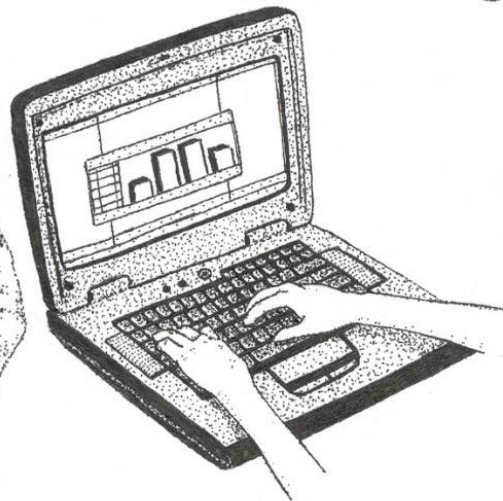
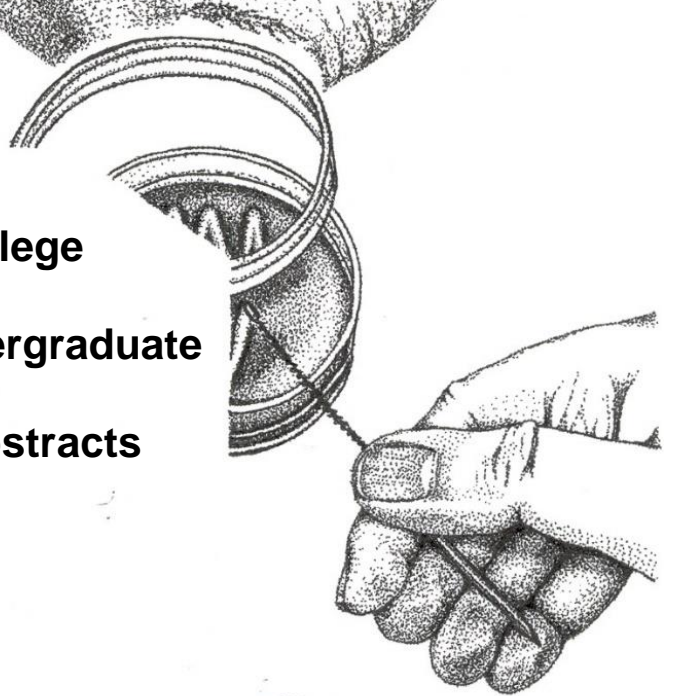


Berea College
Journal of Undergraduate
Research Abstracts

2007



*Christy
Olney
2007*

Introduction

During the Fall 2006 Science Retreat, the science faculty at Berea College approved a student initiative proposed by Emilie Throop (Biology - Class of 2007; presently a graduate student at Kansas State University) to publish abstracts of undergraduate research on an annual basis. Last year, with Emilie's assistance, the inaugural edition of the, "Berea College Journal of Undergraduate Research Abstracts Science Division 2006", was published. In this second issue an effort has been made to also include undergraduate research completed by students in disciplines outside the sciences. Though not inclusive of all the undergraduate research conducted last year by Berea College students, this year's journal contains 36 abstracts representing majors from ten different academic departments. These abstracts represent research completed on-campus with funds provided by Berea College's Undergraduate Research and Creative Projects Program (URCPP – 14/17 reporting), a few "special" campus/department designated projects, the Kentucky Biomedical Research Infrastructure Network (KBRIN) funded projects at the Universities of Kentucky and Louisville, and additional off-campus research at various universities and research facilities around the country. The abstracts are published as submitted; editorial changes have only been made: (1) to the titles of each abstract by the editor to ensure consistency of style and (2) by department chairs. Much of this collaborative work was presented at off-campus meetings including the Annual Meeting of the Kentucky Academy of Science (28 presentations and 10 awards received). Presentations and awards are listed below each abstract where appropriate. Hopefully this publication will continue in the future and serve as a resource for: (1) Berea College's efforts in admissions, development, and departmental self-studies and (2) students to locate interesting programs for future research and acknowledge their accomplishments.

Acknowledgements

This second journal of Berea College student abstracts would not have been possible without the support of many people. I thank our Dean of the Faculty, Stephanie Browner, for releasing me from short term teaching duties to coordinate this effort. I acknowledge Carolyn Newton, Academic Vice-President/Provost, for providing funds to print hard copies of these abstracts. Also, many thanks to Berea College faculty for their contributions, and of course to their students for whose hard work this journal is a reflection. Once again, we wish to acknowledge Elizabeth Fleming (junior biology major) for providing the beautiful cover art. Finally, we would like to thank all the off-campus mentors at the following research centers and universities for supporting Berea students during the summer of 2007 (number of Berea students in brackets): Argonne National Laboratory (2), IBM Almaden Research Center {1}, Mayo Clinic {2}, Miami University {1}, State University of New York at Stony Brook {1}, University of Arkansas {1}, University of Kentucky {4}, University of Louisville {1}, University of Southern California {1}, and Vanderbilt University {4}. A special acknowledgement is extended to former Berea College students and current trustees, Dr. Harold Moses (Vanderbilt University) and Dr. Chella David (Mayo Clinic), for continuing to coordinate and support research experiences at their respective institutions for Berea College undergraduates.

Ronald B. Rosen (Professor of Biology)

TABLE OF CONTENTS

(Page Number)^c = Research Conducted On Berea College Campus With Berea College Faculty

Department of Agriculture and Natural Resources

Population dynamics of varroa mite (Acari: Varroidae) on different honey bee (Hymenoptera: Apidae) stocks. SPENCER GRAVITT¹, OLIVER POGUE², and SEAN CLARK², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Department of Agriculture and Natural Resources, Berea, KY 40404. 1^c

Management of varroa mites (Acari: Varroidae) in organic beekeeping : Is it possible? OLIVER POGUE¹, SPENCER GRAVITT², and SEAN CLARK¹, ¹Department of Agriculture and Natural Resources, Berea College, Berea, KY 40404 and Department of Biology, Berea College, Berea, KY 40404. 2^c

Body weight gains of grazing lambs under heat stress provided with shade and pelleted feed supplement. JONATHAN SANDS, BONNIE WILSON, DIANNE H. HELLOWIG, and G. NEIL DOUGLAS, Department of Agriculture and Natural Resources, Berea College, Berea, KY 40404. 3^c

Appalachian Studies

Studying Appalachian Studies, 1940-1990. KATHRYN (BETH) BISSMEYER, LINDSEY MARTIN, and CHAD BERRY, Appalachian Center, Berea College, Berea, KY 40404. 4^c

Department of Biology

Proterometra macrostoma (Trematoda: Azygiidae): Further studies on the strain question at North Elkhorn Creek, Scott County, Kentucky. DIKSHYA BASTAKOTY, AARON FIDLER, MILUKA GUNARATNA, TSERING DOLMA, ROBERT TWIGGS, BREA VIRAGH, and RONALD ROSEN, Department of Biology, Berea College, Berea, KY 40404. 5^c

Factors affecting the emergence, infectivity and subsequent development of the *Proterometra macrostoma* (Trematoda: Azygiidae) cercaria. TSERING DOLMA, ROBERT TWIGGS, BREA VIRAGH, DIKSHYA BASTAKOTY, AARON FIDLER, MILUKA GUNARATNA, and RONALD ROSEN, Department of Biology, Berea College, Berea KY 40404. 6^c

- Source and photodegradation of dissolved organic matter as factors of fluoranthene phototoxicity to *Daphnia magna*. ELIZABETH FLEMING¹, RYAN OTTER², ERIN OVERHOLT², CRAIG WILLIAMSON², and JAMES ORIS², ¹Department of Biology, Berea College, Berea, KY, 40404 and ²Department of Zoology, Miami University, Oxford, OH 45056. **7**
- Knocking-out telomere-related genes using uncloned PCR fusion products and homologous recombination in *Aspergillus nidulans*. DAVID FOSTER¹, ALEX NOBLE², AMANDA SHERWOOD³, and PETE MIRABITO⁴, ¹Department of Biology, Berea College, Berea, KY 40404, ²Department of Biology, Georgetown College, Georgetown, KY 40324, ³Department of Biology, Centre College, Danville, KY 40422, and ⁴Department of Biology, University of Kentucky, Lexington, KY 40506. **8**
- Psychophysiological study of response conflict and error processing deficits in patients with Posttraumatic Stress Disorder. GLORIA FRITZ¹ and TATO SOKHADZE², ¹Department of Biology, Berea College, Berea KY 40404 and ²Department of Psychiatry, University of Louisville, Louisville, KY 40292. **9**
- Defining the mechanism of EP4-mediated metastasis. ENRIQUE GARCIA¹, JOE AMANN², and DAVID CARBONE², ¹Department of Biology, Berea College, Berea, KY, 40404 and ²Department of Hematology/Oncology, Vanderbilt University, Nashville, TN 37232. **10**
- Dopamine transporter expression in a “two-hit” rat model of Parkinsonian Syndrome. CLARISSA HARRIS¹, ANDREW D. SAUERBECK², and JIM PAULY² ¹Department of Biology, Berea College, Berea, KY, 40404 and ²College of Pharmacy and Spinal Cord and Brain Injury Research Center, University of Kentucky, Lexington, KY 40504. **11**
- Inositol increases feeding on deterrent mixtures in larval *Manduca sexta*. AMANDA HENSLEY, KATHERINE JOHNSON, and MARC ROWLEY, Department of Biology, Berea College, Berea, KY 40404. **12^c**
- Abrogation of TGF- β signaling in mammary carcinomas recruits myeloid immune suppressor cells through CXCL5/CXCR2 chemokine axis. MEGAN JACKSON¹, ANNA CHYTIL², AGNIESZKA E. GORSKA^{2,3}, HAROLD L. MOSES^{2,3}, and LI YANG³, ¹Department of Biology, Berea College, Berea, KY 40404, ²Department of Cancer Biology, and ³Vanderbilt-Ingram Cancer Center, Vanderbilt University School of Medicine, Nashville, TN. **13**
- Metagenomic characterization of the microbial communities in the Berea College Living Machine. JESSICA LANFAIR, JACOB GUNNELL, JENNA OTT, and DAWN J. ANDERSON, Department of Biology, Berea College, Berea, KY 40404. **14^c**

Analysis of the *Drosophila crmp* gene to understand the role of CRMP in neurogenesis. **15**
AMBER CRUTCHER¹, REBECCA LINVILLE², DEANNA MORRIS³, and JOHN RAWLS³, ¹Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475, ²Department of Biology, Berea College, Berea, KY 40404, and ³Department of Biology, University of Kentucky, Lexington, KY 40506.

