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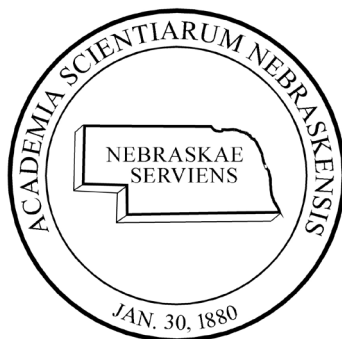
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**PROGRAM
and
PROCEEDINGS**

**THE NEBRASKA ACADEMY
OF
SCIENCES
1880-2011**

including the

**Nebraska Association of Teachers of Science
(NATS) Division
Nebraska Junior Academy of Sciences
(NJAS) Division
and
Affiliated Societies**



131st Anniversary Year

One Hundred-Twentyfirst Annual Meeting

April 15, 2011

**OLIN HALL OF SCIENCE - NEBRASKA WESLEYAN UNIVERSITY
LINCOLN, NEBRASKA**

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The 2011 Fall Conference of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, September 29 - October 1 (Thursday, Friday, and Saturday).

President: Kirsten Smith, Lincoln Public Schools, Lincoln, NE

President-Elect: Jon Pedersen, University of Nebraska–Lincoln, NE

AFFILIATED SOCIETIES OF THE NEBRASKA ACADEMY OF SCIENCES, INC.

1. American Association of Physics Teachers, Nebraska Section

Web site: <http://www.cune.edu/facweb/brent.royuk/naapt/about.htm>

2. Friends of Loren Eiseley

Web site: <http://www.eiseley.org>

3. Lincoln Gem & Mineral Club

Web site: <http://www.lincolngemmineralclub.org/>

4. Nebraska Chapter, National Council for Geographic Education

5. Nebraska Geological Society

Web site: <http://maps.unomaha.edu/ngs/>

Sponsors of a \$50 award to the outstanding student paper presented at the Nebraska Academy of Sciences Annual Meeting, Earth Science Section

6. Nebraska Graduate Women in Science

7. Nebraska Ornithologists' Union

Web site: <http://www.noubirds.org/>

Publishers of the quarterly, *The Nebraska Bird Review*

Spring Meeting, May 20 - 22, 2011, Norfolk, NE

8. Nebraska Psychological Society

<http://www.nebpsych.org/>

9. Nebraska-Southeast South Dakota Section Mathematical Association of America

Web site: <http://math.creighton.edu/maa/>

Spring Meeting, April 8-9, 2011, University of Nebraska at Kearney, Kearney, NE

10. Nebraska Space Grant Consortium

Web site: <http://www.ne.spacegrant.org/>

**THE NEBRASKA SPACE GRANT CONSORTIUM MADE A GENEROUS CONTRIBUTION
TO THE ACADEMY TO HELP DEFRAY COSTS OF THIS MEETING**

THE NEBRASKA ACADEMY OF SCIENCES, INC.

302 Morrill Hall, 14th & U Streets

Lincoln, Nebraska 68588-0339

Affiliated with the American Association for the Advancement of Science

And

National Association of Academies of Science

GENERAL INFORMATION

Members and visitors will be registered at Olin Hall of Science, Nebraska Wesleyan University, 50th & St. Paul, Lincoln, Nebraska. The registration fee is \$60.00 for General Registrants which includes dues and \$10.00 for students with a VALID student ID. Registrants are entitled to the PROGRAM/PROCEEDINGS and to attend any of the section meetings. Junior and senior high school students will register at a separate area, FREE.

Additional copies of the PROGRAM/PROCEEDINGS may be obtained at the Registration Desk or, after the meeting, at the Academy Office, for \$4.00/copy.

The Nebraska Academy of Sciences was organized on January 30, 1880 with monthly scheduled meetings in Omaha, Nebraska. The Academy was reorganized on January 1, 1891 and annual meetings have been held thereafter.

AUTHORS ARE INVITED TO SUBMIT MANUSCRIPTS OF THEIR WORK FOR PUBLICATION IN THE TRANSACTIONS OF THE NEBRASKA ACADEMY OF SCIENCES, a technical journal published periodically by the Academy for 34 years.

Articles in all areas of science, science education, and history of science are welcomed, including results of original research as well as reviews and syntheses of knowledge.

The *Transactions* is moving to a digital format. There are no charges for publication, except for color illustrations, and authors receive 50 free offprints depending on the date of transfer to digital publication. The *Transactions* is distributed free to all members of the Academy and to about 400 libraries worldwide, and it is abstracted by major abstracting services.

Two hard copies and one electronic copy of each manuscript should be submitted to the Nebraska Academy of Sciences, 302 Morrill Hall, 14th and U Street, Lincoln NE 68588-0339. (402) 472-2644, nebacad@unl.edu

Our website address is <www.neacadsci.org>.

