overhauser effect spectroscopy (NOESY) experiments were conducted at two different pHs. Results indicate that the N-terminal domain adheres to the membrane at low pH, perhaps providing protection from lysosomal degradation. Further characterization of the structure of Cav3 will provide critical information on its role in various muscular diseases.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster Presentation)

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation).

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Physiology and Biochemistry Section: 3rd Place Undergraduate Research Competition)

Funded by Hal Moses/Aspirnaut Research Internship and National Institute of Diabetes and Digestive and Kidney Diseases and National Institutes of Health under award number 1R25 DK096999-01



Physiological Dormancy and Germination Patterns in Seeds of the Rare Yellow Gentian (*Gentiana flavida* Muhl). Kevin Montgomery, Moondil Jahan, Olamide Adejumo and Christopher A. Adams. Biology Program, Berea College, Berea, Kentucky, 40404.

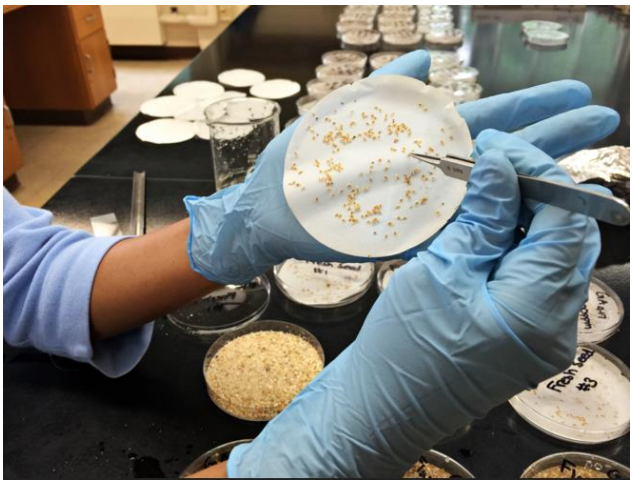
Abstract

Gentiana flavida (yellow gentian) is a perennial member of the Gentianaceae that grows in open habitats, such as old fields, mesic soil prairies, and limestone glades. The species is known to occur in 14 states, being assigned a rank of threatened, endangered, or rare in 11 states. In Kentucky, *G. flavida* is known to occur in only seven counties. Seeds have been determined to possess physiological dormancy, requiring the cold, wet conditions of winter to break dormancy. The purposes of this study were to determine (1) if there is year to year variation in the seed germination patterns of the species, (2) if gibberellic acid is important in the dormancy-breaking process, and (3) which specific type of treatment is most effective. Seeds dispersed in October 2014 were subjected to various periods of cold stratification (0-12 weeks) at 5°C, then moved to 25°C where daily germination was monitored. Ten to twelve weeks of cold stratification produced significantly higher germination than the other treatments, as was observed in the 2013 cohort. Germination percentages from the 2014 cohort, however, were significantly lower than those of the 2013 cohort. Therefore, year to year variation in cohort germination is likely. Gibberellic acid was effective in breaking physiological dormancy, resulting in relatively rapid germination. Seeds were exposed to treatments of GA3, GA4+7, and a combination of GA3,4+7 at various concentrations. All treatments produced germination at the higher concentrations (500 and 1000 ppm), indicating that gibberellins are likely responsible for releasing the seeds from their dormant condition following the cold stratification cue in nature.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Botany Section)

Funded by Berea College URCPP



The Bioactivity of Pericellular Matrix From Adult Stem Cells. Hsuan Peng[1], Yangzi Jiang[2] and Rocky S. Tuan[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]University of Pittsburgh, Pittsburgh, Pennsylvania, 15260.

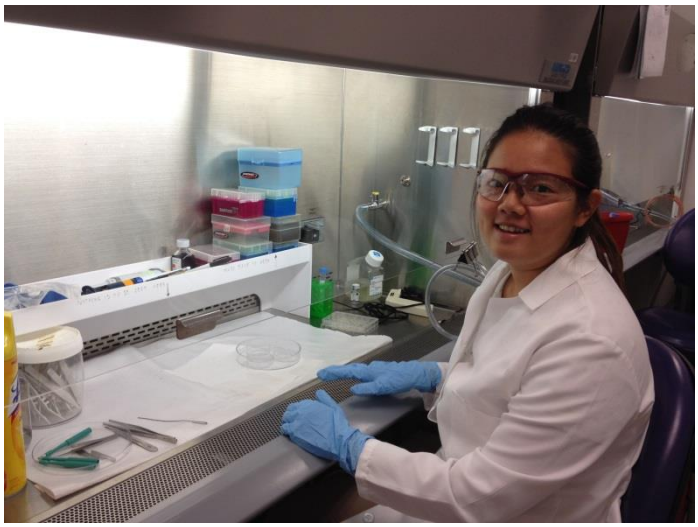
Abstract

Cells are surrounded by local extra cellular matrix (ECM) and neighboring cells in tissue. Pericellular Matrix (PCM) lies between the interface between the plasma membrane and the extracellular matrix. It is the site where integral membrane proteins can interact with the meshwork of proteoglycans, glycolipids, and hyaluronan immediately surrounding a cell. The PCM acts as a microenvironment that interacts with local cells in a reciprocal manner. The cells of a tissue are responsible for producing the PCM, which in term regulates their bioactivities. A key challenge in stem cell research is learning how to direct the differentiation of stem cells toward specific fates. It is known that factors such as bioactive molecules presented in ECM and PCM can regulate stem differentiation potential. To investigate the influence of stem cell-derived extracellular matrix on human bone marrow-derived mesenchymal stem cells (hBMSCs), ECM was isolated from three lineages of stem cells, adipose stem cells (hASCs), bone marrow mesenchymal stem cells (hMSCs), and chondrogenic progenitor cells (hCPCs). Change of gene expression profiles was observed in hBMSCs after 7 days of 3D culture in three different lineages of stem cell derived ECMs.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Cellular and Molecular Biology Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Office of Internships and University of Pittsburgh



The Dynamics of Immunoediting in Skin Carcinogenesis. Chi Peng[1] and Dennis Roop[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Charles C. Gates Center for Regenerative Medicine and Stem Cell Biology, University of Colorado Denver, Denver, Colorado, 80204.

Abstract

The total cost of cancer to society in 2010 was estimated at 263.8 billion dollars. Greater than half of this amount was lost indirectly through morbidity and mortality, making the potential benefits of generalized cancer prevention enormous. Since the human immune system is able to recognize and eliminate transformed cells, immunotherapy is a promising approach for cancer prevention. While these strategies remain very promising for cancer treatment, they are unlikely to provide a preventative approach since nascent transformed cells have undergone less progression than the cells of a mature cancer. The theory of immunoediting, championed by Robert Schreiber, provides a well-supported theory that unifies all observed interactions between the immune system and unseen, transformed cells. This process contains three distinct phases known as elimination, equilibrium, and escape. The major goal is to characterize transformed cells of the first two stages of immunoediting, which occur prior to visible tumor formation. Using genetically-engineered mouse models (GEMMs), observation and isolation of covert transformed cells in vivo were established. This novel system will allow characterization of both the immune effectors and also the immunologically relevant adaptations of unseen, cutaneous neoplasms as they progress toward malignancy. Isolation of these cells for the first time will allow screening for drugs and small molecules that may be used to directly target them or sensitize them to an accompanying vaccine. Importantly, a preventative approach could address the complications of metastasis since early targeting could eliminate cells before dissemination or outgrowth in the secondary site.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Cellular and Molecular Biology Section)

Funded by Berea College Office of Internships and University of Colorado Denver

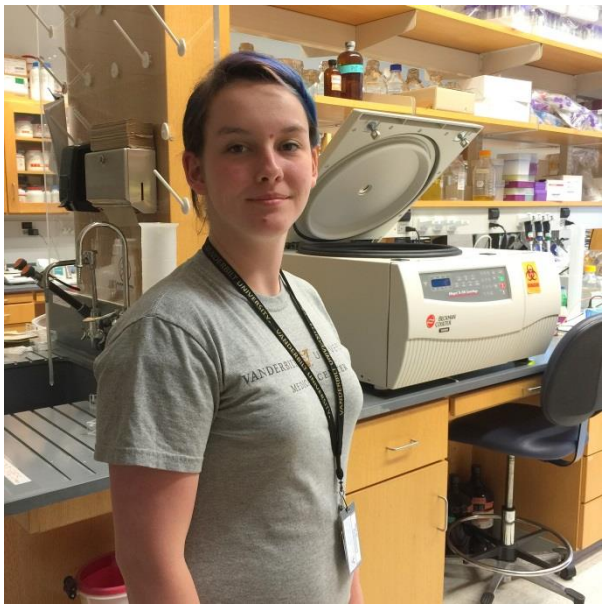
The Effect of Ziram on Cortical Neurons Through E1 Inhibition. Monica Moran[1], Diana Neely[2], Kathleen Dennis[2] and Aaron Bowman[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Department of Neuroscience, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

Dysfunction of the ubiquitin-proteasome pathway has been suggested to play a role in Parkinson's disease pathogenesis. The ubiquitin-activating enzyme E1 plays a critical role in starting the cascade of events for ubiquitin activation. Ubiquitin is vital for several neuronal mechanisms such as cell viability, proliferation, synaptic plasticity, synapse development, and neuronal transmission. Here we show that Ziram, one of the pesticides associated with increased risk for Parkinson's disease, causes neurotoxicity and inhibits the activity of the ubiquitin-activating enzyme E1 in cortical glutamatergic and midbrain dopaminergic neurons differentiated from human-induced pluripotent stem cells derived from control subjects.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster presentation)

Funded by Hal Moses/Aspirnaut Research Internship and National Institute of Diabetes and Digestive and Kidney Diseases and National Institutes of Health under award number 1R25 DK096999-01



Thermal Tolerance Differs Between Terrestrial and Aquatic Life History Stages in the Eastern Newt (*Notophthalmus viridescens*). Sunaina Sherchan, Sarah Tabor and Patrick M. Mineo. Biology Program, Berea College, Berea, Kentucky, 40404.