Design and development of palladium-iron bimetallic electrocatalysts for polymer electrolyte fuel cells. **16**
JESSICA R. PRICE¹, RICHARD COOKS¹, MARK CUNNINGHAM², XAIAPING WANG³, and DEBORAH MYERS³, ¹Department of Biology, Berea College, Berea, KY 40404, ²Department of Chemistry, Berea College, Berea, KY 40404, and ³Argonne National Laboratory, Argonne, IL 60439.

Identification of genes regulated by p63 in human epithelia. **17**
BRITTNI ROSS¹, CHRISTOPHER BARTON², KIMBERLY JOHNSON², and DEBORAH MAYS², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Department of Biochemistry, The Vanderbilt-Ingram Cancer Center, Vanderbilt University, Nashville, TN 37232-0146.

Role of MHC Class II expression on mouse T regulatory cells. **18**
RACHEL SAUNDERS¹, ASHUTOSH MANGALAM², and CHELLA DAVID², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Department of Immunology, Mayo Clinic, Rochester, MN-55901.

Of mice and men - Do arthritic-resistant mice provide clues to protection from rheumatoid arthritis? **19**
JOSH SPARKS¹, VEENA TANEJA², and CHELLA DAVID², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Mayo Clinic, Department of Immunology, Rochester, MN 55902.

Nick-directed loop mismatch DNA excision in human cells. **20**
MEIPING SUN¹ and GUO-MIN LI², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Department of Toxicology, University of Kentucky, Lexington, KY 40536.

DEPARTMENT OF CHEMISTRY

Synthesis of vinyl fluorides from alkyl halides and alcohols. **21**
G. K. SURYA PRAKASH¹, LAXMAN GURUNG², SUJITH CHACKO¹, and GEORGE A. OLAH¹, ¹Loker Hydrocarbon Research Institute and Department of Chemistry, University of Southern California, Los Angeles, CA 90089-1661 and ²Department of Chemistry, Berea College, Berea, KY 40404.

Chemical and P-31 NMR analysis of phosphorus in soils affected by swine waste overflow. **22^c**
DIN OBADELE MANDLEY and PAUL C. SMITHSON, Department of Chemistry, Berea College, Berea, KY 40404.

New synthetic pathway to abnormal and normal N-heterocyclic carbene complexes. KAYLA R. MEADOWS, MAREK COUNTS, and ANES KOVACEVIC, Department of Chemistry, Berea College, Berea, KY 40404. 23^c

Reduction of proton-driven spin diffusion artifacts from 2D zfr-INADEQUATE MAS NMR spectra. THABISO MUSAPELO, LAXMAN GURUNG, BRIAN SUTTON, and JAY BALTISBERGER, Department of Chemistry, Berea College, Berea, KY 40404. 24^c

The synthesis of aluminum magnesium layered double hydroxides and characterization of phosphate ion exchange experiments. ANTHONY REYNOLDS¹ PAUL SIDERIS², and CLARE P. GREY², ¹Department of Chemistry, Berea College, Berea, KY 40404 and ²Center for Environmental Molecular Science, Department of Chemistry, State University of New York at Stony Brook, NY. 25

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

An examination of fingerprint analysis using the fourier transform. JONATHAN HUNT, MICAH J. SMITH, and LARRY A. GRATTON, Department of Mathematics and Computer Science, Berea College, Berea, KY 40404. 26^c

DEPARTMENT OF MUSIC

Berea College jazz project: The recording of African and Latin influenced jazz for tuba, saxophone, and percussion. CHARLES TURNER, WILLIAM BRATTON, ERIN BARGER, and JACOB HAMRICK, Department of Music, Berea College, Berea, Kentucky, 40404. 27^c

DEPARTMENT OF PHYSICAL EDUCATION AND HEALTH

Profile of physical activity levels and mindfulness among physically independent older adults. Part I. Personality traits. CORTNEY MCCARTY, JASMINE MOORE, and, MARTHA BEAGLE, Department of Physical Education and Health, Berea College, Berea, KY 40404. 28^c

Profile of physical activity levels and mindfulness among physically independent older adults. Part II: Physical activity. CORTNEY MCCARTY, JASMINE MOORE, and, MARTHA BEAGLE, Department of Physical Education and Health, Berea College, Berea, KY 40404. 29^c

Profile of physical activity levels and mindfulness among physically independent older adults. Part III: Mindfulness. CORTNEY MCCARTY, JASMINE MOORE, and, MARTHA BEAGLE, Department of Physical Education and Health, Berea College, Berea, KY 40404. 30^c

DEPARTMENT OF PHYSICS

Effect of doping novel thin film Sb_2Te phase-change material on its optical and switching time property. KANNATASSEN APPAVOO¹, ROBERT M. SHELBY², SIMONE RAOUX², DELIA MILLIRON², and AMER LAHAMER¹, ¹Department of Physics, Berea College, Berea, KY, 40404 and ²IBM Almaden Research Center, 650 Harry Road, San Jose, CA 95120. **31**

Prospects for LISA to detect the Christodoulou memory of gravitational waves. SHIBLEE RATAN BARUA¹ and Dr. DANIEL KENNEFICK^{2,3}, ¹Department of Physics and Mathematics, Berea College, Berea, KY 40404, ²Arkansas Center for Space and Planetary Sciences, University of Arkansas, Fayetteville, AR 72701, and ³Department of Physics, University of Arkansas, Fayetteville, AR 72701. **32**

Laser ablation of graphite at Berea College: To successfully produce fullerenes at Berea College and then to synthesize new endohedral metallofullerenes using laser ablation. BRAD STEELE, DAVID GILMOUR, and AMER LAHAMER, Department of Physics, Berea College, Berea, KY 40404. **33^c**

First light at the renovated Berea College observatory. MOHAMMED YUSUF, BRYAN GOVER, and TRACY HODGE, Department of Physics, Berea College, Berea, KY 40404. **34^c**

DEPARTMENT OF PSYCHOLOGY

Where have all the students gone? Factors influencing the retention and academic success of students who entered Berea College in the fall of 2006. KALEIGH MCCOY and DAVE PORTER, Department of Psychology, Berea College, Berea, KY 40404. **35^c**

DEPARTMENT OF TECHNOLOGY AND INDUSTRIAL ARTS

Quantifying acoustical properties of tone-woods. MARTY EDWARDS, WILLIAM HAZLET, TIMOTHY HOLMAN, JAYME SPAUGH, and GARY MAHONEY, Department of Technology and Industrial Arts, Berea College, Berea, KY 40404. **36^c**

SELECTED STUDENT REFLECTIONS **37**

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

Population dynamics of varroa mite (Acari: Varroidae) on different honey bee (Hymenoptera: Apidae) stocks. SPENCER GRAVITT¹, OLIVER POGUE², and SEAN CLARK², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Department of Agriculture and Natural Resources, Berea, KY 40404.

Varroa mites (*Varroa destructor*) are currently one of the greatest threats to commercial beekeeping. These ectoparasites have plagued beekeepers in the United States for two decades and are one of the possible causes being examined in the recent phenomenon of colony collapse disorder (CCD). Use of synthetic acaricides has proven to be of only limited value in the management of this pest due to the evolution of resistance in the mites. Greater emphasis is being placed on selection and breeding programs as a more durable strategy for long-term management. In this study we evaluated five genetic stocks of honey bees in central Kentucky during hive establishment by comparing colony growth and the mite population levels. The experimental treatments included four Italian stocks and one cross of Russian and New World Carniolan stocks (NWC/Russian). The Italian stocks included: 1) Italian, with no claims of special traits; 2) All Star, bred for honey production and varroa mite resistance according to the supplier; 3) a stock derived from a local survivor hive that had not been treated with acaricides since establishment in 2001 (referred to as Berea survivor stock or BSS), and 4) a stock exhibiting the SMR (suppression of mite reproduction) trait. No significant differences were found in colony growth rates, measured either as weight or area of capped brood and honey, among the five stocks. Italian and BSS stocks had the highest mite populations, while the SMR and NWC/Russian stocks had the lowest, throughout most of the 3-month study. However, a correlation was found between hive establishment date and varroa mite abundance, with higher mite levels being associated with longer periods since establishment. Although the hives were all established during a one month period this significant correlation confounds any comparisons across treatments, making any conclusions about differences among the stocks tentative. The hives will have to be monitored for a longer period to determine if the differences observed among the stocks persist.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation - Ecology and Environmental Sciences Section)

URCPP Funded Research

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

Management of varroa mites (Acari: Varroidae) in organic beekeeping : Is it possible?
OLIVER POGUE¹, SPENCER GRAVITT², and SEAN CLARK¹, ¹Department of
Agriculture and Natural Resources, Berea College, Berea, KY 40404 and ²Department of
Biology, Berea College, Berea, KY 40404

Management of varroa mites (*Varroa destructor*) presents one of the most difficult challenges to organic as well as conventional beekeeping. Most conventional beekeepers have relied on synthetic acaricides for suppressing varroa mite populations but these chemicals have become less effective in recent years due to the evolution of resistance and are increasingly a focus of environmental and health concerns. Integrated management of varroa mites without the use of synthetic chemicals must be based on the selection of resistant honey bee stock, regular mite monitoring and action thresholds, and use of alternative therapeutic practices when mite populations reach those thresholds. In 2004, Berea College Gardens and Greenhouse, the horticultural component of the Berea College Farm, began a program to establish an apiary for honey production that could be certified organic. This included testing stock from different sources for resistance to varroa mite, regular monitoring of varroa mite abundance in the hives, and evaluation of non-chemical therapeutic practices. Results collected so far indicate that organic management of varroa mites is feasible, at least on a small-scale (less than 25 hives). Other questions about the possibility for organic certification remain however, as beekeepers are also required to provide detailed information about land management in the entire foraging area of the bees. This requirement will preclude most beekeepers from being able to achieve certification even when all hive management practices meet organic standards.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Agriculture Section)

URCPP Funded Research

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

Body weight gains of grazing lambs under heat stress provided with shade and pelleted feed supplement. JONATHAN SANDS, BONNIE WILSON, DIANNE H. HELLWIG, and G. NEIL DOUGLAS, Agriculture and Natural Resources Department, Berea College, Berea, KY 40404.