PROGRAM

FRIDAY, APRIL 15, 2011

- 7:30 a.m. REGISTRATION FOR ACADEMY, Lobby of Lecture wing, Olin Hall
- 8:00 Aeronautics and Space Science, Session A, Olin 249
Aeronautics and Space Science, Session B, Olin 224
Collegiate Academy, Biology Session A, Olin B
Collegiate Academy, Chemistry and Physics, Session A, Olin 324
- 8:25 Chemistry and Physics, Section A, Chemistry, Olin A
- 8:30 Biological and Medical Sciences, Session A, Olin 112
Biological and Medical Sciences, Session B, Smith Callen Conference Center
Chemistry and Physics, Section B, Physics, Planetarium
Junior Academy, Judges Check-In, Olin 219
Junior Academy, Senior High REGISTRATION, Olin Hall Lobby
NWU Health and Sciences Graduate School Fair, Olin and Smith Curtiss Halls
- 9:00 Junior Academy, Senior High Competition, Olin 124, Olin 131
Teaching of Science and Math, Olin 325
- 9:10 Aeronautics and Space Science, Poster Session, Olin 249
- 10:00 Applied Science and Technology, Olin 325
- 10:30 Aeronautics and Space Science, Poster Session, Olin 249
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN B
Dr. Erin Flynn, Nocturnal Manager, Omaha's Henry Doorly Zoo
- 12:00 LUNCH, PATIO ROOM, STORY STUDENT CENTER
(pay and carry tray through cafeteria line, or pay at NAS registration desk)
Aeronautics Group, Conestoga Room
- 1:00 p.m. Anthropology, Olin 111
Biological and Medical Sciences, Session C, Olin 112
Biological and Medical Sciences, Session D, Smith Callen Conference Center
Chemistry and Physics, Section A, Chemistry, Olin A
Chemistry and Physics, Section B, Physics, Planetarium
Collegiate Academy, Biology Session A, Olin B
Collegiate Academy, Biology Session B, Olin 249
Collegiate Academy, Chemistry and Physics, Session B, Olin 324
Collegiate Academy, Chemistry and Physics, Session C, Olin 325
Earth Science, Olin 224
Junior Academy, Judges Check-In, Olin 219
Junior Academy, Junior High REGISTRATION, Olin Hall Lobby
Junior Academy, Senior High Competition, (Final), Olin 110
- 1:30 Junior Academy, Junior High Competition, Olin 124, Olin 131
- 2:00 NJAS Board/Teacher Meeting, Olin 219
- 4:45 BUSINESS MEETING, OLIN B
- 5:30 AWARDS RECEPTION for NJAS, Scholarships, Members, Spouses, and Guests
First United Methodist Church, 2723 N 50th Street, Lincoln, NE

*For papers with more than one author, an asterisk follows the name of the author(s) who plans to present the paper at the meeting.

AERONAUTICS AND SPACE SCIENCE

Chairperson: Scott E. Tarry

NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

SESSION A

Olin 249

- 8:00 a.m. 1. ENHANCING INTRODUCTORY COURSES WITH HANDS-ON PROJECTS. William E. Spurgeon, Division of Business and Information Technology, Western Nebraska Community College, Scottsbluff.
- 8:10 2. SIR: IMAGE ANALYSIS. Jonathan Spurgeon, Division of Math and Science, Western Nebraska Community College, Scottsbluff.
- 8:20 3. DARK MATTER ANNIHILATIONS AND THE OBSERVED POSITRON EXCESS FROM FERMI AND PAMELA. Katherine Garrett* and Gintaras Duda, Department of Physics, Creighton University, Omaha.
- 8:30 4. CONSTRAINTS ON UNIVERSAL EXTRA-DIMENSIONAL DARK MATTER FROM DIRECT DETECTION RESULTS. Trevor J. Torpin* and Gintaras Duda, Department of Physics, Creighton University, Omaha.
- 8:40 5. PARTICLE DARK MATTER – BEYOND THE STANDARD MODEL. Gintaras K. Duda, Department of Physics, Creighton University, Omaha.
- 8:50 6. CONSTRAINING BAL QUASAR KINETIC LUMINOSITY WITH CIII* ABSORPTION. David C. Austerberry, Department of Physics, Creighton University, Omaha.
- 9:00 7. MODELING THE TORI SURROUNDING ACTIVE GALACTIC NUCLEI WITH MASS OUTFLOWS USING NIR SPECTRA. Barbara Medvar* and Jack Gabel, Department of Physics, Creighton University, Omaha.
- 9:10 BREAK/POSTER PRESENTATIONS
- 9:30 8. SLOSH DYNAMICS OF ORION'S SERVICE MODULE PROPELLANT TANK. Joan Yule*, Linxia Gu, and the Microgravity Team, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 9:40 9. DEVELOPING pH CHART FOR BIODIESEL TITRATION. Amanda Smith* and Anthony Limato, Department of Biology, College of Saint Mary, Omaha.
- 9:50 10. EFFECT OF DROPLET SIZE IN THE ROLE OF FUEL VAPOR ACCUMULATION EFFECTS IN DROPLET BURNING. Inkant Awasthi* and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln.