Abstract

Due to the effect of temperature on the rates of biochemical reactions, environmental temperature is an important determinant of physiological function in ectotherms. Not surprisingly, many ectotherms have adapted to function optimally at their respective environmental temperatures. Due to the physical properties of water, ectotherms that live in aquatic environments experience less daily temperature variation compared to those from terrestrial environments. Ectotherms from variable thermal environments should maintain function over a wider range of temperatures compared to those from stable environments. However, few studies have investigated how temperature affects the physiological function of a single species that experiences different thermal environments throughout its life cycle. The eastern newt (*Notophthalmus viridescens*) alternates between terrestrial and aquatic life history stages. Adults are fully aquatic, whereas juveniles are terrestrial. Therefore, we asked whether metabolic rate and thermal tolerance differed between aquatic and terrestrial life history stages. We collected juvenile and adult newts during the summer. All newts were maintained for one week prior to experiments. To determine if the effect of temperature on metabolic rate differs between life history stages, we measured the metabolic rate of juvenile and adult eastern newts at 8˚C and 26˚C. Metabolic rate did not differ between adults and juveniles at either temperature. To determine if thermal tolerance differs between life history stages, we measured the critical thermal maximum (CT max)–the temperature at which the animal loses its righting response. CT max was lower in juveniles compared to adults, indicating that adults can tolerate higher temperatures than juveniles.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Physiology and Biochemistry Section)

Funded by Berea College URCPP

A Simple Mechanochemical Aryl Bromination Procedure. Katie Bragdon, Dorothy Coe and Nicholas Marshall. Chemistry Program, Berea College, Berea, Kentucky, 40404.

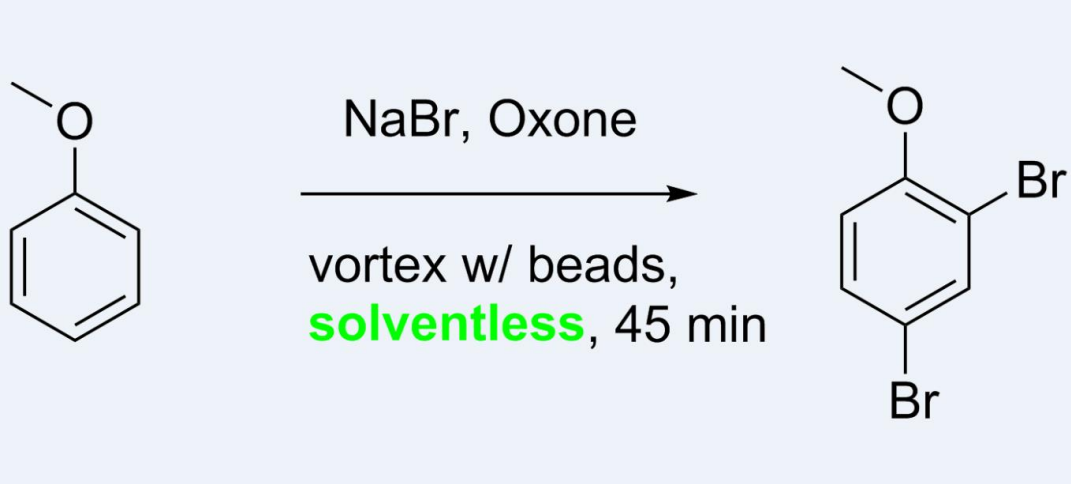
Abstract

A series of aromatic compounds (11 examples) were halogenated to give aryl bromides and dibromides in 45-73% yield using simple mechanochemical techniques based on a laboratory vortex mixer or rock tumbler and requiring no specialized costly equipment. No solvent or external heat was used, giving a particularly green procedure. Bromination was effected under these conditions with a mixture of "Oxone" (potassium monopersulfate triple salt) and sodium bromide, mild reagents with low toxicity. Aniline was not brominated under these conditions, but underwent oxidative polymerization resulting in the first reported solventless preparation of polyaniline.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral and Poster Presentations-Organic/Inorganic Chemistry Section)

Funded by Berea College URCPP



Abnormal N-Heterocyclic Carbene Complexes. Lyndsey J. Barker, Maria S. Ledesma-Alonso, Samuel A. Effoe, Benjamin R. Quesada and Anes Kovacevic. Chemistry Program, Berea College, Berea, Kentucky, 40404.

Abstract

N-heterocyclic carbenes have become increasingly popular ligands for organometallic catalysis in recent years. They are found to be a good alternative for more traditional phosphine based ligands. These carbenes are fully tunable sterically and to some extent electronically. For normal N-heterocyclic carbenes, the metal will typically bind to the front of the ligand. In abnormal N-heterocyclic carbenes, the front of the ligand (position 2) is blocked, forcing the metal to bind to the back of the ligand (positions 4 & 5). Due to the binding in the back, abnormal carbenes are better electron donors than normal carbenes, making them useful in homogenous catalysis.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section)

Funded by Berea College URCPP

Chemical and Physical Resistance of Guayule and Nitrile Blend Rubber Gloves. Boubacar Cherif[1] and Katrina Cornish[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]The Ohio State University, Columbus, Ohio, 43210.

Abstract

Natural rubber latex is harvested by tapping trees such as the *Hevea brasiliensis* Muell. Arg, (para or Brazilian rubber tree) and or the parenchyma cells of *Parthenium argentatum* Gray (guayule). 89% of all the latex is converted to solid rubber for applications such as tires. However, 11% is partially dewatered and used to make items as medical gloves, dental dams, balloons and condoms. Natural rubber latex is used in these applications due to its ability to maintain a superior mechanical performance compared to synthetic rubbers such as nitrile. Another advantage is the ability of natural rubber to maintain a comfortable fit (almost as a second skin) and high level of tactile sensitivity. Although natural rubber is very elastic and strong, protein constituents in *Hevea* can cause severe latex allergies, and it has low chemical resistance against most hydrocarbon and organic solvents. Guayule latex circumvents latex allergies but is still sensitive to organics. Synthetic gloves avoid Type I (immediate) latex allergies, but both natural and synthetic materials usually contain residual irritant accelerators, which can cause Type IV (delayed) allergies and irritant dermatitis. Nitrile rubber is more resistant to chemical solvents and oils than natural rubber latex. A blend of guayule and nitrile was made to combine the positive properties of both guayule and nitrile latex. The objective of this research was to make a glove which combines the advantages of guayule natural latex with those of synthetic nitrile by blending the materials and using a xanthate-based non-irritant accelerator system. The research was conducted using the dip tech machinery for proper latex dipping. Thin films of rubber were made from various percentages of the nitrile and guayule rubber latex to find the optimum combination of chemical resistance and form-fit-feel, in a non-allergenic rubber matrix. These different gloves will be tested for their physical properties, permeation and degradability using American Society for Testing and Materials (ASTM) methods.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Analytical/Physical Chemistry Section: 3rd Place Undergraduate Research Competition)

Funded by Summer Research Program Opportunity

Dissipative Particle Dynamics (DPD) Simulations of Hard Nanoparticle-Encapsulated Polymeric Micelle Formation. Kyaw Hpone Myint[1] and Barbara Wyslouzil[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]The Ohio State University, Columbus, Ohio, 43210.

Abstract

Polymer-protected medical nanoparticles are of interest for drug delivery, medical imaging and cancer therapy. Despite their widespread usage in the biomedical field, the formation of nanoparticle-containing micelles is not fully understood at the molecular level. Consequently, the production of uniform micelles for medical use is currently only feasible in the laboratory setting and is not viable on the commercial scale because of inconsistent size and shape that result from the large-scale production. Developing a model provides a way to visualize and observe the molecular implications of various polymer interactions during micelle formation, which are not possible to observe in physical experiments. The goals of this study are: (1) to model the encapsulation of nanoparticles to get an understanding of micelle formation at the molecular level, and also (2) to explore the experimentally controllable parameters affecting the uniformity of micelles, which would ultimately give us a way to control the micelle size commercially. Over the summer, we have successfully developed a DPD model for the encapsulation of nanoparticles, and our initial findings show that changing each parameter has the predictable effect on the micelle formation process.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Analytical/Physical Chemistry Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Office of Internships

Effect of FeRu Core-Shell Catalysts Size on Fischer–Tropsch Reactions. Alaina Fox[1] and Daniela Mainardi[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Louisiana Tech University, Ruston, Louisiana, 71272.