Climate can drastically influence livestock production. Livestock experiencing heat stress must divert energy from tissue accretion to maintenance of homeothermy. Subsequently, average daily gains are reduced. Shade is often recommended for livestock during summer. Effects of shade on lamb performance remain unverified, however. Therefore, treatments were arranged in a 2 x 2 factorial design to determine if providing shade and/or a pelleted nutritional supplement (17% crude protein; 71.8 % total digestible nutrients) to lambs grazing endophyte-infected fescue affected their average daily gains during midsummer. Forty lambs of similar weights were equally divided into four treatment groups. Groups were placed in 1.3 acre plots and received either 1) shade and supplement, 2) shade and no supplement, 3) supplement and no shade, and 4) no shade and no supplement. All lambs had ad libitum access to water. Supplement was provided for ad libitum consumption. Data were subjected to ANOVA. Multiple comparisons between groups were made using Tukey's Honestly Significant Difference test. Weights were similar between groups 1 (36.15 kg) and 3 (37.4 kg; $P = 0.92$) and groups 2 (30.5 kg) and 4 (30.1 kg; $P = 0.99$). Final weights of groups 1 and 3 were significantly different from weights of groups 2 (1 vs. 2, $P < 0.05$; 3 vs. 2; $P < 0.01$) and 4 (1 vs. 4, $P < 0.05$; 3 vs. 4; $P < 0.01$). Data suggest providing shade had no significant affect on body weight gains. Providing nutritional supplement significantly increased body weight gains of grazing lambs.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation - Agriculture Section)

URCPP Funded Research

Studying Appalachian Studies, 1940-1990. KATHRYN (BETH) BISSMEYER, LINDSEY MARTIN, and CHAD BERRY, Appalachian Center, Berea College, Berea, KY 40404.

During 2007, the Appalachian Studies Association (ASA) celebrated its thirtieth anniversary, and although significant, the founding of the ASA was one of several initiatives throughout the twentieth century that ultimately led to a blossoming of research about and activism in Appalachia, especially after World War II. This research project examines several facets of Appalachian Studies as it developed interdisciplinarily in the second half of the twentieth century. The first project involved pedagogy, and mined through untapped materials saved by Les Pross (whom we interviewed) from the old humanities general studies course at Berea College that began in 1948. One of the assignments—known as the “home community essay”—asked students to write about the arts in their communities and then map their community for the instructor. For many first-generation students from Appalachia, these assignments were one of the first opportunities that students had to reflect on their home communities *away* from those communities, and today these maps in particular reveal insights about race, class, gender, and economic development. The assignment is an excellent example of the identification of Appalachia as legitimate academic inquiry that increasingly defined the second half of the twentieth century. The second portion involved transcribed interviews with 12 pillars of the Appalachian studies movement: Richard Drake, Shaunna Scott, Gordon McKinney, Roberta Herrin, Steve Fisher, John Inscoe, Helen Lewis, Jerry Williamson, Pat Beaver, George Brosi, Loyal Jones, and Ron Eller. One of these interviews will be published in *Appalachian Journal*.

URCPP Funded Research

Proterometra macrostoma (Trematoda: Azygiidae): Further studies on the strain question at North Elkhorn Creek, Scott County, Kentucky. DIKSHYA BASTAKOTY, AARON FIDLER, MILUKA GUNARATNA, TSERING DOLMA, ROBERT TWIGGS, BREA VIRAGH, and RONALD ROSEN, Department of Biology, Berea College, Berea, KY 40404.

Proterometra macrostoma is a digenetic trematode with an indirect life cycle involving a snail intermediate host and a centrarchid fish definitive host. Previous work in 1990 and 1991 at North Elkhorn Creek established eight different cercarial strains based on morphological (distribution of papillae and spines), behavioral (swimming and daily/seasonal emergence), and physiological (centrarchid fish host specificity) differences. The purpose of the present study was to summarize the frequency of these strains and the number of single vs. multiple strain infections in snails collected from North Elkhorn Creek during the summers of 2000, 2004, and 2007 for comparison to the 1990/1991 baseline study. Additional experiments with selected cercarial strains (i.e., I, III, and VIII) compared immature egg loads, swimming distance under red and white light and developmental rate in the bluegill, *Lepomis macrochirus*, based on egg morphology. The frequencies of strains I and III were the most numerous, while strains II, VI and VIII have been relatively uncommon over the last seven years. The majority of infected snails, *Elimia semicarinata*, had multiple strain infections. A significant difference was found between the average egg numbers and the mean swimming distances (white light) of strain III vs. VIII and strain I vs. III cercariae, respectively. No significant difference was found between the proportions of egg types found in strain I and III cercariae on days 12 and 20 postinfection of bluegill indicating no difference in the developmental rate of these adult worms. Future work will focus on the isolation and characterization of DNA from strains of *P. macrostoma*.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Zoology Section)

URCPP Funded Research

Factors affecting the emergence, infectivity and subsequent development of the *Proterometra macrostoma* (Trematoda: Azygiidae) cercaria. TSERING DOLMA, ROBERT TWIGGS, BREA VIRAGH, DIKSHYA BASTAKOTY, AARON FIDLER, MILUKA GUNARATNA, and RONALD ROSEN, Department of Biology, Berea College, Berea KY 40404.

Proterometra macrostoma is a digenetic trematode widely distributed in streams and rivers east of the Mississippi River. The life cycle is indirect, incorporating a snail intermediate host and a centrarchid fish definitive host. The purpose of this study was to assess: (1) how changes in osmolality and dissolved oxygen (DO) affect emergence of the *P. macrostoma* cercaria from its snail intermediate host (2) the infectivity of this cercaria to centrarchid fish prior to retraction of the worm's body into its cercarial tail and (3) the length of time required for initial egg development in adult worms derived from *P. macrostoma* cercariae lacking eggs. No significant difference was found between the average number of cercariae emerging in artificial pond water (APW; 24 mOsm), artificial snail water (ASW; 102 mOsm) and APW + mannitol (60 mOsm) at 20° C. A significant difference was found in the average number of emerging cercariae in snails maintained in APW, aerated APW and super-saturated (oxygenated) APW at 27° C. Developing adult worms were recovered from fish exposed to cercariae with bodies not retracted into their tails. At day five postinfection, six worms recovered from two experimentally infected bluegill had an average of 51.5 ± 13.2 (mean \pm SD) eggs indicating the progression of normal development in the fish definitive host. Adult worms derived from cercariae lacking eggs had significantly fewer (13.9 ± 1.3) eggs compared to adult worms recovered from cercariae with eggs (21.7 ± 2.3) at day one postinfection of young bluegill at 22.7° C.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Zoology Section; 1ST place in undergraduate research competition)

URCPP Funded Research

Source and photodegradation of dissolved organic matter as factors of fluoranthene phototoxicity to *Daphnia magna*. ELIZABETH FLEMING¹, RYAN OTTER², ERIN OVERHOLT², CRAIG WILLIAMSON², and JAMES ORIS², ¹Department of Biology, Berea College, Berea, KY, 40404 and ²Department of Zoology, Miami University, Oxford, OH 45056.

Dissolved organic matter (DOM) has been shown to greatly reduce fluoranthene phototoxicity to aquatic organisms both by decreasing its bioavailability and by absorbing and scattering solar ultraviolet radiation (UVR). Related studies have suggested that photodegradation of DOM decreases its ability to bind to phototoxic chemicals similar to fluoranthene. In order to explore the relationship between photodegradation of DOM and phototoxicity, five acute toxicity tests were performed on *Daphnia magna* under artificial sunlight with both photodegraded and non-photodegraded treatments of DOM from autochthonous and allochthonous sources; for each test five fluoranthene concentrations were achieved. A bioaccumulation experiment provided 12 hour body accumulation data for each treatment ($\mu\text{g/g}$). Twelve hour median lethal concentrations (LC50s) were compared to UV-A (340 nm) specific absorption and 12 hour body burden for all treatments; individual treatments were compared using parametric analysis. Only non-photodegraded, allochthonous DOM significantly decreased *Daphnia* mortality ($p < 0.0001$). LC50s for DOM treatments were directly correlated with specific absorbance and, in contrast to previous research, body accumulation. UVR absorption and scattering were determined to be the cause of decreased mortality for non-photodegraded, allochthonous DOM treatments; however, further research is required in order to determine why mortality and body fluoranthene concentration were inversely related.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation –Ecology and Environmental Science Section – 1st place in undergraduate research competition)

Knocking-out telomere-related genes using uncloned PCR fusion products and homologous recombination in *Aspergillus nidulans*. DAVID FOSTER¹, ALEX NOBLE², AMANDA SHERWOOD³, and PETE MIRABITO⁴, ¹Department of Biology, Berea College, Berea, KY 40404, ²Department of Biology, Georgetown College, Georgetown, KY 40324, ³Department of Biology, Centre College, Danville, KY 40422, and ⁴Department of Biology, University of Kentucky, Lexington, KY 40506.