- 10:00 11. CHEMISTRY ANALYSIS WITH VERNIER. Alex Egentowich* and Brena Mauck, Department of Biology, College of Saint Mary, Omaha.
- 10:10 12. EXPERIMENTAL INVESTIGATION OF PERFORMANCE OF ELECTRO-CHEMICAL MACHINING BY COATED ELECTRODES FOR APPLICATIONS IN AEROSPACE AND AIRCRAFT INDUSTRY. K. P. Rajurkar*, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln; and A.K. Swain, Texas Tech University, Lubbock, TX.
- 10:20 13. NANOSTRUCTURED ELECTRODES FOR SUPERCAPACITOR ELECTRICAL ENERGY STORAGE DEVICES. Robert Jacobberger*, Paul Goodman, and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. EVALUATING THE ACCURACY OF COMMERCIALY AVAILABLE WATER TESTING METHODS. Katie James*, and Jeremy Karr, Department of Biology, College of Saint Mary, Omaha.
- 11:00 15. POLARIZING EFFICIENCY OF THIN FILMS OF IR806. Joshua Beck* and Liubov Kreminska, Department of Physics and Physical Science, University of Nebraska at Kearney.
- 11:10 16. IMAGE ANALYSIS OF LIQUID CRYSTAL POLARIZERS. Jeremy Stromer* and Liubov Kreminska, Department of Physics and Physical Science, University of Nebraska at Kearney.
- 11:20 17. POSITIONAL AVERAGE STRUCTURE FROM AN INCOMMENSURATELY MODULATED CRYSTAL OF PROFILIN:ACTIN. Jason Porta, Department of Biology, University of Nebraska Medical Center, Omaha.
- 11:30 18. GAS EMBOLIC FACTORS IN CARDIOVASCULAR HEALTH. Eric Cutler* and Linxia Gu, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 11:40 19. HYDROSTATIC INDIFFERENCE POINT MODEL OF THE HUMAN VENOUS SYSTEM. Brian Steinert, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 11:50 20. THE INTEGRATION OF PROPANE FLAMING AND MECHANICAL CULTIVATION FOR EFFECTIVE WEED CONTROL IN AGRICULTURE. Brian Neilson*, Chris Bruening, and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 12:00 ADJOURN

AERONAUTICS AND SPACE SCIENCE

Chairperson: Michaela Lucas

NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

SESSION B

Olin Hall Room 224

- 8:00 a.m. 1. THE EFFECTS OF MASAI BAREFOOT TECHNOLOGY (ROCKER BOTTOM) SHOES ON JOINT KINEMATICS AND KINETICS. Neil B. Huben*, Sara A. Myers, and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.
- 8:10 2. ELASTIC BAND-BASED RESISTANCE TRAINING AS A METHOD OF MAINTAINING MUSCULAR STRENGTH AND MASS IN HEALTHY ADULTS. Jon Carey*, Sara A. Myers and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.
- 8:20 3. THE EFFECTS OF AUDITORY OSCILLATIONS THAT INCLUDE CHAOS. Nate Hunt, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.
- 8:30 4. EPISODE SIMULATION OF ASIAN DUST STORMS WITH AN AIR QUALITY MODELING SYSTEM. Cui Ge*, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln; and MeiGen Zhang, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China.
- 8:40 5. ARCHITECTURAL STANDARDS DEVELOPMENT FOR LONG TERM PARTIAL GRAVITY HABITATS. Matthew Carper*, and Ram Bishu, Department of Industrial Engineering, University of Nebraska–Lincoln.
- 8:50 6. ANALYSIS OF HYPERSPECTRAL IMAGERY TO MAP INVASIVE BLACK MANGROVE IN COASTAL TEXAS. Alissa C. Hart* and John F. Schalles, Department of Biology, Creighton University, Omaha.
- 9:00 7. REMOTE SENSING OF SURFACE VISIBILITY FROM SPACE. Amy Gehring* and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln.
- 9:10 BREAK/POSTER PRESENTATIONS
- 9:30 8. IDENTIFICATION OF ALKALIPHILIC BACTERIA FROM WESTERN NEBRASKA. Luke Wright*, Kathryn Score, and Ann Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 9:40 9. AUTOMATED, BOAT-BORNE REMOTE SENSING OF WATER QUALITY IN A GEORGIA TIDAL WATERSHED. John P.R. O'Donnell*, Department of Environmental Science, and John F. Schalles, Department of Biology, Creighton University, Omaha.
- 9:50 10. TRACKING WHOOPING CRANES WITH WIRELESS SENSOR NETWORKS. David Anthony*, Paul Bennett, Mehmet C. Vuran, Sebastian Elbaum, and Matthew Dwyer, Department of Computer Science and Engineering, University of Nebraska–Lincoln.

- 10:00 11. MAPPING ZONES OF GROUNDWATER DISCHARGE WITH STREAMBED TEMPERATURE MEASUREMENTS, CHADRON CREEK, NORTHWESTERN NE. Joseph J. Reedy*, Michael B. Leite, Jennifer L. Balmat, and Kodi Young, Department of Geosciences, Chadron State College, Chadron.
- 10:10 12. PRELIMINARY CORRELATION OF REMOTELY-SENSED LINEAMENTS TO FAULTS ON THE PINE RIDGE IN NORTHWESTERN NEBRASKA. Jennifer L. Balmat*, and Michael B. Leite, Department of Geosciences, Chadron State College, Chadron.
- 10:20 13. ESTIMATING CORN YIELD FOR NEBRASKA USING WEATHER DATA AND THE LAND SURFACE TEMPERATURE AND EVAPOTRANSPIRATION DERIVED FROM LANDSAT SATELLITE DATA. Vijendra K. Boken*, Chelsea Martin, Nicholas Volpe, and Ryan Levell, Department of Geography and Earth Science, University of Nebraska at Kearney; and Joseph D. Nigro, Department of Science Systems Applications, and Compton J. Tucker, Department of Hydrospheric and Biospheric Sciences, NASA Goddard Space Flight Center, Greenbelt, MD.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. REMOTE SENSING AND GIS AS TOOLS TO ASSIST NEBRASKA'S EMERGING GRAPE AND WINE INDUSTRY. Ting Chen* and Donald Rundquist, School of Natural Resources, University of Nebraska–Lincoln; and Craig Romary, Nebraska Department of Agriculture, Lincoln.
- 11:00 15. INCREASING STUDENTS' AWARENESS ABOUT SCIENCE AND SUSTAINABILITY. Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha.
- 11:10 16. CRYOCOOLER VALIDATION FOR THE VASIMR ISS DEMONSTRATOR MISSION. Eldon Summerson*, Kevin Watts, Andrew Kelley, Joe Bartles, Andrea Gilkey, Khoa Chu, Derek Fierstein, Kyrik Weidman, and Carl Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 11:20 17. CONTROL AND MECHANICAL DESIGN CONSIDERATIONS FOR A SELF-RECONFIGURABLE MODULAR ROBOT FOR SPACE APPLICATIONS. S.G.M. Hossain*, and Carl A. Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 11:30 18. DYNAMICALLY RECONFIGURING MODULAR ROBOTS FOR EFFICIENT MANEUVERABILITY IN INITIALLY UNKNOWN TERRAINS. Zachary Ramaekers* and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha; and Carl Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 11:40 19. INVESTIGATING THE IMPACT OF DISTRACTION ON REMOTE SURGICAL SKILLS LEARNING IN TELEMEDICINE. Irene H. Suh*, and Ka-Chun Siu, College of Public Health, University of Nebraska Medical Center, Omaha.