Abstract

Density Functional Theory (DFT) is employed to study the adsorption of carbon monoxide (CO) on iron ruthenium (FeRu) nanoclusters. The RPBE functional in combination with DNP basis set under the Generalized Gradient Approximation (GGA) method was employed for nanocluster structural stability analysis and CO adsorption and dissociation studies. The nanocluster with highest cohesion energy was next tested upon CO adsorption and dissociation using DFT at all different possible catalytic sites (top, bridge, hollow). The energy required to dissociate CO on the surface of the catalyst (Ru15Fe4) was found to be 1.65eV according to LDA/PWC theory level.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section)

Funded by Louisiana Alliance for Simulation-Guided Materials Applications

Examination of Phosphate Crystals by PIETA J-Coupling and PASS NMR Experiments.
Kodey Blankenship and Jay Baltisberger. Chemistry Program, Berea College, Berea, Kentucky, 40404.

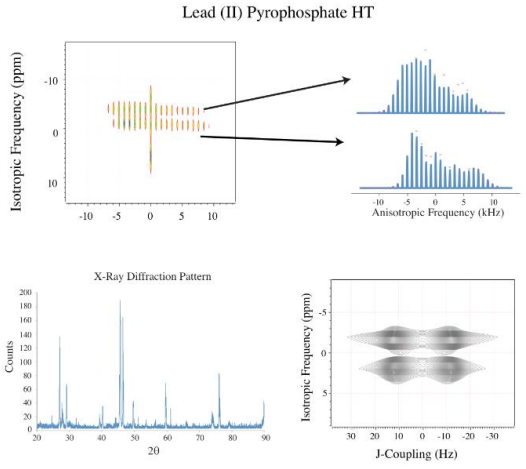
Abstract

A range of crystalline pyrophosphate samples was examined by means of solid state Nuclear Magnetic Resonance (NMR). These metal phosphates included samples of barium, lead (II), calcium, tin (II), and zinc pyrophosphate. Samples were prepared via both aqueous precipitation and high temperature sintering and crystallinity was confirmed via powder X-ray diffraction. The high temperature reaction produced more crystalline samples; however, this came at the cost of the creation of some Q^0 and Q^2 sites. All samples were studied both by preforming J-resolved experiments using Phase Incremented Echo Train Acquisition (PIETA) at fast Magic-Angle Spinning (MAS) as well as slow spinning sideband experiments using Phase Adjusted Spinning Sidebands (PASS). The data from the PASS sideband data sets was simulated using a program written during last summer's research. The data from the sideband simulation program shows consistent ζ and η values across the Q^1 sites of the pyrophosphate samples, while some Q^0 and Q^2 sites were also observed as in previous phosphate glass sample research. The PEITA data suggests that the J-coupling is also consistent in the pyrophosphate, suggesting that these metal cations do not have a large effect on crystalline phosphate bond angles/lengths.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Analytical/Physical Chemistry Section)

Funded by Berea College URCPP



Functionalization Work on Dopamine Nanoparticles With the Incorporation of Human Serum Albumin (HSA). Andrew Norris[1], Sean Harvey[2], Andreas Riegger[2], Tanja Weil[2] and David Ng[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]University of Ulm, Ulm, Germany.

Abstract

Polydopamine is known for its multifunctional coating. It has the ability to assemble and adhere to virtually any surface. These properties make it attractive in various fields of research including potential biomedical applications. Polydopamine will form a range of nano and micro aggregates when submerged in its reaction media. Because of its spontaneous nature, it is difficult to control particle formation. At the University of Ulm's Institute for Organic Chemistry III, a method was designed by Seah Harvey to control the particle formation size of polydopamine with the introduction of a copolymer, a derivative of polyethylene glycol (PEG). As a result, controlled nanoparticle sizes with this method are being established. In parallel with the establishment of the previously described method, this research will focus on work on the incorporation of human serum albumin (HSA) into the dopamine nanoparticles. Observations with fluorescence labeling, dynamic light scattering (DLS), and atomic force microscopy (AFM) were used to establish HSA incorporation and particle size. This was followed by cell viability and uptake assays with A549 lung carcinoma cells. Cell cytotoxicity, uptake, and imaging via confocal microscopy provided conclusive preliminary results. Results showed that this method for incorporating HSA in the dopamine nanoparticles does not act as desired when combined with the A549 cells. Aggregation of the particles outside the cell walls was a particular issue. In short, this protein incorporation will not be an effective method for the functionalization of dopamine nanoparticles and these tested biological applications.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section)

Funded by Berea College Office of Internships and Institute for Organic Chemistry III at the University of Ulm

Identification of Factors Stabilizing the 3D Structure of the Goodpasture Autoantigen of Glomerular Basement Membrane. Tatiana Mikhailova[1], Neonila Danylevych[2,3], Billy Hudson[2-6] and Vadim Pedchenko[2,3]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Division of Nephrology and Hypertension, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [3]Center for Matrix Biology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [4]Department of Biochemistry, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [5]Vanderbilt-Ingram Cancer Center, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [6]Department of Pathology, Microbiology and Immunology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

In Goodpasture's disease, autoantibodies bind to α3 and α5 NC1 domains of collagen IV in glomerular basement membrane (GBM), leading to rapidly developing glomerulonephritis and renal failure. These domains exist in GBM as a hexameric complex, termed the Goodpasture autoantigen, which is composed of α3, α4 and α5 NC1 monomers. Significant amounts of these monomers are crosslinked with sulfilimine bonds, which might be the reason why the native α345 hexamers do not bind Goodpasture autoantibodies. Here, we investigated the factors that contribute to the hexamer stability and inertness toward binding of autoantibodies. For this study we purified human recombinant α3, α4, and α5 NC1 monomers from mammalian cell culture media using FLAG affinity chromatography. Through FPLC size exclusion chromatography on a Superdex S200 column, we demonstrated that α345 hexamer assembly requires the presence of physiological concentration of NaCl. Furthermore, we showed that the sulfilimine bond introduced through the oxidation of methionine residues with hypobromous acid stabilizes the hexamer and prevents dissociation into monomers in the chloride-free environment. We conclude that both Cl^- ions and sulfilimine crosslinks stabilize the α345 hexamer and that perturbation of either may induce pathological conformational changes initiating Goodpasture's disease.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster Presentation)

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Physiology and Biochemistry Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College Office of Internships, Hal Moses/Aspirnaut Research Internship and Vanderbilt University

Mechanochemical Chlorination and Iodination of Electron-Rich Aromatics. Tyler Hutsell, Marco Santos and Nicholas Marshall. Chemistry Program, Berea College, Berea, Kentucky, 40404.

Abstract

A procedure for the green halogenation of moderately electron-rich aromatic compounds was developed, giving aryl chlorides and iodides in 20-60% yield in a green and solvent-free synthesis. Chlorination was performed under these conditions by generating chlorine from "Oxone" (potassium monopersulfate triple salt) and sodium chloride, while iodination required molecular iodine and addition of the phase transfer catalyst tetra-n-butylammonium iodide.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section)

Funded by Berea College URCPP

New Methods to Synthesize Nickel N-Heterocyclic Carbene Complexes. Samuel A. Effoe, Benjamin R. Quesada, Lyndsey J. Barker, Maria S. Ledesma-Alonso and Anes Kovacevic. Chemistry Program, Berea College, Berea, Kentucky 40404.

Abstract

N-heterocyclic carbenes have become increasingly popular ligands for organometallic catalysis in recent years. They are found to be a good alternative for more traditional phosphine based ligands. They are fully tunable sterically and to some extent electronically. This reaction shows a new synthetic pathway to normal nickel carbene complexes. The method used included silver transmetalation and direct addition of the ligand to a nickel complex.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section: 3rd Place Undergraduate Research Competition)

Funded by Berea College URCPP

Phytochemical Investigation of *Albizia shimperiana* and *Bridelia micrantha* for Cytotoxic Principles Against Drug Sensitive and Multidrug Resistant Cancer Cell Lines. Job Limo[1] and Leonidah Kerubo[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]University of Nairobi, Nairobi, Kenya, 00100.

Abstract

The purpose of this research was to investigate the cytotoxic abilities of the active compounds in *Albizia shimperiana* and *Bridelia micrantha*, tropical plants. The idea was to isolate the active compounds in the stem bark of the both plants and subject the compounds to bioassay of cancer cell lines in order to investigate their anticancer potential. Both plants are used traditionally by communities in Kenya in management of tumors and related ailments. The program ran for nine weeks at the University of Nairobi (Nairobi, Kenya), during the summer of 2015. I was involved in the fieldwork, sample collection, and the actual isolation in the lab. Isolation was done via gravitational column chromatography with MeOH/DCM, DCM/Hexane, Et_2NH/Hexane, and MeOH/H_2O as the solvents. We were able to fully isolate the active compounds in *Bridelia micrantha*, and my allotted nine weeks were over before we could start the separation of the compounds in *Albizia shimperiana*. The isolated compounds were sent to Germany for bioassay analysis and to the University of Mississippi for NMR structural analysis, because the University of Nairobi had no such facilities. The results of both analyses had not been sent back by the time I concluded my nine week research at the University of Nairobi. The anticipated outcome for the research was to identify the active ingredients in both plants that exhibited anticancer potential. The findings may be useful in development of affordable cancer management drugs in Kenya.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section)

Funded by Berea College Office of Internships, Entrepreneurship for the Public Good (EPG) and University of Nairobi

Rapid, Electroless Surface Modification Through Surface-Directed Azo Coupling. Tatiana Mikhailova, Brennan Taylor and Nicholas Marshall. Chemistry Program, Berea College, Berea, Kentucky, 40404.