We attempted to delete fifteen genes implicated in telomere maintenance from the genome of the filamentous fungus, *Aspergillus nidulans*. This is part of a project studying the molecular mechanisms of telomere maintenance. Telomere maintenance is important because these structures, which constitute the ends of linear chromosomes, are critical to maintaining chromosome integrity. Defects in telomeres lead to cellular senescence or chromosome rearrangements, events that are implicated in premature aging and cancer in humans. We are using *A. nidulans* because it has telomeres that resemble mammalian telomeres and because sophisticated experimental approaches can be used to rapidly yield insight into the molecular mechanisms of telomere maintenance. The fifteen genes were chosen based on their sequence similarity to genes implicated in telomere maintenance in other organisms. We created the gene knockout constructs using fusion PCR and attempted to replace the endogenous genes with our constructs by homologous recombination. Based on southern blot and PCR analyses, we succeeded in creating knockouts for at least six genes (0038.3, 1207.3, 5205.3, 2887.3, 10614.3, 6895.3). The results are consistent with six other genes being knocked out (2417.3, 10449.3, 2271.3, 4546.3, 0091.3, 0153.3). Further work is needed to clarify whether these genes have been knocked out. Three genes were not successfully knocked out (4555.3, 0596.3, 9113.3). Alternative strategies or approaches are likely to be required to create mutants for these genes. The mutants created by this work will be novel tools that can be used to investigate telomere maintenance in future studies.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Cellular and Molecular Biology Section – 1st place in undergraduate research competition)

KBRIN Funded Research

Psychophysiological study of response conflict and error processing deficits in patients with Posttraumatic Stress Disorder. GLORIA FRITZ¹ and TATO SOKHADZE², ¹Department of Biology, Berea College, Berea KY, 40404 and ²Department of Psychiatry, University of Louisville, Louisville, KY 40292.

Deficits in response conflict detection and motor response monitoring during a speeded forced choice task (Erkisen's flanker test) in post traumatic stress disorder (PTSD) patients were investigated using dense-array event-related potential (ERP) technique. Compared to matched controls (N=15), patients with PTSD (N=12) had slower reaction time and a higher error rate. During the incongruent flanker condition, PTSD patients showed altered and prolonged N200 and N450 ERP components in the fronto-centro region, suggesting abnormalities in potential response conflict detection and processing. PTSD patients demonstrated smaller error related negativity, again suggesting a lowered response monitoring ability. The PTSD group also had a higher heart rate and low heart rate variability indicative of a decreased autonomic cardiac control. This study suggests that patients with PTSD have cognitive deficits in motor response conflict detection and error monitoring, and that these deficits could be revealed with electrocortical and autonomic measures during speeded reaction time task.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Health Sciences Section)

KBRIN Funded Research

Defining the mechanism of EP4-mediated metastasis. ENRIQUE GARCIA¹, JOE AMANN², and DAVID CARBONE², ¹Department of Biology, Berea College, Berea, KY, 40404 and ²Department of Hematology/Oncology, Vanderbilt University, Nashville, TN, 37232.

Metastasis, the spread of a primary tumor to distant sites, is responsible for much of the mortality associated with cancer. Increased levels of the arachidonic acid metabolite, PGE₂, have been correlated with metastasis and poor outcome for cancer patients. PGE₂ operates through the E Prostaglandin Receptors (EP1-4) that are G-protein-coupled receptors (GPCRs), which mediate intracellular signaling. Literature supports the involvement of EP4, one of the four subtypes, in cancer metastasis. Inhibition or knockdown of this receptor in cancer cells greatly reduces the number of metastases in several mouse models. However, the mechanism of EP4-mediated metastasis has yet to be elucidated. We created a series of EP4/EP2 chimeric proteins designed to test particular EP4 regions that may be involved in the metastatic process. We examined the ability of these chimeric proteins to phosphorylate downstream proteins implicated in metastasis such as AKT/PKB and ERK. We are also looking at the platelet-cancer cell interaction in metastasis. Platelets tend to aggregate around a cancer cell shielding it from the immune system and aiding in the cancer cell's extravasion into a new site. We would like to determine if EP4 is involved in the interaction tumor cells with platelets. By using EP4 inhibitors and cancer cells with EP4 protein knocked down with a shRNA construct, it is our intention to show that EP4 contributes to metastasis by regulating the proteins necessary to allow cancer cell interactions with platelets. Defining these mechanisms may lead to better cancer treatments that halt metastasis, improving patient outcomes.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Cellular and Molecular Biology Section)

Dopamine transporter expression in a “two-hit” rat model of Parkinsonian Syndrome. CLARISSA HARRIS¹, ANDREW D. SAUERBECK², and JIM PAULY², ¹Department of Biology, Berea College, Berea, KY, 40404 and ²College of Pharmacy and Spinal Cord and Brain Injury Research Center, University of Kentucky, Lexington, KY 40504.

Characteristics of an organism exemplifying Parkinsonian Syndrome may be induced with the exposure to chemical toxins, particularly trichloroethylene (TCE) and with the treatment of traumatic brain injury (TBI). Preliminary studies have shown that long term exposure to TCE may lead to cellular degeneration in both the substantia nigra (SN) and the striatum by affecting mitochondrial respiration in dopamine-transporter neurons. The neuro-inflammation triggered by TBI may cause secondary damage to the dopaminergic system of the basal ganglia. The aim of this study was to evaluate the affect of TCE followed by TBI on dopamine transporter expression. The results indicate that animals that received trichloroethylene prior to receiving a traumatic brain injury exhibit a decrease in the number of tyrosine hydroxylase neurons in the substantia nigra. When animals received trichloroethylene prior to traumatic brain injury there was a dramatic decrease in the tissue spared. Animals that received trichloroethylene prior to receiving a traumatic brain injury exhibit an increase in the density of dopamine transporter (DAT) in the substantia nigra. Animals that received trichloroethylene prior to receiving a traumatic brain injury exhibit an increase in the density of dopamine transporter (DAT) in the ventral tegmental area (VTA).

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation –Health Sciences Section)

Inositol increases feeding on deterrent mixtures in larval *Manduca sexta*. AMANDA HENSLEY, KATHERINE JOHNSON, and MARC ROWLEY, Department of Biology, Berea College, Berea, KY 40404.

The tobacco hornworm, larval *Manduca sexta*, is a well known pest of the plant family Solanaceae, (tobacco, tomato, pepper, potato, etc.). Food choice and feeding behavior is primarily determined by the gustatory system of this caterpillar. Bitter compounds, such as caffeine, and salts, such as potassium chloride, are known to be feeding deterrents. Caterpillars will eat much less of these substances when given a choice between the deterrent and water. Inositol is a feeding incitant, which induces but does not sustain feeding. Previous research has shown that when inositol is combined with one deterrent, the result is increased and sustained feeding of the mixture. To test the hypothesis that inositol will offset the deterrence of a mixture and cause increased and sustained feeding on multiple feeding deterrents, we conducted experiments through a series of behavioral assays using various mixtures of caffeine, potassium chloride, and inositol.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Poster and Oral Presentation –Zoology Section; 1st place in undergraduate research poster competition; 3rd place in undergraduate research oral competition)

URCPP Funded Research

Abrogation of TGF- β signaling in mammary carcinomas recruits myeloid immune suppressor cells through CXCL5/CXCR2 chemokine axis. MEGAN JACKSON¹, ANNA CHYTIL², AGNIESZKA E. GORSKA^{2,3}, HAROLD L. MOSES^{2,3}, and LI YANG³,

¹Department of Biology, Berea College, Berea, KY 40404, ²Department of Cancer Biology, and ³Vanderbilt-Ingram Cancer Center, Vanderbilt University School of Medicine, Nashville, TN.

TGF- β is a very important tumor suppressor. Inactivation or alteration of TGF- β signaling is common in human cancers. We have previously observed that deletion of Tgfbr2 gene results in increased breast tumor progression and metastasis. However, the mechanism behind this observation is unclear. Myeloid immune suppressor cells, or MISCs, are host cells that are known to be immune suppressive and tumor promoting. As CXCL5 production is increased in breast adenocarcinomas with Tgfbr2 deletion, we hypothesize that CXCL5 interacts with its specific receptor CXCR2 and results in MISC recruitment into the tumor microenvironment, thus promoting tumor progression and metastasis. Studies were performed to elucidate the recruitment of MISCs *in vivo* MMTV PyVmT mouse model with specifically the deletion of TGF-B signaling in mammary adenocarcinomas. Mice bearing MMTV PyVmT Tgfbr2 knock out tumor or floxed control tumor were treated with a CXCR2 receptor antagonist SB-265610 at 2 mg/kg/ day by I.P. injection. This treatment with SB-265610 significantly reduced the recruitment of MISCs to Tgfbr2 null breast tumors but not the control tumors. From this study it can be concluded that therapeutic intervention to interrupt the CXCL5/CXCR2 chemokine axis may decrease the recruitment of MISCs to the tumor microenvironment with decreased TGFB signaling thus inhibit breast cancer progression.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation – Cellular and Molecular Biology Section)

Metagenomic characterization of the microbial communities in the Berea College Living Machine. JESSICA LANFAIR, JACOB GUNNELL, JENNA OTT, and DAWN J. ANDERSON, Department of Biology, Berea College, Berea, KY 40404.

Microbes are critical for the maintenance and sustainability of the ecosystems on Earth, both natural and manmade. Microbes exist in communities consisting of hundreds, if not thousands, of different species. These microbes adjust, adapt and co-evolve as a community of organisms, establishing their own dynamic biosphere. Studies to characterize microbial communities have historically involved isolating and individual members of the community. More recently, metagenomics methodologies have allowed researchers to study the diversity of microbes in an ecosystem by direct chromosomal DNA analysis. A number of recent studies have focused on characterizing the microbial populations involved in water bioremediation, in natural settings such as creeks, streams and lakes as well as manmade settings such as wastewater treatment plants. Little research has, however, been done to characterize the microbial flora in alternative wastewater treatment systems such as the Berea College Living Machine.[®] This new research project has begun to employ a metagenomic approach, as well as classical culturing methodologies, to characterize the microbial populations in the Berea College Living Machine.[®]

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Microbiology Section)

URCPP Funded Research

Analysis of the *Drosophila crmp* gene to understand the role of CRMP in neurogenesis. AMBER CRUTCHER¹, REBECCA LINVILLE², DEANNA MORRIS³, and JOHN RAWLS³, ¹Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475, ²Department of Biology, Berea College, Berea, KY 40404, and ³Department of Biology, University of Kentucky, Lexington, KY 40506.