- 11:50 20. CLOSE-RANGE SPECTRAL ANALYSIS OF WINE-GRAPE LEAVES. Dominic Biondo*, and Donald Rundquist, School of Natural Resources, University of Nebraska–Lincoln.
- 12:00 ADJOURN

AERONAUTICS AND SPACE SCIENCE

Poster Session 9:10 – 9:30 a.m. & 10:30 – 10:50 a.m.
Olin Hall 249

BUILDING A COMMUNITY OUTREACH PROGRAM. Carolyn Behney and Jeremy Karr, Department of Chemistry, College of Saint Mary, Omaha.

COMPARATIVE ANATOMY AND DISSECTION: PIG, RABBIT, AND HUMAN. T’Essence Bessick and Jeff Keyte, Department of Arts and Sciences, College of Saint Mary, Omaha.

CHEMICAL DEMONSTRATIONS. Emily E. Duval Carmenaty and Jeremy Karr, Department of Chemistry, College of Saint Mary, Omaha.

UNDERSTANDING AND DEVELOPING HPLC METHODS. Chelsea P. Dean and Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha.

THE INTEGRATION OF IPAD TECHNOLOGY INTO STEM EDUCATION COURSEWORK. Neal Grandgenett and Neal Topp, Department of Teacher Education; and Robert Shuster, Department of Geology; and Dana Richter-Egger, Department of Math and Science; and Michael Matthews, Department of Mathematics, University of Nebraska at Omaha.

SURGICAL ROBOTIC TOOL EXCHANGER. Anna Horst, Department of Mechanical Engineering, University of Nebraska–Lincoln.

ARTIN-SCHREIER-WITT EXTENSIONS IN CHARACTERISTIC ZERO. Alexander James, Department of Computer Engineering, University of Nebraska at Omaha.

INCORPORATING MATLAB IN CALCULUS. Samantha Marquez and Jing Chang, Department of Mathematics, College of Saint Mary, Omaha.

DESIGN AND IMPLEMENTATION OF A SIX DEGREE OF FREEDOM MINIATURE *IN VIVO* SURGICAL ROBOT FOR USE IN LONG-TERM SPACE FLIGHT. Ryan McCormick, Department of Mechanical Engineering, University of Nebraska–Lincoln.

EXPLORATIONS IN STEM: AN EDUCATIONAL SCIENCE LITERACY PROGRAM. Ryan J. Tefft, Department of Geology; and Neil B. Huben and William E. Tapprich, Department of Biology, University of Nebraska at Omaha.

MINIATURE *IN VIVO* SURGICAL ROBOT FOR LONG-TERM SPACE FLIGHT. Tyler D. Wortman, Department of Mechanical Engineering, University of Nebraska–Lincoln.

GAIT ABNORMALITIES IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE. Jennifer M. Yentes and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

ANTHROPOLOGY

Co-Chairpersons: Wayne A. Babchuk and Melissa J. Garfield
Department of Anthropology
University of Nebraska–Lincoln
Olin Hall 111

- 1:00 p.m. WELCOME
- 1:15 1. UNEARTHING AGRICULTURAL FACTORS, HEALTH INDICATORS, AND DEVELOPMENT CONCERNS IN SOUTH WOLLO, ETHIOPIA. Annie Cafer, Department of Anthropology, University of Nebraska–Lincoln.
- 1:30 2. DIET AND DISEASE: SUBSISTENCE CHANGE AND TUBERCULOSIS AMONG THE OMAHA AND PAWNEE. Owen O’Reilly, Department of Anthropology, University of Nebraska–Lincoln.
- 1:45 3. LOCAL FOOD ENVIRONMENTS AND OBESITY IN CHILDREN IN RELATION TO SOCIOECONOMIC STATUS. Sarah Lush, Department of Anthropology, University of Nebraska–Lincoln.
- 2:00 4. SEEKING DEEP TIME: REPORT OF THE 2010 ACTIVITIES OF UNL FIELD SCHOOL IN ARCHAEOLOGY IN THE SEARCH FOR MIDDLE HOLOCENE AGE CULTURAL DEPOSITS IN THE SALT CREEK DRAINAGE, SE NEBRASKA. LuAnn Wandsnider, Department of Anthropology, University of Nebraska–Lincoln.
- 2:15 5. SLING TECHNOLOGY: MODELING OF CAPABILITIES AND EXPERIMENTATION. Eric Skov, Department of Anthropology, University of Nebraska–Lincoln.
- 2:30 6. BEING BOTH MAN AND WOMAN: THE CULTURAL ONTOLOGY OF DIMORPHIC GENDER ROLES AMONG THE BERDACHE AND BABAYLAN. Mayo Buenafe, Department of Anthropology, University of Nebraska–Lincoln.
- 2:45 BREAK
- 3:00 7. WOMEN’S WORTH: A WESTERN MISCONCEPTION. Caroline Jones, Department of Anthropology, University of Nebraska–Lincoln.