Abstract

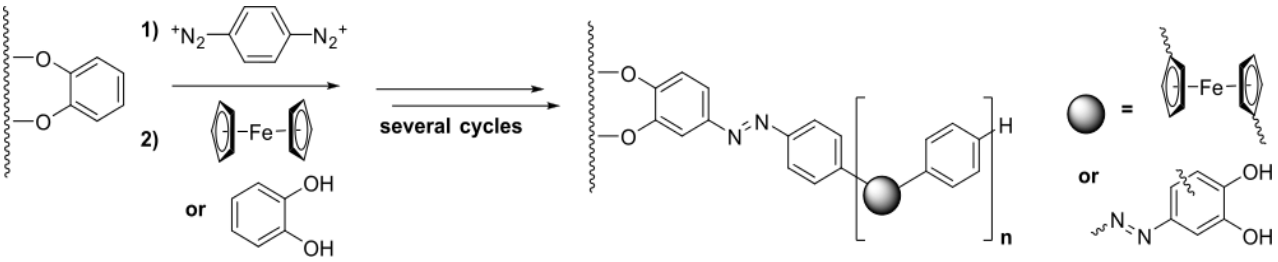
Grafting of aryl diazonium salts by spontaneous or reductive decomposition is a widely used technique for producing functionalized thin films. This technique is difficult to control and the rapid reductive method is limited by the need for an external potential or reducing agent. We present an alternative method for grafting aryl diazonium salts to a surface by reacting diazonium ions in solution with an electron-rich aromatic monolayer in a classical azo or Gomberg coupling. This method combines the rapidity of reductive electrografting with the controllable nature of self-assembly, and yields a potentially photoswitchable layer due to the azobenzene moiety in the product.

250th Annual Meeting of the American Chemical Society, August 16th-20th, 2015, Boston Convention and Exhibition Center, Boston, Massachusetts (Poster Presentation)

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section)

Funded by Berea College URCPP



Synthesis of Amine-Functionalized Cyclotribenzylenes (CTBs). John Attelah[1], Gracia El Ayle[2] and K. Travis Holman[2]. [1]Chemistry Program, Berea College, Berea, KY, 40404. [2]Georgetown University, Washington, DC, 20057.

Abstract

Amine functionalized benzenes are of major importance in the catalytic world. Many research groups have recently embarked on different ways to synthesis aminated bromine. Due to this interest we embarked on a project to synthesize amine-functionalized cyclotribenzylenes (CTBs) cups to use in shaping a three dimensional space around a catalytically active metal center using beta diketiminate. There are two different types of $(NH_2)_3$-CTA depending on the symmetry; C1 and C3. To come up with the two cups, we use different methods for each. For the C1, we used a three-step method whereas the C3 required a multistep synthesis using the tris-bromo-cyclotrianisylene (Br_3-CTA) as a precursor. Formation of amine functionalized cups is a new type of research which is interesting to study as it has different probabilities of binding. Most of the cups are used to form cryptophanes that are used for encapsulation of gases. Since the origin of the concept of host-guest chemistry, a wide variety of synthetic organic compounds have been prepared as molecular receptors, which can form self-organized systems with various degrees of complexity, and have possible applications including molecular recognition, drug delivery, separation and storage, bio sensing, and catalysis (chemical reaction inside the confined space of a molecular nonreactor).

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Organic/Inorganic Chemistry Section)

Funded by Berea College Office of Internships and Georgetown University Chemistry Department

The Effects of Heat Shock Preconditioning on Protein Induction and Cell Survival After Nanoparticle Exposure. Jonah Rector[1] and Jay Brewster[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Pepperdine University, Malibu, California, 90263.

Abstract

Carbon black (CB) is a type of nanoparticle that is found in air pollution and is a known environmental toxin. Titanium dioxide (TiO_2) is another toxic nanoparticle found in many everyday products. A technique known as heat shock preconditioning has been shown to afford protection from various poisons, but never in the case of nanoparticles. The purpose of this research was to evaluate whether preconditioning with heat shock (HS) is substantial enough to protect cells against nanoparticle exposures, since nanoparticles are able to activate cell death through apoptosis. It was hypothesized that heat shock exposure would afford human bronchial epithelial (16HBE14o) cells protection against nanoparticle induced cell death. The bronchial epithelial cells underwent heat shock before being exposed to numerous doses of CB and TiO_2. To measure cell survival, cells were fixed, stained with crystal violet and measured using a fluorescent plate scanner. Bronchial epithelial cells exposed to nanoparticles showed a general trend in survival if first exposed to heat shock. In addition, a Western blot was used to measure expression of specific pro-survival proteins following heat shock preconditioning. Of those analyzed, heat shock protein 70 (Hsp70) proved to be induced the most. Future work would consist of analyzing protein expression with the addition of nanoparticles to heat shock, the use of nanoparticles alone, and measuring cleaved caspase-3 activity.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Cellular and Molecular Biology Section)

Funded by National Science Foundation, Natural Science Division of Pepperdine University Research Experience for Undergraduates and REU-Site Grant #DBI-1062721

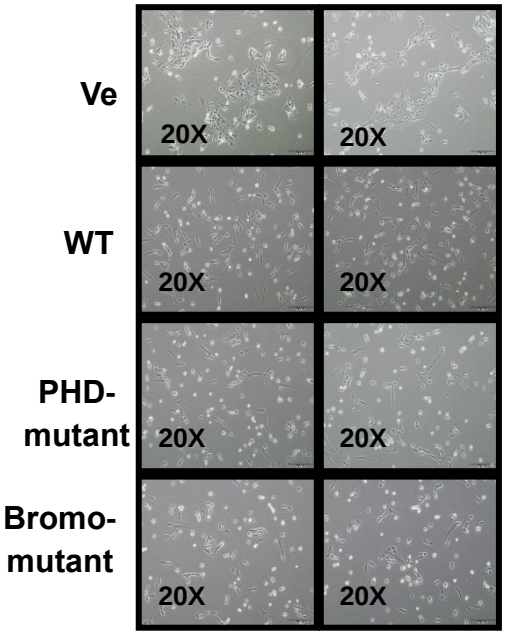
TRIM24 Induces Epithelial to Mesenchymal Transition (EMT) in MCF10A Cells. Bruce Plowshay, Jr.[1], Kaushik N. Thakkar[2] and Michelle C. Barton[2]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Department of Epigenetics & Molecular Carcinogenesis, Center for Cancer Epigenetics, The University of Texas MD Anderson Cancer Center, Houston, Texas, 77030.

Abstract

TRIM24 is a newly discovered protein of interest due to its role in tumorigenesis of breast and liver cancer. Our research was conducted using normal immortalized MCF10A cells to determine if TRIM24-overexpression induced a mesenchymal phenotype and the potential glucose metabolism genes that were allowing an Epithelial to Mesenchymal Transition (EMT) - like process. We overexpressed TRIM24 using lentiviral infection, mutated the PHD and Bromodomains of TRIM24 to determine which protein domain might have played a role in EMT, utilized qPCR to amplify designated glucose metabolism and cell adhesion genes, and finally utilized a Boyden chamber assembly assay to measure the amount of migration. Our experiments, most importantly, showed a change in morphology of MCF10A cells upon over expressing TRIM24, and a nearly 100% migration upon imaging the Boyden chambers containing the MCF10A cells. Main conclusions of these experiments are that TRIM24 interacts with membrane proteins e-cadherin, vimentin, and n-cadherin; TRIM24 induces a mesenchymal phenotype upon overexpression; and TRIM24 overexpression resulted in a large magnitude of migration. Further studies include an invasion-type assay, and quantitative analysis of a more diverse class of EMT and glucose metabolism genes.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College Office of Internships and Cancer Prevention Research Institute of Texas (CPRIT)



Type 1 Interferon Expression Following Small Molecule Inhibition of Cyclic GMP-AMP Synthase. Seth Reasoner[1], Jessica Vincent[2], Katherine Rothamel[2], Byungil Kim[2] and Manuel Ascano[2,3]. [1]Chemistry Program, Berea College, Berea, Kentucky, 40404. [2]Department of Biochemistry, Vanderbilt University Medical Center, Nashville, Tennessee, 37232. [3]Department of Pathology, Microbiology and Immunology, Vanderbilt University Medical Center, Nashville, Tennessee, 37232.