The protein products of the insect *crmp* gene are functionally highly divergent but structurally very similar, produced by alternative splicing of a mutually exclusive exon that comprises only 9% of the protein sequence: DHP catalyzes the second step of pyrimidine degradation and is ubiquitously expressed in non-neuronal tissues; CRMP, a neuronal-limited protein in animals, has been implicated in a variety of processes in neuronal polarity and axonal growth cone dynamics. Our studies are focused on utilizing the remarkable structural similarities of these two proteins in insects, coupled with the powerful genetic facility of *Drosophila*, to better understand the role of CRMP in neurogenesis. Animals that ubiquitously over-express CRMP stop development during the first larval instar stage and, in earlier work to identify genes that interact with *crmp*, we obtained a series of mutations that suppress that mis-expression block (*i.e.*, allow normal development). The work to be described here extends those results with two follow-up experiments to determine how many genes are represented among the twenty suppressor mutations and, perhaps, to determine the location of those genes. We will report the results of experiments to map those suppressor mutations and the results of lethal complementation tests of the mutations. Another experiment has been carried out to investigate the possibility that CRMP participates in a functionally redundant pathway, as suggested by the apparently normal development of *crmp*-null animals. Results will be presented of a screen designed to isolate “synthetic lethal” mutations that might reveal the alternative neurogenesis pathway.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Cellular and Molecular Biology Section)

KBRIN Funded Research

DEPARTMENTS OF BIOLOGY & CHEMISTRY

Design and development of palladium-iron bimetallic electrocatalysts for polymer electrolyte fuel cells. JESSICA R. PRICE¹, RICHARD COOKS¹, MARK CUNNINGHAM², XIAIPING WANG³, and DEBORAH MYERS³, ¹Department of Biology, Berea, College, KY 40404, ²Department of Chemistry, Berea College, Berea, KY 40404, and ³Argonne National Laboratory, Argonne, IL 60439.

The path to more efficient energy sources for modes of transportation, to replace the CO₂-emitting, low efficiency internal combustion engine, has led the Department of Energy and Argonne National Laboratory to develop commercially competitive polymer electrolyte fuel cells (PEFCs). The purpose of this project is to design and develop bimetallic cathodic electrocatalysts for PEFCs with high electrochemical activity and high stability in order to replace more expensive platinum-based electrocatalysts. The bimetallic electrocatalysts reported in this study are composed of the precious metal palladium (Pd) and the base metal iron (Fe) fixed onto carbon support. The less expensive iron base metal is designed to comprise the core of the bimetallic alloy with a monolayer outershell consisting of palladium. The Pd-Fe electrocatalysts were synthesized by the impregnation method, utilizing Fe(NO₃)₃ and Pd(NO₃)₂ as metal precursors, producing bimetallic catalysts with a range of metal compositions. The precursor salts were reduced to the Pd-Fe bimetallic electrocatalyst in a dilute hydrogen atmosphere. Transmission electron microscopy, temperature programmed-reduction, and cyclic voltammetry (using the rotating disk electrode) were used to characterize the electrocatalysts' composition and particle size, reduction conditions for heat treatment, and catalyst stability and performance, respectively. The bimetallic catalyst with a molar ratio of 30:70 (Pd:Fe), heat treated in regen gas at 620 °C for 10 h, showed the highest activity of 65.31 mA/mg_{Pd} at 0.85V. Further research will focus on maximizing catalyst performance by optimizing heat treatment conditions to minimize particle size with a core-shell morphology. The desired end result is a bimetallic alloyed electrocatalyst that is cost efficient, has a high rate of oxygen reduction, a small particle size, and an activity of 440 mA/mg metal at 0.9V (2010 DOE target).

Oral presentation, August 1, 2007, Argonne National Laboratory, Argonne, Illinois.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation – Chemistry Section; 2ND place in undergraduate research competition)

Identification of genes regulated by p63 in human epithelia. BRITTNI ROSS¹, CHRISTOPHER BARTON², KIMBERLY JOHNSON², and DEBORAH MAYS²,
¹Department of Biology, Berea College, Berea, KY 40404 and ²Department of Biochemistry, The Vanderbilt-Ingram Cancer Center, Vanderbilt University, Nashville, TN 37232-0146.

p63, a homolog of the tumor suppressor p53, is expressed as one of at least six different isoforms. p63-deficient mice die from dehydration as a result of a complete lack of stratified epithelia and all of its derivatives, including epidermis, mammary and salivary glands, prostate epithelium, and other tissues. This phenotype is recapitulated in humans in which heterozygous germline mutations result in epithelial abnormalities such as ectrodactyly and ectodermal dysplasia. Genomic amplification and overexpression of p63 is also observed in numerous cancers of epithelial origin, particularly squamous cell carcinoma (SCC). To identify genes regulated by p63 in normal human epidermal keratinocytes (NHEK), we used global chromatin immunoprecipitation coupled with DNA sequencing to identify genomic binding sites of p63. Additionally, Affymetrix microarray analyses were completed following siRNA-mediated disruption of p63 expression in NHEKs. Crossing the two datasets revealed 86 candidate p63 target genes that, as measured by ontology analysis, enrich for functional classifications that reflect the phenotype observed in p63-null mice. We validated a subset of these genes as displaying p63-dependent expression and further found that these genes display expression patterns that are altered during the course of keratinocyte differentiation. A greater understanding of p63 function will provide further insight into the role(s) governed by p63 during the development, maintenance, and tumorigenesis of complex epithelial tissues.

2007 Vanderbilt Summer Science Academy Symposium, August 3, Vanderbilt University, Nashville, TN

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Cellular and Molecular Biology Section)

Role of MHC Class II expression on mouse T regulatory cells. RACHEL SAUNDERS¹ ASHUTOSH MANGALAM², and CHELLA DAVID², ¹Department of Biology, Berea College, Berea, KY-40404 and ²Department of Immunology, Mayo Clinic, Rochester, MN-55901.

T regulatory cells (Tregs) are CD4+CD25+ T cells that express the transcription factor FoxP3 and have the functional properties of anergy and suppression. Although studied extensively in mice, the role of Tregs in humans is not well understood. The purpose of this study was to determine whether the expression of HLA-DR on CD4+ T cells in DR3.AEo transgenic mice play a role in Treg function. This question was evaluated by isolating class II+ and class II- Treg (CD4+CD25+), and T effector (CD4+CD25-) populations from naive DR3.AEo mouse splenocytes through magnetic separation followed by fluorescence-activated cell-sorting (FACS). These two populations were stimulated alone or together with CD4+CD25- T effector cells at different ratios on an anti-CD3 and anti-CD28 coated plate. Results showed that both class II+ and class II- Tregs were anergic, however only class II+ Tregs could suppress proliferation of T effector cells. Further analysis showed that this suppression was mediated by both cell-cell contacts as well as through soluble mediators. We also observed that class II+ Tregs could not suppress cells that have been pre-stimulated with anti-CD3 and anti-CD28. In conclusion, our preliminary data suggests that class II+ T regulatory cells from HLA-DR3 transgenic mice can simulate the activity of human class II+ T regulatory cells, implying that the DR3.AEo mouse model can help to better understand how T regulatory cells behave in humans.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation – Cellular and Molecular Biology Section)

DEPARTMENT OF BIOLOGY

Of mice and men - Do arthritic-resistant mice provide clues to protection from rheumatoid arthritis? JOSH SPARKS¹, VEENA TANEJA², and CHELLA DAVID², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Mayo Clinic, Department of Immunology, Rochester, MN 55902.

Rheumatoid arthritis is an autoimmune disease that affects females significantly more than males. Genetically, predisposition to rheumatoid arthritis is associated with the presence of certain Human Leukocyte Antigen (HLA) class II alleles like HLA-DRB1*0401, while DRB1*0402 provides protection. DRB1*0401 and DRB1*0402 mice have been generated previously. Collagen-induced arthritis in mice is used as a model to study rheumatoid arthritis in humans. The DRB1*0401 mice develop arthritis similar to that observed in humans, while DRB1*0402 mice are protected against the disease. In order to understand why DRB1*0402 is protective the differences in immune system cells between resistant and susceptible mice were investigated. In addition, we investigated why arthritis undergoes remission during pregnancy. The data indicated that the immune cell composition between arthritic resistant and susceptible mice differ greatly, specifically in the presence of regulatory T cells. Data also suggested the immune system auto-suppresses itself during pregnancy. Significant changes occur during pregnancy that allows the disease to undergo remission.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Health Sciences Section; 2nd place in undergraduate research competition)

Nick-directed loop mismatch DNA excision in human cells. MEIPING SUN¹ and GUO-MIN LI², ¹Department of Biology, Berea College, Berea, KY 40404 and ²Department of Toxicology, University of Kentucky, Lexington, KY 40536.

In human cells, both normal metabolic activities and environmental factors such as ultraviolet light can cause DNA damage, resulting in as many as one million individual molecular lesions per cell per day. DNA damages causes an increased rate of gene mutations which influence the cell functions and susceptible to certain types of cancer, including hereditary nonpolyposis colorectal cancer. Luckily, damage to DNA can be detected by cells and specific DNA repair systems enable the repair. Mismatch repair is one of the repair systems which requires a nick on either side of the mismatch and contains mismatch recognition, excision of nucleotides containing wrongly incorporated bases, and resynthesis primary procedures. Previous studies have shown that, like base-base mismatch repair, cells can also repair mismatched DNA molecules due to an insertion/deletion that forms a loop structure in a nick-directed pathway. The mechanism of base-base mismatch repair is very clear. However, loop mismatch repair has not been well explored. In this research, we study the excision pattern of loop mismatch DNA. Using loss of endonuclease cutting sites after excision, we found that nick-directed excision occurred in both 3' and 5' double stranded circular loop substrates, and that 5' substrates showed a higher extent of excision. Loop structure and DNA purity both decrease enzyme digestion efficiency in nick-directed loop mismatch DNA excision. Adding the DNA polymerase inhibitor aphidicolin to block DNA resynthesis for repair with endogenous dNTPs stimulated the nick-directed excision, especially on 5' substrates.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Cellular and Molecular Biology Section)

DEPARTMENT OF CHEMISTRY

Synthesis of vinyl fluorides from alkyl halides and alcohols. G. K. SURYA PRAKASH¹, LAXMAN GURUNG², SUJITH CHACKO¹, and GEORGE A. OLAH¹, ¹Loker Hydrocarbon Research Institute and Department of Chemistry, University of Southern California, Los Angeles, CA 90089-1661 and ²Department of Chemistry, Berea College, Berea, KY 40404.