- 3:15 8. EVOLUTIONARY SOCIAL SCIENCE AND THE ENVIRONMENTAL CRISIS: WITH A FOCUS ON POPULATION AND CONSUMPTION, GENDER ISSUES AND CRITICAL QUESTIONS FOR RESEARCH. Charles A. Flowerday, Department of Anthropology, University of Nebraska–Lincoln
- 3:30 9. A RE-EXAMINATION OF THE NATURE OF MALE PARENTAL INVESTMENT. Nathan R. Sell, Department of Anthropology, University of Nebraska–Lincoln.
- 3:45 10. FIFTH GRADE AS A RITE OF PASSAGE. Sevda Budak, Department of Teaching, Learning, and Teacher Education, University of Nebraska–Lincoln.
- 4:00 11. DUALITY OF THE KIRPAN: USING SEMANTICS TO EXAMINE THE ROLE OF FUNCTIONING IN DEFINING AN ARTICLE OF FAITH AMONGST KHALSA SIKHS. Don Arp, Jr., Department of Anthropology, University of Nebraska–Lincoln.
- 4:15 12. LOST OR REVIVED: THE PATHS OF ENDANGERED LANGUAGES. Gwyneth Talley, Department of Anthropology, University of Nebraska–Lincoln.
- 4:30 13. FIFTY YEARS OF THE CENTRAL KALAHARI GAME RESERVE (1961-2011): A HISTORY OF LAND USE, CONTESTED RESOURCES, LEGAL RIGHTS, AND JUSTICE AMONG INDIGENOUS PEOPLES. Wayne A. Babchuk, Department of Anthropology, University of Nebraska–Lincoln; and Robert K. Hitchcock, Center for Global Change and Earth Observations, Michigan State University, East Lansing, MI 48824-1034; and Maria Sapignoli, Department of Sociology, University of Essex, Colchester CO4 3SQ, United Kingdom.

BIOLOGICAL AND MEDICAL SCIENCES

Chairperson: Annemarie Shibata
Department of Biology, Creighton University

SESSION A

Session Chairperson: Kimberly Carlson, University of Nebraska at Kearney
Olin 112

- 8:30 1. A SURVEY OF MIDWESTERN LEOPARD FROGS (*RANA PIPIENS* AND *RANA BLAIRI*) FOR EVIDENCE OF GONADAL DYSGENESIS AMONG MALES. Katherine Lansu*, Megan Konz, and J.E. Platz, Department of Biology; and Laura Bruce, Department of Biomedical Sciences, Creighton University, Omaha.
- 8:42 2. LIFE HISTORY OF *SPEA BOMBIFRONS*: LONGEVITY, A FIRST LOOK. Megan Konz*, and J.E. Platz, Departments of Biology; and L. Bruce, Department of Biomedical Sciences, Creighton University, Omaha.
- 8:54 3. ADHESIVE TARSAL SETAE IN MALE TIGER BEETLES: STRUCTURE, FUNCTION, AND EVOLUTION. Mathew L Brust*, A. Denniston, M. Nielsen, and B. Baker, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 9:06 4. A TALE OF TWO PRAIRIES: REGAL FRITILLARIES AT TWO EASTERN NEBRASKA PRAIRIE PRESERVES. Michael E. Kilbride* and Theodore Burk, Department of Biology, Creighton University, Omaha.
- 9:18 5. THE RELATIONSHIP BETWEEN 20-HYDROXYECDYSONE AND REPRODUCTIVE BEHAVIOR AND PHYSIOLOGY IN WOLF SPIDERS. Reed M. Stubbendieck*, A.J. Zera, and E.A. Hebets, School of Biological Sciences, University of Nebraska–Lincoln.
- 9:30 BREAK
- 9:45 6. THE ROLE OF LIGHT IN *JUNIPERUS VIRGINANA* (EASTERN RED CEDAR) INVASION IN TALLGRASS PRAIRIE. Laura Rice* and Mary Ann Vinton, Department of Biology, Creighton University, Omaha.
- 9:57 7. OUTER BARK ANNUAL GROWTH RINGS CORRELATED WITH WOOD RINGS IN HACKBERRY *CELTIS OCCIDENTALIS*. Paul K. Evans*, Science Department, Metropolitan Community College, Omaha.
- 10:09 8. FUNGAL DIVERSITY OF A COTTONWOOD ROOT SYSTEM. Jeff Shaw*, Mary Harner, and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney.
- 10:21 9. ANTIBIOTICS FROM NATIVE PLANTS FOR USE AGAINST MRSA. Nisha Durand*, William Tuma, Ann Buchmann, Joyce Hardy, and Ron Weedon, Department of Physical and Life Sciences, Chadron State College, Chadron.

10:33 10. SIDEROPHORE PRODUCTION BY ALKALINE-SALINE LAKE BACTERIA. Marcelle Strydom* and J.J. Shaffer, Department of Biology, University of Nebraska at Kearney.