Abstract

The innate immune pathway consisting of cyclic GMP-AMP synthase (cGAS), its second messenger product cyclic GMP-AMP, and Stimulator of Interferon Genes (STING) plays a key role in cytosolic DNA sensing by initiating a type 1 interferon response. This pathway acts as a cellular anti-viral and anti-bacterial defense mechanism. However, self-DNA can also trigger this pathway; cGAS has been implicated in autoimmune disorders such as Aicardi-Goutières Syndrome. The development of small molecule antagonists of cGAS has potential utility as an autoimmune therapy. The lead compounds of a diverse high-throughput small molecule drug screen are being evaluated by various *in vitro* and cellular assays to characterize their inhibition of cGAS activity. The goal of this project was to establish quantitative PCR (qPCR) as a primary assay to assess the effectiveness of these potential immunomodulators in a murine primary cell culture of bone marrow-derived macrophages. Following stimulation with immunoreactive double-stranded DNA and treatment with candidate cGAS antagonists, beta interferon expression was measured by qPCR. Conditions were established and optimized for this qPCR testing. Work is ongoing to fully assess the efficacy of various small molecule antagonists in inhibiting cGAS and to determine their subsequent effects on interferon expression.

Division of Kidney, Urologic and Hematologic Disease Summer Undergraduate Research Conference, July 30th-August 1st, 2015, Emory University, Atlanta, Georgia, 30322. (Poster Presentation)

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Cellular and Molecular Biology Section: 2nd Place Undergraduate Research Competition)

Funded by Berea College Office of Internships, Hal Moses/Aspirnaut Research Internship, and Vanderbilt University

Dashboard Management System: A Tool to Manage Data Efficiently at the Back End and to Display Data Meaningfully at the Front End. Phyo Phyo Kyaw Zin, Scott Heggen and Matt Jadud. Computer Science Program, Berea College, Berea, Kentucky, 40404.

Abstract

A common goal of sustainability administrators is to raise environmental awareness and sustainability efforts by sharing the data they collect with the public. However, they generally encounter many challenges in publicizing data and promoting environmental awareness to their campus community due to the lack of an efficient system. Berea College's Office of Sustainability encounters similar struggles, despite a wealth of data being collected and tabulated. The major challenges include time and labor intensiveness in organizing enormous data, and publishing it to a common platform. Therefore, Dashboard Management System (DMS), an integrated platform for managing and displaying sustainability data, has been constructed in an effort to raise awareness around the Berea campus about ways in which the community can improve their conservation habits. The system enables administrative duties to be efficiently executed by storing and organizing large data, entering it into a system, and quickly publishing it in meaningful graphs to the community via the Sustainability website. Not only does DMS provide a valuable form of environmental assessment, integral to strategic planning and decision-making for the stakeholder committee, but it also serves as a communication tool to society by means of comprehensive graphical displays.

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Computer and Information Sciences Section)

Funded by Berea College Labor Program

Design and Development of a Bio-Inspired Robotic Quadruped Using Programmable Central Pattern Generators. Bria Williams, Kristian Toole, Scott Heggen and Matt Jadud. Computer Science Program, Berea College, Berea, Kentucky, 40404.

Abstract

To obtain an understanding of biomechanics in order to simulate quadrupedal animal locomotion with robotics, this research presents the development and implementation of a biologically inspired quadrupedal robot whose walking gait depends on programmed central pattern generators (CPGs) made to resemble a canine in motion. Central pattern generators are located in an organism's nervous system and play an important role in orchestrating the animal's musculoskeletal system in order to achieve locomotion. Using an open-sourced 3D printed robot, CPGs were reproduced using an Arduino as the central nervous system. During research we found that CPGs manage when the muscles contract and release which can be compared to the muscles being on or off; with this analogy CPGs can be deduced to being muscle oscillators. Oscillators were the key to translating CPGs into a computational setting. Finally, sinusoidal graphs were used to show oscillations over a certain amount of time and to demonstrate how the frequency of the sine waves can be manipulated by altering the period of the sine graph. Thus, we successfully created a simple and mutable central pattern generator.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

Developing an Affordable Traffic Counting System Using Computer Vision. Carlos Andres Berejnoi Bejarano, Scott Heggen and Matt Jadud. Computer Science Program, Berea College, Berea, Kentucky, 40404.

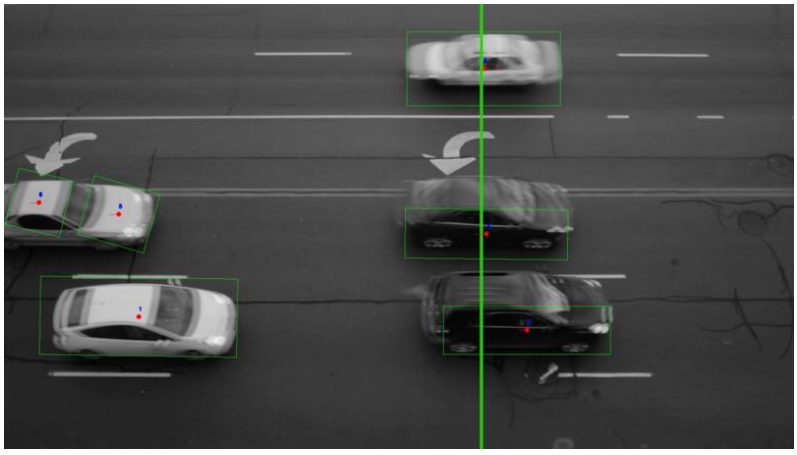
Abstract

During a summer of research for the Computer Science department at Berea College, Berea, Kentucky, USA, a traffic counting system was implemented using computer vision techniques. The purpose of this system is to be able to count the number of vehicles that transit a road using only one stationary camera and an affordable computer. As such, the system must be able to run with limited resources while being reliable for this task. The target low level computer is a Raspberry Pi B with Raspbian. OpenCV is a library of computer vision functions and algorithms implemented in optimized C++, with Python bindings. This is the tool chosen for the project. The C++ code provides the efficiency needed to do fast image processing, while the Python bindings allow for quicker development without sacrificing speed of execution. After two months of work, the counter is able to count moving vehicles with reasonable accuracy but with specific conditions. More work and development is needed for it to be complete and ready for real use.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Computer and Information Sciences Section)

Funded by Berea College URCPP



The Detection of Gas in Fracking Contaminated Water. Amber Tolleson, Ashley Aiken, Scott Heggen and Matt Jadud. Computer Science Program, Berea College, Berea, Kentucky, 40404.

Abstract

The quest for energy independence within the United States has provoked the use of a method called hydraulic fracturing, "fracking", which provides access to otherwise unavailable domestic sources of natural gas and oil. However, the environmental backlash associated with this new source of fuel is often devastating. When we received word that landmen had bought out various mineral rights in our small town, the preparation for fracking began. We started to focus our efforts towards generating a water monitoring system as a precursor to any fracking activity. The ultimate goal was to create a low-cost, replicable sensor apparatus that would enable people to monitor their water before, during, and after fracking occurred. This would provide the ability to chart the effect, if any, that this fuel removal method had on local well water sources. Not only would this sensor system provide important baseline data, but it could potentially alert community residents to the contamination of their drinking water. While the sensor system that we developed is highly capable of detecting the presence of gas in water, the sensors were not calibrated, therefore, further research must be conducted to determine if the sensors can detect trace amounts of gas in water.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Berea College URCPP

Waves of Empire: Mapping Early Imperial Oceanic Sovereignty. Lydia Bauler, M. Ethan Johnson, T. Joseph Carrick and Jason E. Cohen. English Program, Berea College, Berea, Kentucky, 40404.

Abstract

This research project significantly expanded the scope of the Waves of Empire project begun at Duke University in 2012 and extended to Berea to include the Spring 2013 course "Waves of Empire." The summer's research work product is currently live at www.wavesofempire.org. The URCPP enabled the project to accomplish several new and related goals. First, it provided the time and resources to integrate a fresh corpus of archival documents from legal and governmental sources particularly focused on the political implications of piracy and privateering in the West Indies (i.e., Caribbean) into the site. Further, both the students and I built on the recent work I have done using new approaches to textual material through computational forms of analysis – methods including topic modeling, natural language processing, and named entity recognition – that rely on machine learning to help digest large text corpuses. As a result, we have begun to develop a third stage in the process: building a historical social network of early modern pirate relationships and conflict. To accomplish this end, we began developing the framework for a computational network analysis tool to enable deeply tagged legal entries and related text objects to be analyzed through statistical models of relationship among the objects and their historical fields. This work will continue in the coming year as the network model continues to be refined.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral and Poster Presentations)

Funded by Berea College URCPP

Comparing Optical Heart Rate Monitors to a Gold Standard During Continuous and Interval Cardiovascular Exercise. David Orr, Colin Weckman and A.J. Mortara. Health and Human Performance Program, Berea College, Berea, Kentucky, 40404.