An effective route for the synthesis of vinyl fluorides from alkyl halides and alcohols using 1-fluoro-bis(phenylsulfonyl)methane is developed. Primary and secondary alkyl iodides and bromides undergo SN₂ reaction and alcohols undergo Mitsunobu reaction giving moderate to excellent yields of monofluoro bisphenyl sulfonyl derivatives. These derivatives undergo elimination reactions in the presence of a base followed by reductive desulfonylation to yield vinyl fluorides. This novel methodology is found to be very efficient and has applications for the synthesis of various biologically important molecules. The methodology can also be extended for the synthesis of various monofluoromethyl substituted compounds.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation – Chemistry Section)

Chemical and P-31 NMR analysis of phosphorus in soils affected by swine waste overflow. DIN OBADELE MANDLEY and PAUL C. SMITHSON, Department of Chemistry, Berea College, Berea, KY 40404.

Waste spills from a small confined animal feeding operation (CAFO) on the Berea College farm in east central Kentucky, USA have negatively impacted water quality in a stock watering pond downslope from the swine waste lagoons. In a 2006 study we collected soil samples from 100 georeferenced points in two small watersheds, one that receives lagoon overflow and an adjacent control watershed that receives no swine waste inputs. Available soil phosphorus in the drainage path of the affected watershed was significantly ($P < 0.0001$) higher than in upland samples from the same watershed. In this study we further characterized the 52 soil samples from the affected watershed. We determined organic and inorganic P in 0.25 M NaOH + 0.05 M EDTA extracts of the soils, and conducted P-31 NMR analysis on the extracts of selected soils from the watershed. Inorganic NaOH-EDTA P was much higher in the treatment drainage compared to adjacent upland samples (mean difference 1560 mg P/kg, $P < 0.0001$). Organic P was also higher in the drainage path, but much less so (mean difference 900 mg P/kg, $P = 0.035$). For all samples, estimates of organic P averaged 75% of total NaOH-EDTA P (range 14-100%). P-31 NMR analysis of selected extracts showed most P to be inorganic orthophosphate, with the organic fraction occurring mostly as mono- and diester P. Organic P was about 20-25% of total NaOH-EDTA P as estimated by NMR, suggesting that the commonly used NaOH-extractable organic P value is an overestimate.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation – Chemistry Section)

DEPARTMENT OF CHEMISTRY

New synthetic pathway to abnormal and normal N-heterocyclic carbene complexes. KAYLA R. MEADOWS, MAREK COUNTS, and ANES KOVACEVIC, Department of Chemistry, Berea College, Berea, KY 40404.

N-heterocyclic carbenes have become increasingly popular ligands 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. Recently, a new “type” of N-heterocyclic carbene complex, abnormal carbene, has been reported. This research project provides a new synthetic pathway to N-heterocyclic carbene complexes. Our synthetic approach includes $[\text{Ir}(\text{H})_2(\text{PPh}_3)_2(\text{Acetone})_2]\text{X}$ as a metal precursor and room temperature C-H bond activation.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation – Chemistry Section; 1st place in undergraduate research competition)

URCPP Funded Research

Reduction of proton-driven spin diffusion artifacts from 2D zfr-INADEQUATE MAS NMR Spectra. THABISO MUSAPELO, LAXMAN GURUNG, BRIAN SUTTON, and JAY BALTISBERGER, Department of Chemistry, Berea College, Berea, KY 40404.

The primary shortcoming of the z-filtered refocused INADEQUATE MAS NMR pulse sequence is the possibility of artifacts introduced during the z-filter due to proton-driven spin diffusion (PDS) where by extra peaks in the single-quantum dimension (from other sites in the molecule) appear correlated with a given double-quantum frequency. This is a problem when the spinning speeds are too slow (less than 15 kHz) to sufficiently average the proton-proton homonuclear dipolar couplings. This would be especially important when working with large volume rotors that are difficult to spin fast enough to completely average the homonuclear couplings. In our experiments we used the frequency-switched Lee-Goldberg (FSLG) method of homonuclear decoupling during the z-filter to remove the artifact peaks. This method has the advantage of being quite easy to setup and implement on most modern NMR spectrometers.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation – Chemistry Section)

URCPP Funded Research

DEPARTMENT OF CHEMISTRY

The synthesis of aluminum magnesium layered double hydroxides and characterization of phosphate ion exchange experiments. ANTHONY REYNOLDS¹, PAUL SIDERIS², and CLARE P. GREY², ¹Department of Chemistry, Berea College, Berea, KY 40404 and ²Center for Environmental Molecular Science, Department of Chemistry, State University of New York at Stony Brook, NY.

Layered Double Hydroxides (LDHs) are layered crystalline structures that have been proposed to be used as sorbants for environmental remediation of water especially in the case of arsenate/arsenite compounds. In this study, a series of LDHs were synthesized with Aluminum concentrations of 17%, 25% and 33%. The long-range structure was studied using powdered X-ray diffraction. The local environments were probed using magic angle spinning nuclear magnetic resonance (MAS NMR). Each LDH was successfully anion exchanged with several phosphates at various pH. The use of ³¹P and ¹H NMR techniques including ³¹P{¹H} cross-polarization allowed for the speciation of the anions in the interlayer.

93rd Annual Meeting of the Kentucky Academy of Science, November 8–10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation – Chemistry Section)

DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE

An examination of fingerprint analysis using the fourier transform. JONATHAN HUNT, MICAH J. SMITH, and LARRY A. GRATTON, Department of Mathematics and Computer Science, Berea College, Berea, KY 40404.

Fingerprint analysis is commonly used for personal identification and seems generally believed to be an infallible process. However, recent cases, like that of an Oregon lawyer misidentified as a terrorist suspect, have cast doubt on the reliability of these practices when applied to digital images that may be easily modified. This investigation is concerned with possible causes of such identification errors, as well as the introduction of measures that may reduce them. Principles of image processing are applied to digital fingerprint images to determine and isolate the information (i.e. ridge structure) necessary for accurate identification. The discrete version of the Fourier transform serves as the primary mathematical tool. The analysis focuses on two important factors: resolution and image enhancement. Classical sampling theory is used to determine a minimum sampling resolution necessary to recover ridge details. Standard enhancement techniques and there effects on ridge details in the original image are discussed in the framework of Fourier analysis.

34th Pi Mu Epsilon Student Conference, September 28-29, 2007, Miami University, Oxford, OH

*Invited Colloquium Talk, November 2, 2007, Susquehanna University, Selinsgrove, PA
Joint Mathematics Meetings, January 6-9, 2008, San Diego, CA*

URCPP Funded Research

Berea College jazz project: The recording of African and Latin influenced jazz for tuba, saxophone, and percussion. CHARLES TURNER, WILLIAM BRATTON, ERIN BARGER, and JACOB HAMRICK, Department of Music, Berea College, Berea, Kentucky, 40404.

Jazz tubists have not performed recordings of original African and Latin influenced jazz music; and performances of original African and Latin jazz by North American wind and percussion musicians have been rare. The purpose of the research is to present an African and Latin influenced jazz recording featuring the tuba, saxophone, and multiple percussion instruments. Accompanying liner notes provide photographs and background information regarding the music and the performers of the *Berea Jazz Project*. Guest artists for the performance include New York City jazz vocalist Gail Wynters, Ecuadorian guitarist Bruce Farris, bassist of the Latin band *Airto*, student vocalist Jessica French, and members of the Berea College *Black Music Ensemble*. Examples of repertoire performed are *Uruhu* (Swahili for “freedom”); *Tomba in 7* by Latin jazz artist *Airto*; *Quito*, by Bruce Farris; and *Calling Out My Name*, by Tripp Bratton. Two compositions, written by North Americans, *Hurricane Camille* and *Spain* have been arranged in Latin Jazz style, using Latin instrumentation of tonal percussion. The research steps include 1.) Acquisition of a professional recording studio, 2.) transcription, arranging, and formatting of music using 3.) preparation of a background synthesizer/drum/click track, used for single track recording, 4.) recording of each instrument or voice (in separate tracks), 5.) editing and mixing of the various tracks, 6.) final mixing and mastering of the recording, 7.) preparation of CD liner notes, and 8.) production of the CD. Expected outcomes of this research include the production of the first recording of African and Latin influenced jazz by a tubist, thereby expanding repertoire for the instrument; to produce a rare recording of original African and Latin influenced music by a North American wind and percussion performers; and to prompt further research and recording of original African and Latin influenced jazz by North American artists.

URCPP Funded Research

DEPARTMENT OF PHYSICAL EDUCATION AND HEALTH

Profile of physical activity levels and mindfulness and personality traits among physically independent older adults. Part I. Personality traits. CORTNEY MCCARTY, JASMINE MOORE, and, MARTHA BEAGLE, Department of Physical Education and Health, Berea College, Berea, KY 40404.