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

Session Chairperson: Karin Van Dijk, Creighton University
Smith Callen Conference Center

- 8:30 1. STRUCTURAL CHARACTERIZATION AND ANALYSIS OF PRE-QUEUOSINE RIBOSWITCH. Christina Nguyen*, Donald Schrack, and Juliane Soukup, Department of Chemistry, Creighton University, Omaha.
- 8:42 2. A PUTATIVE MAMMALIAN RIBOSWITCH IN THE SPERMINE BIOSYNTHETIC PATHWAY. Katie Del Vecchio*, Molly McDevitt, Jodi Monahan, Garrett Soukup, and Juliane Soukup, Department of Chemistry, Creighton University, Omaha.
- 8:54 3. EVOLUTIONARY CONSERVATION OF A POTENTIAL MAMMALIAN RIBOSWITCH. Andrew Kavan*, Molly McDevitt, and Juliane Soukup, Department of Chemistry, Creighton University, Omaha.
- 9:06 4. *PSEUDOMONAS SYRINGAE* INDUCES REDUCTION IN HISTONE H3 ACETYLATION IN A TYPE III SECRETION DEPENDENT MANNER. Troy Hubbard*, Andrew Karpisek, McKenzie Jarecki, and Karin van Dijk, Department of Biology, Creighton University, Omaha; and Byeong-ryool Jeong and James Alfano, Center for Plant Science Innovation, University of Nebraska–Lincoln.
- 9:18 5. NATIVE STRUCTURE OF THE 5' NONTRANSLATED REGION OF THE *COXSACKIEVIRUS* B3 GENOME AS DETERMINED BY CHEMICAL PROBING. Brooke L. Sullivan* and William E. Tappich, Department of Biology, University of Nebraska at Omaha.
- 9:30 BREAK
- 9:45 6. PUTATIVE DNA MOTIF ASSOCIATED WITH *T. GONDII* BRADYZOITE INDUCTION. Sushrut D. Kamerkar* and Paul H. Davis, Department of Biology, University of Nebraska at Omaha.
- 9:57 7. CHARACTERIZATION OF rRNA INTRONS IN FUNGI. Travis Kirchner* and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney; and Jolanta Miadlikowska, Ester Gaya, and François Lutzoni, Department of Biology, Duke University, Durham, NC.

- 10:09 8. CHARACTERIZATION OF MUTANTS DEFICIENT IN RNA INTERFERENCE IN GREEN ALGAE. Michael Stewart*, Eun-Jeong Kim and Heriberto Cerutti, School of Biological Sciences and Plant Science Initiative, University of Nebraska–Lincoln.
- 10:21 9. THE CCR4-NOT CO-ACTIVATOR FUNCTIONS IN GCN4 REGULATED GENE EXPRESSION AFTER TRANSCRIPTION. Dhananjay Nawandar*, Andrew Seberg, Naomi Barcomb and Mark J. Swanson, Department of Biology, University of Nebraska at Omaha.
- 10:33 10. IDENTIFYING ELEMENTS OF POST-TRANSCRIPTIONAL REGULATION IN THE GENERAL AMINO ACID CONTROL PATHWAY OF *SACCHAROMYCES CEREVISIAE*. Emily B. Harrison* and M.J. Swanson, Department of Biology, University of Nebraska at Omaha.
- 11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCE

SESSION C

Session Chairperson: Brad Ericson, University of Nebraska at Kearney
Olin 112

- 1:00 1. OPTIMIZATION OF AN IN-CELL WESTERN ASSAY FOR HIPPOCAMPAL NEURONS IN PRIMARY CULTURE. Tobiah B. Elbert* and Janet Whitson, Department of Natural Science, Concordia University, Seward.
- 1:12 2. OMEGA-3 TO OMEGA-6 RATIOS: LACK OF EFFECT ON LEARNING AND MEMORY. David Pattison*, Kimberly Miller, Timothy von Behren, Mallory Hicks, Jacky Potane, Justin Boutwell, Rebecca Aldrich, and Janet Whitson, Department of Natural Science, Concordia University, Seward.
- 1:24 3. THE USE OF COARSE GRAINED NORMAL MODE ANALYSIS IN UNDERSTANDING A β PROTOFIBRIL DYNAMICS. Curtis Scott Jordan* and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 1:36 4. ELASTICITY OF ALZHEIMER'S A β PROTOFIBRILS STUDIED WITH FULLY ATOMISTIC NORMAL MODE ANALYSIS. Trang Doan*, Department of Chemistry, and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 1:48 5. IDENTIFICATION AND CHARACTERIZATION OF PRION INHIBITOR BINDING REGIONS FOR THE AGAAAAGA PEPTIDE. Tana Friesth*, Department of Sociology, and Jason Bartz, Department of Medical Microbiology and Immunology, and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 2:00 6. ROLE OF EGFR IN HAIR CYCLING AND INFLAMMATION IN THE SKIN. Jessica A. Gaulter*, K.J. Bichsel, and L.A. Hansen, Department of Biomedical Sciences, Creighton University, Omaha.