Abstract

The purpose of this project was to evaluate the accuracy and hysteresis of an optical heart rate monitor versus a gold standard. Thirty participants volunteered, and met the screening criterion, for this project. During the initial testing session participants were familiarized with all equipment and testing procedures before signing a written consent form approved by the college's IRB. Participants completed a graded exercise test to determine maximal heart rate and oxygen consumption. During the second testing session participants completed three interval protocols, with three sprints each. Interval intensity was determined by the results of the graded exercise test. The Microsoft Band (MS Band) was used to measure heart rate optically; while a Polar heart rate monitor (Polar) served as a gold standard electrical measurement. Significant differences ($P \leq .05$) were found between the MS Band and the Polar during the graded exercise test and the final interval protocol. Average differences between the MS Band and the Polar were 12.5 bpm and 6.6 bpm for the graded exercise test and the third interval respectively. A significant number of signal drops were witnessed during these tests, meaning that the band lost track of heart rate for several seconds and was then able to reacquire it. On the other hand, during the first two intervals, no significant differences were found. Signal drops were also fewer and the correlations between the two devices were stronger. The average difference for the first two intervals is less than one bpm (.44 and .56 respectively). From the data it seems reasonable to conclude that optical heart rate monitors such as the MS Band are accurate during low and moderate intensity exercise, even exercise that is not steady state. However at higher intensities optical heart rate monitors begin to lose signal more frequently and tend to under estimate heart rate as compared to a gold standard. Optical heart rate monitors, especially the MS Band appear to be fairly accurate at constant, steady state low to moderate intensity exercise, i.e. a casual jog or treadmill run. However, if intensity varies, accuracy suffers. Furthermore, as intensity increases, accuracy also suffers. Consumers need to consider their particular exercise needs and habits before purchasing one of these products. Is a 10% relative variance (approximately 16 beats per minute) too much error for the average exerciser? Probably not, but for some, who monitor their heart rate response very closely for health, performance, or training reasons, 10% may be a bridge too far.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Kentucky Association for Health, Physical Education, Recreation and Dance Convention, November 15th-17th, 2015, Embassy Suites, Lexington, Kentucky (Oral Presentation)

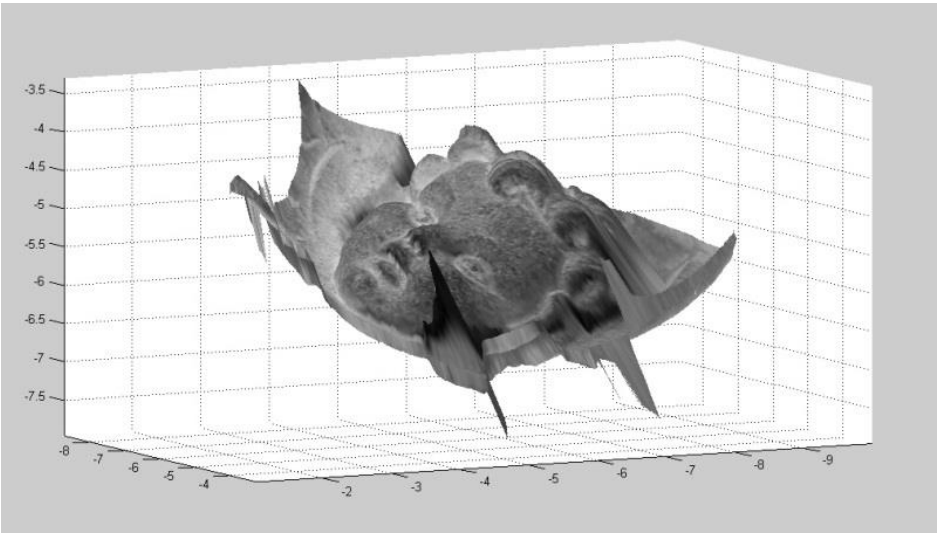
Funded by Berea College URCPP

Undergraduate Research in Imaging Science. Bhawesh Mishra, Kayla Phelps, Xhafer Rama, Vincent Tembo, James Blackburn-Lynch and Larry Gratton. Mathematics Program, Berea College, Berea, Kentucky, 40404.

Abstract

Phase-measuring profilometry (PMP) is a three-dimensional imaging technique in which a sequence of two-dimensional images, captured under structured lighting conditions, are combined to obtain a single high-resolution reconstruction of a three-dimensional surface. This continuing study of the mathematical and computational properties of PMP followed three major lines of inquiry: minimizing signal error; the impact of camera defocus and finite pixels on reconstruction accuracy; and algorithms for "flattening" the curved reconstructed surface. In an effort to maximize the signal-to-noise ratio, a technique known as third-harmonic injection was utilized, allowing maximal amplitude of the first harmonic while staying within the dynamic range of the projector. Assuming a more realistic camera model involving finite aperture as well as pixel width, it was determined that camera defocus has little to no impact on phase calculation over continuous surface. Discontinuities in the surface, on the other hand, can cause significant, sometimes surprising, errors. Once a three-dimensional surface is obtained, it is possible to "flatten" the curved surface provided the Gaussian curvature is zero, such as in the case of a cylinder. Spherical surfaces, however, cannot be flattened without distortion error. The flattening idea was applied to reconstructions of cylinder-like surfaces with non-zero Gaussian curvature.

Funded by Berea College URCPP



Evaluating the Impact of Community Gardens in Appalachia. Gabrielle Christian[1] and Lisa M. Turner[2]. [1]Biology Program, Berea College, Berea, Kentucky, 40404. [2]Nursing Program, Berea College, Berea, Kentucky, 40404.

Abstract

Community gardens have social and nutritional benefits to the neighborhood, physical activity and general health to those who participate. However, there is limited research regarding the impact of community gardens in rural areas. The aims of this research project were: (1) to describe the perceptions of individual's experiences as they develop a garden with the Grow Appalachia program; and, (2) to explore potential health outcomes of individuals and families involved in the Grow Appalachia program. This cross- sectional, mixed-methods pilot study took place in an eastern Kentucky county. At the time of enrollment and 30 days afterward, participants completed a 24-hour diet recall questionnaire, a quality of life questionnaire, and had several body measurements taken. A phone interview was also conducted shortly after enrollment. There were eleven participants. Qualitative analysis reflected (1) increased socialization, (2) a reduction of visits to the store for fruits and vegetables, (3) an increase in knowledge of gardening practices, and (4) an overall positive experience with the Grow Appalachia program. Quantitative analysis found significant changes in (1) improvement in diastolic blood pressure category ($p=0.052$), (2) reduction in body fat percentage ($p=0.001$), (3) reduction in waist circumference ($p=0.020$), (4) less role limitations due to emotional problems ($p=0.053$) and (5) more energy, less fatigue ($p=0.007$). Participants in this pilot study reported numerous physical, emotional and mental health benefits from working in their garden and working with the Grow Appalachia program.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Oral Presentation)

Funded by Berea College URCPP

Building a Low-Cost Atomic Force Microscope for Use in Undergraduate Physics Labs and Research at Berea College. Nathanael Bodine and Troy Messina. Physics Program, Berea College, Berea, Kentucky, 40404.

Abstract

The purpose of this project is to design, build, and use an Atomic Force Microscope for around five hundred to a thousand dollars. Once our project is completed, the AFM should be able to collect data that is precise enough to create a 3D atomic scale representation of sample surfaces. Contributing a useful tool like this to Berea College's Science Division would be a fulfilling and educational experience. We intend the design to be simple enough for other students and professors to be able to reproduce for a low cost. Most commercially made AFMs cost tens of thousands of dollars, and it will be an excellent alternative to expensive factory produced AFMs. We will present design plans and an update of our progress towards completion.

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Physics and Astronomy Section: 2nd Place Undergraduate Research Competition)

Funded by Kentucky Academy of Science Undergraduate Research Grant

Designing Student Maker Spaces. Mackenzie Ridley[1], Troy Messina[1], Daniel Johnsen[2] and Peter Hackbert[3]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]LVL1 Hackerspace, Louisville, Kentucky, 40206. [3]Entrepeneurship for the Public Good, Berea College, Berea, Kentucky, 40404.

Abstract

The Maker movement provides a safe and free environment for like-minded people to creatively build anything they want, from any material, from scratch. This DIY community can be incorporated on any college campus. Over my summer, I worked in LVL1 Hackerspace in Louisville, KY, where I not only learned how to use all of the equipment (3D printers, laser cutters, software design, woodworking, metalworking), but I also gained insights on how to run a makerspace and gear it towards student learning. To promote the truest active learning experience for any student(s), one must provide an environment that promotes awareness of the student through these core learning characteristics: Trial and Error, Ownership/Creativity, Confidence, Leadership, Supportive Peer Group, and Reflection. Combining open space learning areas, funding, advanced technologies, and a community of excited, active individuals, your college or university could host a Makerspace on its campus, and represent the forefront of active learning experiences for students all over the Appalachian Region. In this presentation, I discuss lessons learned from LVL1.

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Science Education Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Office of Internships, Entrepreneurship for the Public Good and Kentucky Academy of Science Undergraduate Research Grant

Differential Thermal Analysis of Bioactive Glass Material for Bone Tissue Regeneration.
Denzell Barnett[1], Greg Humble[2] and Kisa S. Ranasinghe[2]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]Kennesaw State University, Kennesaw, Georgia, 30144.

Abstract

The work presented in this research is focused on an empirical investigation of the characteristic thermal capacity, as a function of the temperature (°C), of bioactive borate glass materials with various compositions of bioactive material. All examined target materials were prepared on site by directly mixing bioactive glass materials and refined via smelting processes. Using differential thermal analysis, boron, cerium, and aluminum doped glass samples were characterized for glass transition cycles, crystallization phases, and melting points. This research successfully details the heat capacities of various bioactive glass materials from temperature ranges of 500-1000°C. Finally, it is estimated that these findings can be applied for the use of scaffolds for bone-regeneration tissue by releasing supporting agents of angiogenesis and bone ossification while in body-fluid environments.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Engineering Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Office of Internships

Mapping Nearby Galaxies at APO (MaNGA). Dadbeh Shaddel[1] and Renbin Yan[2]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]University of Kentucky, Lexington, Kentucky, 40506.