The purpose of this study was to measure the five personality traits presented in the Big Five Inventory controlling for perceived health status, gender, age, educational level, and marital status for older adults who participated in a nationally recognized older adult exercise class, Body Recall, from the cities of Berea and Richmond, Kentucky. The average years of participation in Body Recall was 6.1 years. The five personality traits were assessed using the Big Five Inventory among 130 persons (104 women and 26 men) aged 40 to 94 years ($M=70.5$, $S.D.=11.8$). Results: The more educated a participant of Body Recall was the higher the extraversion score ($p<.01$; $r=.280$); the higher the agreeableness score ($p<.05$; $r=.176$); and the higher the conscientiousness score ($p<.05$; $r=.190$). Controlling for gender, females with more education were more extraverted ($p<.01$; $r=.322$), agreeable ($p<.01$; $r=.258$), conscientious ($p<.05$; $r=.211$), and open ($p<.01$; $r=.305$). Controlling for health, those participants with more education had higher scores in extraversion ($p<.05$; $r=.286$), agreeableness ($p<.05$; $r=.305$), and conscientiousness ($p<.05$; $r=.328$). For those participants in very good health, more education was positively correlated to extraversion ($p<.05$; $r=.320$). The older a participant in this health category, the less neurotic they were ($p<.05$; $r=-.357$). Controlling for length of Body Recall participation, those who had participated longer than eleven years, extraversion ($p<.01$; $r=.509$) and openness ($p<.05$; $r=.421$) provided positive relationships. Conclusions: Based on the results of the Big Five Inventory, participants of seven Body Recall classes that participated in this study can be described as an educated group of older adults who are extraverted, agreeable, and conscientious. Highly educated female participants, more so than the males, were extraverted, agreeable, conscientious, and open. Participants with a perceived health status of very good and more educated were more extraverted; older participants in this health category were less neurotic. Extraversion and conscientiousness were characteristics of those who had participated in Body Recall longer than eleven years. These conclusions can provide an instructor of Body Recall with some fundamental characteristics of a class. Such insights can aid in instructional methods that work for the more educated participants and an acknowledgement that those with lower educational levels are not being reached with current teaching styles and methods of any significance.

National Convention for the American Alliance for Health, Physical Education, Recreation, and Dance in Fort Worth, Texas, April 2008.

URCPP Funded Research

DEPARTMENT OF PHYSICAL EDUCATION AND HEALTH

Profile of physical activity levels and mindfulness and personality traits among physically independent older adults. Part II: Physical activity. CORTNEY MCCARTY, JASMINE MOORE, and, MARTHA BEAGLE, Department of Physical Education and Health, Berea College, Berea, KY 40404.

The purpose of this study was to investigate the relationship of physical activity to perceived health status, gender, age, educational level, and marital status for older adults who participated in a nationally recognized older adult exercise class, Body Recall, from the cities of Berea and Richmond, Kentucky. The average years of participation in Body Recall was 6.1 years. Physical activity was assessed using the Physical Activity Scale for the Elderly (PASE) questionnaire among 130 persons (104 women and 26 men) aged 40 to 94 years ($M=70.5$, $S.D.=11.8$). The total PASE score ranged from 6 to 336. The mean PASE score was 151.5 ($S.D.=67.2$). Results: The relationship between overall PASE score (151.5) and years of attendance (6.1 years) in Body Recall was significant ($p<.05$; $r=-.178$). The longer an older adult participated in Body Recall, the lower their overall PASE score. The relationship between overall PASE score (151.5) and age of Body Recall participants was significant ($p<.05$; $r=-.188$). The younger the participant, the higher their overall PASE score was. Based on gender, the relationship between overall PASE score (148.5) and years of attendance (6.3 years) was significant ($p<.05$; $r=-.212$). The longer a female participated in Body Recall, the lower the overall PASE score. The relationship between overall PASE score (148.5) and years of age for females (70.8 years) was significant ($p<.01$; $r=-.296$). The older a female participant was, the lower the overall PASE score. Controlling for education, the relationship between overall PASE score (146.9) and years of participation (6.7 years) for high school graduates was significant ($p<.05$; $r=-.413$). The longer an older adult with a high school education participated in Body Recall, the lower their overall PASE score. Conclusions: The results from this study did not support the hypothesis that participating in Body Recall would have positive influence in an older adult's physical activity level. Decreased physical activity with age is inevitable, but the Body Recall program is positive keeping some physical activity in the lives of older adults as described by the mean number of years of participation in the program. Although the level of physical activity decreases, attendance and participation in a Body Recall class provides a level of regular physical activity.

National Convention for the American Alliance for Health, Physical Education, Recreation, and Dance in Fort Worth, Texas, April 2008.

URCPP Funded Research

DEPARTMENT OF PHYSICAL EDUCATION AND HEALTH

Profile of physical activity levels and mindfulness and personality traits among physically independent older adults. Part III: Mindfulness. CORTNEY MCCARTY, JASMINE MOORE, and, MARTHA BEAGLE, Department of Physical Education and Health, Berea College, Berea, KY 40404.

The purpose of this study was to investigate the relationship of mindfulness to perceived health status, gender, age, educational level, years of participation, instructor, and marital status for older adults who participated in a nationally recognized older adult exercise class, Body Recall, from the cities of Berea and Richmond, Kentucky. The average years of participation in Body Recall was 6.1 years. Mindfulness was assessed using the Langer Mindfulness Scale among 120 older adults (24 men and 96 women) aged 40-94 years ($M=70.2$; $S.D.=13.2$). The total mindfulness score ranged from 64 to 140. The mean overall mindfulness score was 100.7 ($S.D.=16.2$). The overall scores of the four domains were as follows: novelty producing mean 30.8 ($S.D.=6.5$); novelty seeking mean 26.8 ($S.D.=6.1$); engagement mean 24.3 ($S.D.=5.2$); and flexibility mean 18.8 ($S.D.=3.8$). Results: Controlling for gender, the relationship between age and overall mindfulness overall score was significant ($p<.05$; $r=-.231$). The older the female participant, the lower the overall score was. Controlling for length of participation in Body Recall, the relationship between 2-5 years of participation and novelty seeking, engagement, and total sum score of mindfulness was significant ($p<.05$; $r=-.296$, $r=-.305$, $r=-.298$). Controlling for age, the relationship between age (70-79 years) and total sum mindfulness score and engagement were significant ($p<.05$; $r=.324$, $r=.282$). Among the seven instructors, participants in the class of instructor one had higher total mindfulness scores the longer they had participated ($p<.05$; $r=.229$) and higher novelty seeking scores ($p<.05$; $r=.319$). Those who had participated for 6-10 years had the highest engagement scores and novelty seeking scores ($p<.05$). Those who had participated eleven or more years had higher flexibility scores ($p<.05$). The 60-69 year old participants in this class had the higher engagement scores ($p<.05$). Conclusions: Overall, the total group's overall mindfulness score decreased with age. This can be explained as one ages, one becomes less confident in being mindful or attentive. For those participants who were in the program 2-5 years, Body Recall participation proved to be beneficial for older participants. They were more novelty seeking, more engaging, and had a higher total mindful score. Their participation in the Body Recall class may still be new and challenging, thus providing opportunities and experiences to insure mindfulness. Out of the seven Body Recall classes that participated in this study, the class of instructor one presented more participants who were more mindful. The longer an individual participated in this particular class, the higher their overall mindful score and the higher their novelty seeking score. For those who had participated 6-10 years, engagement and novelty seeking scores were high; eleven or more years of participation had higher flexibility scores. Such positive evidence for the participants in this class may be reflective of the teaching style and experiences offered by the teacher of this class. Although exercise content is similar between classes, teachers do have some freedom in how it is presented. Body Recall has an educational component, and the presentation style of this educational component in this class may enhance the mindful behaviors of these participants, and for those instructors who saw a decrease in mindfulness will now be aware and enhance their lessons with experiences to improve mindfulness.

National Convention for the American Alliance for Health, Physical Education, Recreation, and Dance in Fort Worth, Texas, April 2008.

URCPP Funded Research

Effect of doping novel thin film Sb_2Te phase-change material on its optical and switching time property. KANNATASSEN APPAVOO¹, ROBERT M. SHELBY², SIMONE RAOUX², DELIA MILLIRON², and AMER LAHAMER¹, ¹ Department of Physics, Berea College, Berea, KY, 40404 and ² IBM Almaden Research Center, 650 Harry Road, San Jose, CA 95120.

Phase-change films with their characteristic amorphous-crystalline reversibility have gained much attention in recent years for their numerous potential applications in optically rewritable data-storage media, nanodevices and much effort is now focused on integrating this property into non-volatile memory devices (phase-change random access memory or PCRAM). This research focuses its effort on determining the effect of doping on the switching time property of Sb_2Te film while optimizing its crystallization transition temperature. We compare crystallization behavior of undoped as-deposited and melt-quenched Sb_2Te with its doped counterparts using knowledge that crystalline and amorphous states have distinct optical reflectivity differences. Experiments show that X and Y doped Sb_2Te films have faster switching time as compared to Z doped ones in both the as-deposited (X: 65ns, Y: 80ns, Z:180ns) and melt-quenched state (X: 20ns, Y: 25ns, Z: 50ns). Hence, effective doping may prove to be the key to make Sb_2Te films viable as the next phase-change material to be used in nanodevices and PCRAM. We further seek to ensure that these promising results are solely a product of phase transition using atomic force microscopy.