Abstract

Astronomical surveys usually measure light only at the centers of target galaxies. MaNGA bundles sets of optical fibers into tightly-packed arrays, enabling spectral measurements across the face of each of almost 10,000 nearby galaxies. MaNGA's goal is to understand the "life cycle" of present day galaxies from imprinted clues of their birth and assembly, through their ongoing growth via star formation and merging, to their death from quenching at late times. During summer 2015 at UK, our goal was to optimize the reduction algorithm for images produced by MaNGA IFUs.

15th Annual Berea College Undergraduate Research Symposium, October 23th, 2015, Berea College, Berea, Kentucky (Poster Presentation)

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Physics and Astronomy Section)

Funded by Berea College Office of Internships

Three-Step Induced-Ferroelectric Phase Transition in $(PMN)_{0.8}(PT)_{0.2}$. Yhenew D. Kassie[1], Eugene Colla[2] and Michael Weissman[2]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]University of Illinois Urbana-Champaign, Champaign, Illinois, 61820.

Abstract

Understanding the mechanism by which inhomogeneous polar nano-regions (PNRs) influence the properties of relaxors remains a challenge. How PNRs evolve during the formation of an induced-ferroelectric (FE) order and impact this FE transition is also not well-known. In this project, the dynamics of the FE transition of a single crystal of PMN-20%PT was studied by applying electric field in the [111] direction. We have found that the transition occurs in three distinct steps upon zero-field cooling followed by field aging. During the melting of the induced FE order, two main stages were observed.

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Physics and Astronomy Section: 3rd Place Undergraduate Research Competition)

Funded by University of Illinois at Urbana-Champaign Excellence in Physics Fund

W/V Band Wave Propagation Through Earth's Atmosphere. Nicholas Hubbard[1] and Steven Lane[2]. [1]Physics Program, Berea College, Berea, Kentucky, 40404. [2]Air Force Research Laboratory, Kirtland Air Force Base, Albuquerque, New Mexico, 87116.

Abstract

In recent years, a problem with current communications has been developing. This problem is that the atmosphere is becoming increasingly over-congested with signals of frequencies lower than 10 GHz. Frequencies lower than 10 GHz have been widely utilized for both commercial and private use due to their efficient propagation through Earth's atmosphere. This has led organizations like the Air Force Research Laboratory to conduct research on alternative frequencies to use for communications. This research has led the AFRL to looking at waves within the V (50-75 GHz) and W (75-110 GHz) frequencies, and the logistics of their use. The W/V band project's goal is to learn more about the propagation of these waves. After spending the summer conducting research on atmospheric effects on high-frequency waves, we were able to get a better understanding of the degree to which the changing atmospheric conditions affect W/V band waves.

15th Annual Berea College Undergraduate Research Symposium, October 23rd, 2015, Berea College, Berea, Kentucky (Poster Presentation)

Funded by Applied Technology Associates Corporation and Berea College Office of Internships

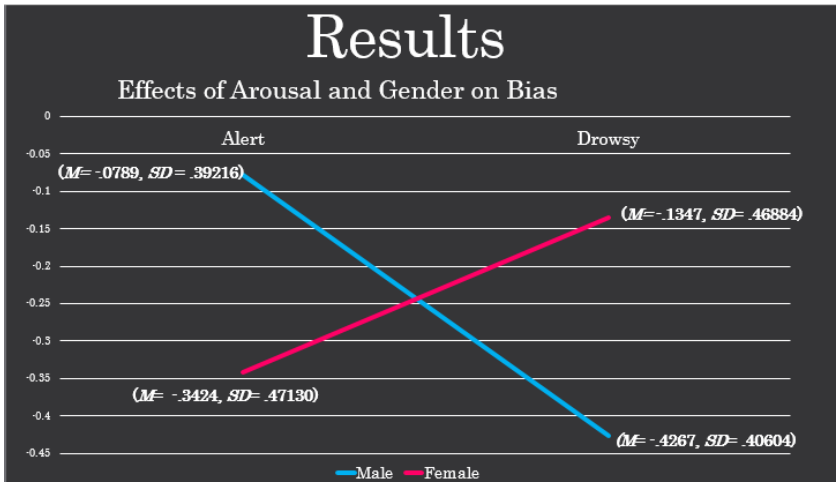
Arousal, Audition and Spatial Awareness: Effects on Bias and Sensitivity. Shelby Cansler and Dave Porter. Psychology Program, Berea College, Berea, Kentucky, 40404.

Abstract

The bias associated with hemi-spatial neglect, a condition suffered by stroke victims, has been studied for many years. Connections between arousal and visio-spatial bias have been studied in healthy participants as well as those with brain injuries. Healthy people have been shown to present symptoms of pseudo-neglect, which results in a leftward spatial bias, when alert, that shifts to the right, as in neglect patients, when they become drowsy. The present study sought to examine this shift in bias in the auditory-spatial realm. Twenty-six participants from Berea College (17 females and 9 males) were presented with a series of tones emanating from an array of speakers while alert and also while drowsy. It was hypothesized that (a) there would be a left bias for alert participants and (b) a rightward shift in that bias when subjects became drowsy, (c) that sensitivity would be effected by arousal and/or gender, and (d) that level of arousal and gender would affect bias. Although drowsiness was not associated with a decrease in sensitivity, the expected leftward bias was found. The main effect of drowsiness on bias was not significant, but the interaction between gender and arousal level suggested males and females' biases shifted significantly but in opposite directions. This study has applications for the busy life people lead today, in that, the more drowsy we get, the more our auditory (and visual) perceptions are altered, which may contribute to automobile accidents or faltering in other spatially affiliated activities (e.g., sports).

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Psychology Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Psychology Program



Effects of Rehearsal Styles on Learning Words in a Foreign Language. Joscelin Rocha-Hidalgo and Dave Porter. Psychology Program, Berea College, Berea, Kentucky, 40404.

Abstract

This study examined the influence of rehearsal type, time of test, and school grade in the recognition and translation of 15 Spanish words by 47 children (18 Elementary School and 29 Middle School) from Berea Community School with no Hispanic background and no previous knowledge of Spanish. The subjects were presented with 20 words in Spanish with their translations in English. For about half the students in each group, visual image was presented instead of repeated cycles of verbal rote rehearsal. Subjects were asked to recognize and translate words they studied previously during the same day of the presentation and one day later. Visual rehearsal was found to increase the scores in both recognition and translation tasks. Elementary school children benefitted from the visual rehearsal to a much greater extent than middle school children. Time of test was only significant in the recognition test but not for translation. School grade was marginally significant for only the recognition task, suggesting that elementary school students performed slightly better than did middle school students.

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Psychology Section)

Funded by Berea College Psychology Program

Evidence of the Relative Contributions of Explicit and Implicit Learning of a Complex Video Game. Kelly Smith[1, 2] and Dave Porter[1]. [1]Psychology Program, Berea College, Berea, Kentucky, 40404. [2]Northern Kentucky University, Highland Heights, Kentucky, 41099.

Abstract

Previous research has found that implicit learning is an important component of the mastery of a variety of skills. This experiment involved 27 Berea College students (about equal numbers of men and women) playing a rotational maze tracking task entitled *Penguin Pursuit* from *Lumosity* on two successive days. During each session, half the subjects played the game while verbalizing a sequence of words in time to a metronome, and half played the game without this verbal side task. The effects of practice and gender were also considered in this 2X2X2X2 mixed design. Participants did better during the second session; men performed better than women; and subjects with the verbal side task actually performed better than the subjects with no verbal side task during the second session. This result supports a conclusion that self-talk can be detrimental to the performance of some complex manual tasks such as this one – especially once subjects have a little practice with the task.

101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Oral Presentation-Psychology Section: 1st Place Graduate Research Competition)

Funded by Berea College Psychology Program

Young Children's Perceptions of Race and Gender. Carmellia Jackson[1], Kelly Smith[1, 2] and Dave Porter[1]. [1]Psychology Program, Berea College, Berea, Kentucky, 40404. [2]Northern Kentucky University, Highland Heights, Kentucky, 41099.

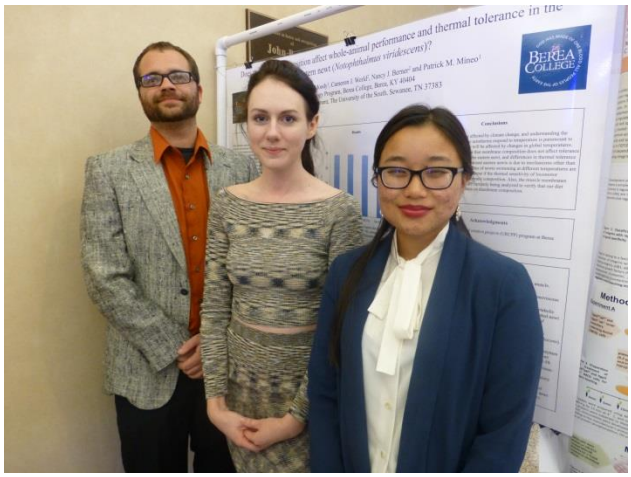
Abstract

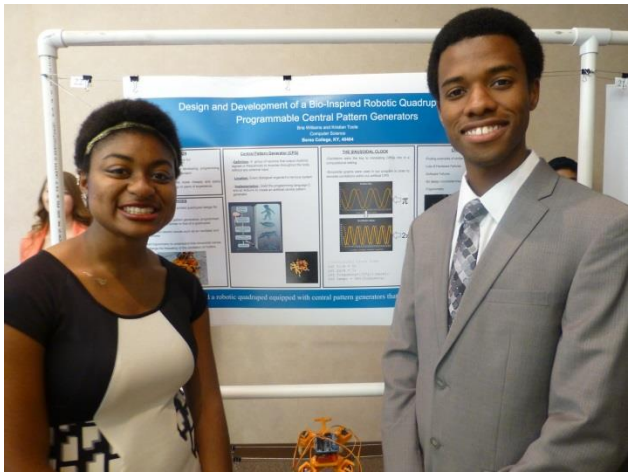
Young minds are very impressionable but what about when it comes to stereotypes of race and gender in society? This study examined thirty, 4 to 7 year olds at Berea College's Child Development Laboratory and their pictorial responses to prompts regarding their personal preferences and their expectations about social status. The results showed that children had a marked preference for personal best friends of the same gender, but their gender did not affect their expectations about social status. In contrast, children showed a significant preference for light skinned children on both personal and social preference tasks. Other than the preference for personal friends of the same gender, the children's own gender and race did not appear to significantly affect their choices. The results suggested that societal views may influence children's overall personal choices and social expectations.

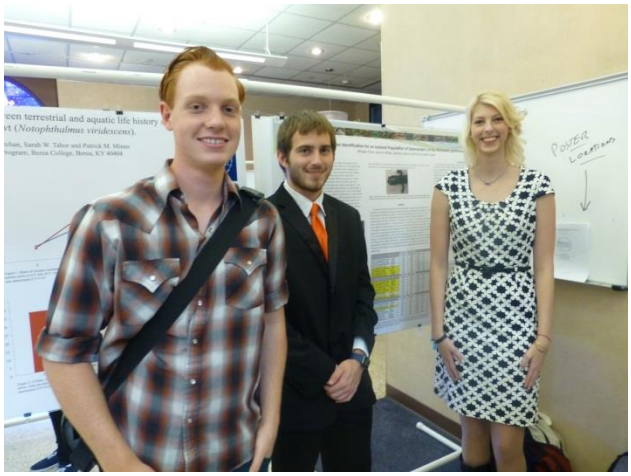
101th Annual Meeting of the Kentucky Academy of Science, November 13th-14th, 2015, Northern Kentucky University, Highland Heights, Kentucky (Poster Presentation-Psychology Section: 1st Place Undergraduate Research Competition)

Funded by Berea College Psychology Program

Figure 1. Berea College students and faculty during the 2015 summer Undergraduate Research and Creative Projects Program presentations.







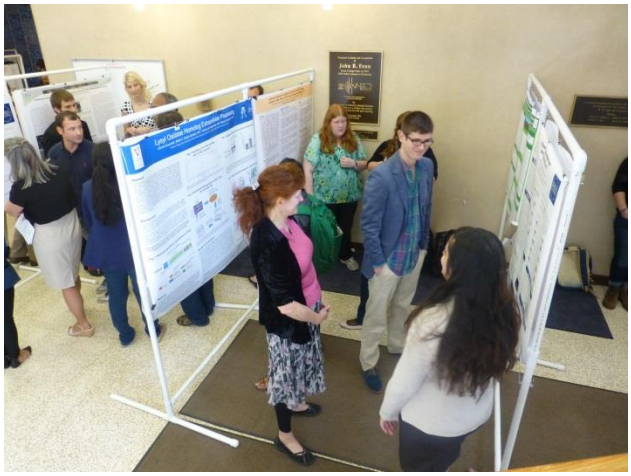
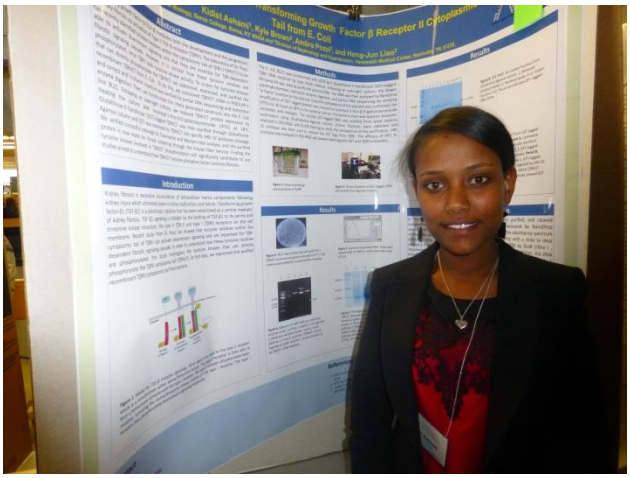
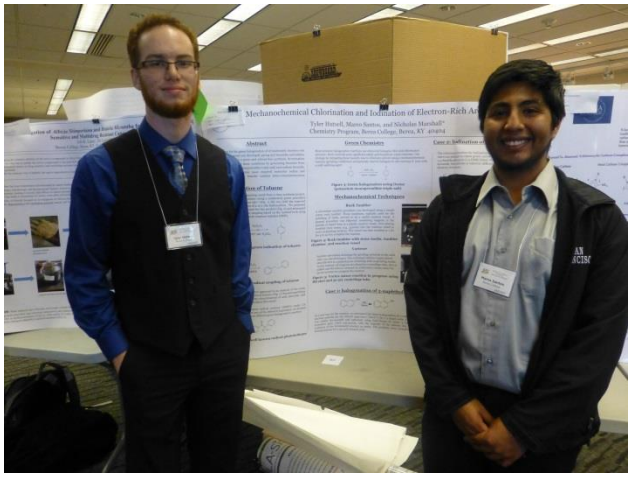
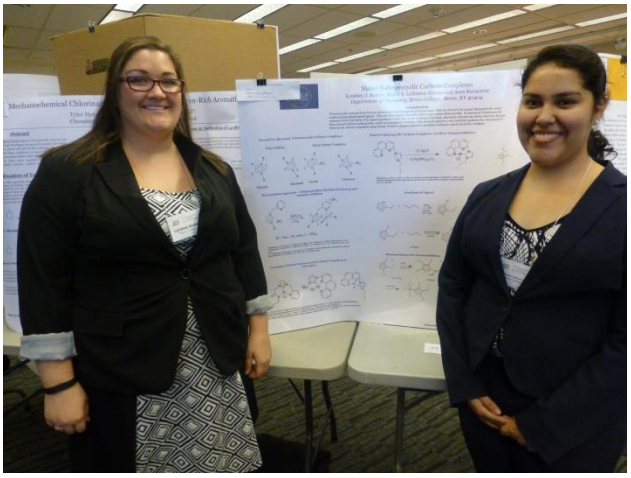
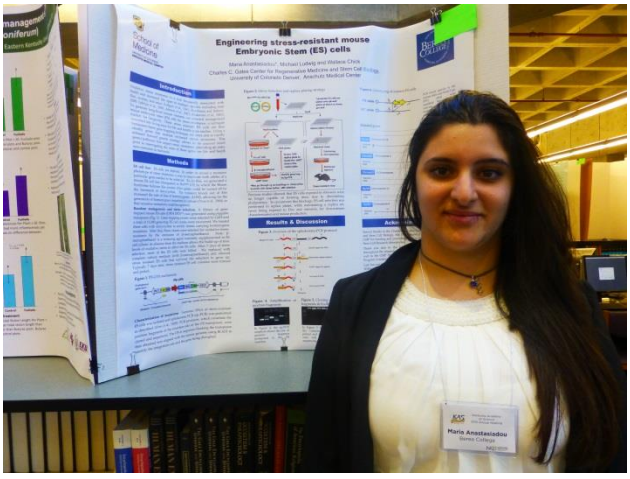


Figure 2. Berea College students and faculty at the Berea Undergraduate Research Symposium on October 23rd, 2015.









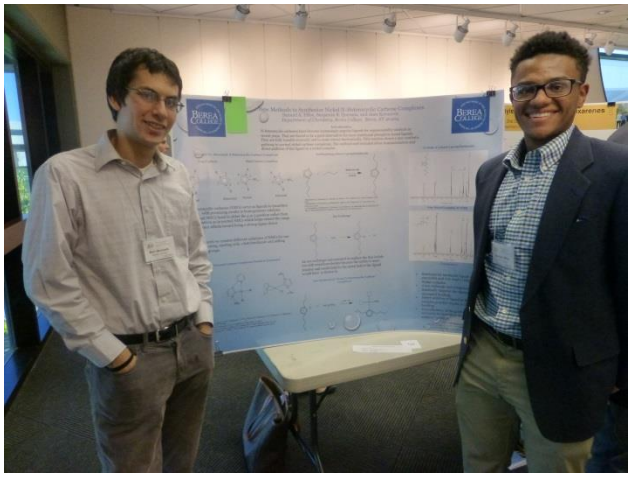


Figure 3. Berea College students and faculty at the Kentucky Academy of Science annual meeting on November 13th-14th, 2015 at Northern Kentucky University.