Remark: Owing to potential patent filing, dopants' identities have been intentionally substituted to X, Y and Z.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation –Physics and Astronomy Section; 1st place in undergraduate research competition)

Prospects for LISA to detect the Christodoulou memory of gravitational waves. SHIBLEE RATAN BARUA¹ and Dr. DANIEL KENNEFICK^{2, 3}, ¹Departments of Physics and Mathematics, Berea College, Berea, KY 40404, ²Arkansas Center for Space and Planetary Sciences, University of Arkansas, Fayetteville, AR 72701, and ³Department of Physics, University of Arkansas, Fayetteville, AR 72701

Einstein's Theory of General Relativity predicts that masses in motion generate waves that travel through space-time at the speed of light. The flux of such waves from a system itself generates a change in the gravitational field which propagates like a wave. This "wave of a gravitational wave" is referred to as the Christodoulou Memory. The purpose of our research work was to predict whether LISA (Light Interferometer Space Antenna) would be able to detect this interesting second-order wave. LISA will be the first dedicated space-based gravitational wave observatory which will use advanced laser interferometry to measure gravitational waves. LIGO (Laser Interferometer Gravitational-Wave Observatory) has been unable to detect the Christodoulou Memory since the frequency range of the possible incoming signal is too low for it to detect. Moreover, the ground-based LIGO is subject to a huge amount of noise disturbances from its surroundings. Our subject of interest for LISA was any binary system 200 Mpc from the Earth which consists of a solar-mass sized stellar body spiralling into a super-massive black hole (SMBH) of 10^6 solar mass. Using FORTRAN 77, we improved the old LIGO-oriented code developed by Dr. Daniel Kennefick to make it suitable for LISA. The result showed that as the stellar object gradually draws near to the SMBH, more and more energy is released resulting in the gradual increase in the memory function. The effect is dramatic near the final coalescence of the two bodies during which there is a significant rise in the value of memory. To justify our result, we included a filter function that would filter out any possible sources of noise disturbances. Even after making all the necessary adjustments to the code, we noticed that there was some form of discontinuity in the graph for the filter function at around the coalescence time. A new formula for the inspiral time temporarily solved the problem, and it assumes the gravitational wave signal will cease when there is one orbit left to make before the two bodies merge. Future work includes overcoming problems associated with the inspiral time by simultaneously optimizing time step-size, total time, and, in turn, frequency range to be detected.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation –Physics and Astronomy Section; 4th place undergraduate research competition)

Laser ablation of graphite at Berea College: To successfully produce fullerenes at Berea College and then to synthesize new endohedral metallofullerenes using laser ablation. BRAD STEELE, DAVID GILMOUR, and AMER LAHAMER, Department of Physics, Berea College, Berea, KY 40404.

In 1996, Harold Kroto, Richard Smalley, and Robert Curl won the Nobel Prize in Chemistry for their discovery of Carbon-60, the third allotrope of carbon. The spherical molecule, whose structure of carbon atoms arranged in pentagons and hexagons is comparable to a soccer ball, has incredible properties applicable to nanotechnology. The object of our research was to generate C-60 through the process of ablation, which involves vaporizing solid carbon with a high-powered laser. We then collected the ablated material and examined what it was using a mass spectrometer. We believe we made trace quantities of C-60. However, further work is needed to reach our main goal which is to synthesize endohedral fullerenes.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Oral Presentation –Physics and Astronomy Section)

URCPP Funded Research

DEPARTMENT OF PHYSICS

First light at the renovated Berea College observatory. MOHAMMED YUSUF, BRYAN GOVER, and TRACY HODGE, Department of Physics, Berea College, Berea, KY 40404.

The Berea College observatory consists of a computer-driven, 16" f/18 Ritchey-Cretien telescope equipped with a Santa Barbara Instrument Group (SBIG) ST-7 CCD camera and standard UBVRI filters. Significant renovations which were undertaken in 2006 include the installation of new stepper motors and a goto computer system provided by DFM Engineering. The summer of 2007 provided the first opportunity to test the new system. Images were obtained of a variety of astronomical objects including the Hercules cluster, Albierio, and RR Lyrae. The new pointing and tracking system works extremely well, allowing for integration times of up to six minutes without having to reposition the object. However, the slow optics of the f/18 system result in a limited field of view ($3.2' \times 2.2'$) and poor photometric conditions at the site combine to make calibrated, all-sky photometry problematic. We have obtained and are in the process of testing two Meade focal reducers (f/6.3 and f/3) which should greatly increase the field of view of the optical system and allow us to obtain relative photometric measurements of a wide variety of astronomical objects.

93rd Annual Meeting of the Kentucky Academy of Science, November 8—10, 2007, University of Louisville, Louisville, Kentucky (Poster Presentation –Physics and Astronomy Section)

URCPP Funded Research

DEPARTMENT OF PSYCHOLOGY

Where have all the students gone? Factors influencing the retention and academic success of students who entered Berea College in the fall of 2006. KALEIGH MCCOY and DAVE PORTER, Department of Psychology, Berea College, Berea, KY 40404.

This report contains the findings from multiple analyses of an extensive data base containing information about the demographic characteristics, academic preparation, academic potential and experiences of 385 students who entered Berea College in the Fall of 2006, as well as the characteristics of the particular section of an introductory general studies course in which they were enrolled. In general, their experiences in the college's introductory general studies course, GSTR 110, had a profound influence on their retention and academic success. Student demographic characteristics had only a small influence on their retention and academic success. Student retention and academic success were found to be completely unrelated to student satisfaction or their ratings of teacher or course effectiveness. However, course characteristics such as the number of common meeting hours and student workload were found to strongly influence grades and subsequently retention and academic performance. Both the number of hours the class met and the quality of student engagement in this course appear to be positive predictors of subsequent student success. The strength of the relationships discovered support the continuation and extension of this line of inquiry.

Associate Dean of Faculty Assessment Project Funding

DEPARTMENT OF TECHNOLOGY AND INDUSTRIAL ARTS

Quantifying acoustical properties of tone-woods. MARTY EDWARDS, WILLIAM HAZLET, TIMOTHY HOLMAN, JAYME SPAUGH, and GARY MAHONEY, Department of Technology and Industrial Arts, Berea College, Berea, KY 40404.

Builders of fine stringed instruments have generally applied one or more tests, during the construction process, to ensure a consistent, desirable tone. Antonio Stradivari (1644-1737) and Giuseppe Guarneri (1698-1744) carved the plates (tops and backs) while using a combination of flexing and tapping to achieve desired stiffness and resonant frequency. Additional tests include applying principles discovered by Ernst F. Chladni (1756-1827), directing a frequency at a plate and using a non-magnetic material to display the nodes and antinodes, and the recent process promoted by Roger Siminoff of deflection tuning. This is the process of applying a known mechanical load to a plate and then measuring the amount of deflection present. The purpose of this study was to design test equipment and establish testing procedures that would quantify the process of tuning tone-woods on a guitar. The team was able to identify and manipulate the frequency of the guitar tops and backs with the aid of Virtual Stroboscope and Voice Vista software. Test equipment and procedures were established and used in the actual construction of guitar tops and backs. Frequency tests using both Stroboscope and Chladni patterns were conducted and documented at multiple stages during the process. Stroboscope frequencies were recorded and Chladni tests were videotaped to document the pattern change at various frequencies. This information was correlated to demonstrate the relationship between the tests. A deflection tuner was designed and constructed, however additional testing will be necessary.

URCPP Funded Research

SELECTED STUDENT REFLECTIONS

As a component of fulfilling the ALE (Active Learning Experience) requirement in General Studies, Biology majors were required to write a two page reflection paper on their summer research experience. What follows are some selected excerpts (slightly edited when necessary) from these reflections. An effort has been made to conceal the individuals and the projects they were associated with. It is our hope that other departments will follow suit in the future as this feedback provides an effective strategy to qualitatively gauge the success of our efforts.

I did not truthfully know what I had gotten myself into come time to start research in early June. I expected a certain level of field work, lab work, analysis, documentation, troubleshooting, problem solving, and educated guesses. Yet, looking back on the ten weeks I spent with the team, I find myself thinking that the research experience helped me with more than just facts and figures and the understanding of those things; it actually gave me invaluable—priceless—experience working with some of the most amazing people in a real-world situation that I will certainly find in medical school and beyond.

The summer almost seemed to fly by. For once, I was actually excited to go to work, when it is usually the worst part of the day, or week, for me. Surrounded by science and biological equipment was a drastic change from the routine of the school year. Each day was a new adventure, even when some days consisted of a continuation of particular experiments. The somewhat reclusive nature of lab work was a treat to my introverted nature, and always enjoyable.

We knew that the setup for the experiment was not going to be easy and we encountered many different problems. Each time we ran the experiment we discovered a new mistake in our setup. However, our enthusiasm never diminished. We really wanted to get proper data and so we kept on persisting.

As great as my research was, the people on my research team were even greater. I believe that as long as you are working with a team in which everyone gets along well, the work is automatically simplified 100 times and lab becomes livelier. When it was time to do some serious work, we were all into it and when it was time for break, we played hard. So, we had a very good balance and I loved working with everyone in the lab.

At the beginning, I was skeptical on how the summer would turn out. I had doubts that students in my research group would like each other, and that the research may not be that interesting. However, on the first day all my doubts vanished. From that first day I fell in love with the topic and had many questions and research ideas in my head. I knew from that first day that this summer was going to be one of the best summers of my life.

Our research group made the very best of each and everything we did. It felt good to realize that as our research proceeded we were all so interested in getting good results from the projects we ran that we did not mind conducting the same experiment countless times, going to the lab to check on things at late hours of night, and occasionally starting work really early. I really

appreciate the way (our mentor) encouraged us to think for ourselves, design our own experiments or come up with new things that we could do. It made us like our work even more and also made us feel like we were in charge of our own experiments. I found the sense of responsibility our mentor gave us with his approach really motivating.

In the first few weeks, I consistently got no results following a whole day of effort from early morning to the early evening. I felt so frustrated about it that I almost lost my confidence to continue the project. But my supervisor and colleagues encouraged and helped me to solve the technique problems I was having. Then, from the third week on, I began to get samples back and got better and better results. I was also moved by the enthusiasm of the researchers in the lab. Most of the time, they came to lab early in the morning and did not leave lab until midnight. They never felt bad about the time they spent in the lab. A successful experiment made them happy like a child. From these colleagues and mentors, I saw the great spirit of contribution associated with scientific research. Every new breakthrough in science requires months and years of devoted work. Under their influence, I developed more and more interest in scientific research which strengthened my decision to devote my whole life to this.

My practical reasoning, creative thinking, and problem solving abilities were also developed through the summer. In a lab situation, one must really be prepared for anything that comes up or goes wrong. There were many obstacles in which we had to find creative solutions in order to continue with the research. This summer has given me much more than a simple summer job. Participating in this lab experience has prepared me for work in future labs, and future possible careers. It has presented me with skills and abilities that I will be able to use throughout my life in science. As such, it has been more valuable than can be described.