- 2:12 7. CHARACTERIZATION OF THE 6Q DELETION IN FOLLICULAR LYMPHOMAS BY NEXT GENERATION DNA SEQUENCING. Katie Wichers*, Karen Deffenbacher, Cindy Lachel, David Klinkebiel, and Wing C. Chan, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha.
- 2:24 8. ENVIRONMENTAL STRESS REGULATION EFFECTS ON GLUCOSE TOLERANCE IN KK-A^y MICE WITH NON-INSULIN DEPENDENT *DIABETES MELLITUS*. Mathew B. Day* and Janet Steele, Department of Biology, University of Nebraska at Kearney.
- 2:36 BREAK
- 2:50 9. MEASURES FOR BOOLEAN PROTEIN INTERACTION NETWORKS. Karen L. Holly* and Mark Pauley, School of Interdisciplinary Informatics, University of Nebraska at Omaha; and John Konvalina, Department of Mathematics, University of Nebraska at Omaha.
- 3:02 10. DOMAIN SPECIFIC ASSEMBLY FOR NEXT GENERATION SEQUENCING. Julia Warnke* and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha.
- 3:14 11. IDENTIFYING BIOLOGICALLY RELEVANT SUBSYSTEMS USING CORRELATION NETWORKS. Dylan Nielsen*, Kate Dempsey and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

Session Chairperson: Annemarie Shibata, Creighton University
Smith Callen Conference Center

- 1:00 1. ROLE OF PROSTANOID RECEPTORS IN THE INHIBITORY EFFECT OF SYNTHETIC ISOPROSTANE, Ag113 ON POTASSIUM-INDUCED [3H] D-ASPARTATE RELEASE IN ISLOATED BOVINE RETINA. Jamal M. Jamil*, Edem Kegey, Na'ara Harrison, Catherine A. Opere, Pharmacy Sciences, Creighton University, Omaha; amd Thierry Durand, Jean-Marie Galano, and Alexandre Guy, Institut des Biomolécules Max Mousseron, Montpellier cedex, France.
- 1:12 2. LINKING FUMONISIN EXPOSURE TO NEURAL TUBE DEFECTS. Kathryn Score*, Chadron State College, Chadron; and Janee Van Waes, and Joyce Maddox, Creighton University, Omaha.
- 1:24 3. EFFECT OF TIMP-2 IN TRUNK NEURAL CREST PATHFINDING. Anne E James*, Alicia Muhleisen, and Mark V Reedy, Department of Biology; and Philip R Brauer, Department of Biomedical Sciences, Creighton University, Omaha.

- 1:36 4. DICER, DON'T LEAVE HOME WITHOUT IT. Megan Bosch*, Amanda Hake, and Annemarie Shibata, Department of Biology; and Marsha Pierce and Garrett Soukup, Department of Biomedical Sciences, Creighton University, Omaha.
- 1:48 5. RT-PCR ANALYSIS OF MICROGLIAL NEUROTROPHIC PROPERTIES. Irsa Shoiab* and Annemarie Shibata, Department of Biology, Creighton University, Omaha.
- 2:00 6. INNATE IMMUNE RESPONSE TO *CYTOMEGALOVIRUS* IN MACROPHAGES. Riley Machal*, Department of Physical and Life Sciences, Chadron State College, Chadron and Thomas Jerrells, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha.
- 2:12 7. PRODUCTION AND PURIFICATION OF NORA VIRUS ORF 3 PROTEIN. Andrew Prosocki*, Darby J. Carlson, Ethan Cordes, Brad Ericson, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.
- 2:24 8. HIV-1 PROTEIN CONCENTRATION AND GENE REGULATION ALTERED UPON TREATMENT WITH ANTIRETROVIRAL NANOPARTICLES. Emily McMullen* and Annemarie Shibata, Department of Biology, Creighton University, Omaha; and Michael Goede, Chris J Destache, School of Pharmacy and Health Professions, Creighton University, Omaha; and Alex Pham, Department of Mathematics, Creighton University, Omaha.
- 2:36 BREAK
- 2:50 9. THE DEVELOPMENT OF AN AUTOMATED PIPELINE FOR GENOME WIDE ASSOCIATION. Patrick Kwete Bokashanga*, Ishwor Thapa, Dhundy Bastola, and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha.
- 3:02 10. EFFECTS ON LONGEVITY OF *DROSOPHILA MELANOGASTER* AFTER USING MUTATIONAL INSERTIONS TO KNOCKOUT GENES. Rachel Hall* and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.
- 3:14 11. CHARACTERIZATION AND EXPRESSION OF *SIMULIUM VITTATUM* (BLACK FLY) SILK GENES: AN EXAMINATION OF SILK GENETICS AND EVOLUTION. Angelica Woo*, C.L. Brockhouse, and S. Cho, Department of Biology, Creighton University, Omaha.
- 3:26 12. SEQUENCING THE GAPDH GENE IN *MEDicago LUPULINA*. Zachary Bishop* and Amanda Waddle, Department of Physical and Life Sciences, Chadron State College, Chadron.

CHEMISTRY AND PHYSICS

Chairperson:

Andy Zhong, Department of Chemistry, University of Nebraska at Omaha

SECTION A, CHEMISTRY

Olin A

- 8:25 a.m. WELCOME
- 8:30 1. DEVELOPMENT AND OPTIMIZATION OF THE ENTRAPMENT METHOD FOR USE IN THE ANALYSIS OF DRUG-PROTEIN INTERACTIONS IN HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. Abby Jackson*, H. Xuan, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 8:50 2. A STUDY OF OXYGEN VACANCY DEFECTS IN NANOSTRUCTURED CERIUM OXIDES. Chin Li Cheung*, Neil J. Lawrence, Joseph R. Brewer, Gonghua Wang, and Jamie Wells-Kingsbury, Department of Chemistry, University of Nebraska–Lincoln; and Lu Wang and Wai Ning Mei, Department of Physics, University of Nebraska at Omaha; and T.S. Wu and Yun-Liang Soo, Department of Physics, National Tsing Hua University, Taiwan.
- 9:10 3. CARBONYL ¹³C CHEMICAL SHIFTS, N→PI* INTERACTIONS, AND PROTEINS. Bradley Worley*, Gerard S. Harbison, and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln.
- 9:30 4. NMR METABOLOMICS AS A NOVEL TOOL TO STUDY PANCREATIC CANCER. Teklab Gebregiworgis*, Bo Zhang, and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln; and Panjak K. Singh, Salk Institute, University of Nebraska Medical Center, Omaha.
- 9:45 BREAK
- 9:50 5. CATALYST DESIGN FOR ASYMMETRIC HYDROFORMYLATION. Andrew E. Geis* and N.C. Thacker, Department of Chemistry, University of Nebraska–Lincoln.
- 10:05 6. DEVELOPMENT OF PORPHYRIN-BASED METAL-ORGANIC FRAMEWORKS WITH COORDINATIVELY UNSATURATED METAL CENTERS. Haemi Chung* and Wonyoung Choe, Department of Chemistry, University of Nebraska–Lincoln.
- 10:20 7. AFFINITY SORBENTS FOR EXTRACTION AND CONCENTRATION OF ENVIRONMENTAL CONTAMINANTS. Efthimia Papastavros* and D.S. Hage, Chemistry Department, University of Nebraska–Lincoln; and D.D. Snow and D.A. Cassada, Water Center, School of Natural Resources, University of Nebraska–Lincoln.
- 10:35 8. EXPLORING COBALT AS AN ALTERNATIVE BIS-OXAZOLINE COMPLEX. Michele M. Kalal*, Kazuya Toyama, and James M. Takacs, Department of Chemistry, University of Nebraska–Lincoln.
- 10:50 BREAK

- 11:00 MAIBEN LECTURE - OLIN HALL B
- 1:00 p.m. WELCOME
- 1:05 9. PORPHYRINIC METAL-ORGANIC FRAMEWORKS FOR DETECTION OF EXPLOSIVES. Brandon J. Burnett* and Wonyoung Choe, Department of Chemistry, University of Nebraska–Lincoln.
- 1:25 10. ANALYSIS OF THE EFFECTS OF GLYCATION ON THE BINDING OF SULFONYLUREA DRUGS TO HUMAN SERUM ALBUMIN. Ryan E. Matsuda* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 1:45 11. DETECTION OF MERCURY (II) USING CHELATION ENHANCED QUENCHING CHEMOSENSOR. Chen Hou*, Yang Yang, John Blecha, and Haishi Cao, Department of Chemistry, University of Nebraska at Kearney.
- 2:05 12. DETERMINATION OF β -SECRETASE BINDING SITE CHARGES EMPLOYING MD SIMULATION AND MOLECULAR DOCKING. Dima A. Sabbah* and Jonathan L. Vennerstrom, College of Pharmacy, University of Nebraska Medical Center, Omaha; and Haizhen Zhong, Department of Chemistry, University of Nebraska at Omaha.
- 2:25 13. DETECTION OF HETEROGENEOUS DRUG-PROTEIN BINDING BY FRONTAL ANALYSIS AND HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY. Zenghan Tong*, K.S. Joseph, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 2:45 BREAK
- 2:50 14. IDENTIFICATION AND ANALYSIS OF THE PRODUCTS REMOVED FROM HUMAN FEET BY AN ELECTROLYSIS FOOTBATH. Courtney Dupper* and Charles Freidline, Division of Science & Mathematics, Union College, Lincoln.
- 3:10 15. OPTIMIZATION OF POLYMERIZATION CONDITIONS FOR AFFINITY MONOLITH COLUMNS CONTAINING IMMOBILIZED PROTEINS. Erika Pfaunmiller* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 3:30 16. ANALYSIS OF PROTEIN PHOSPHORYLATION IN PROTEIN DATABANK. Mengyi Zha*, Teddy Woolman, Charlotte McGinn, and Haizhen Zhong, Department of Chemistry, University of Nebraska at Omaha.
- 3:50 17. A NOVEL ELECTROCHEMICAL PEPTIDE-BASED SENSOR FABRICATED USING IMAC CHEMISTRY FOR THE DETECTION OF ARAH2 ANTIBODIES. Anita J. Zaitouna* and Rebecca Y. Lai, Department of Chemistry, University of Nebraska–Lincoln.
- 4:10 CLOSING COMMENTS

CHEMISTRY AND PHYSICS

Chairperson:

Renat Savirianov, Department of Physics, University of Nebraska at Omaha

SECTION B, PHYSICS

Planetarium

- 8:35 1. Keynote Address: SCANNING TUNNELING MICROSCOPES – OUR EYES AND HANDS INTO THE NANOWORLD. Axel Enders, Department of Physics and Astronomy, University of Nebraska–Lincoln.
- 9:05 2. A LABVIEW® PROGRAM IMPLEMENTED TO EXTRACT ABSOLUTE PHASE FROM AN INTERFEROGRAM OBTAINED WITH A DIGITAL HOLOGRAPHIC MICROSCOPE. Semere M. Woldemariam, Department of Physics, Creighton University, Omaha.
- 9:25 3. DYNAMIC LIGHT SCATTERING STUDIES ON ALKALI-MODIFIED BORATE LIQUIDS. S.Schnell, Department of Physics, Creighton University, Omaha.
- 9:40 4. FLUORESCENCE LIFETIME IMAGING FOR THE ASSESSMENT OF CELLULAR METABOLISM IN MULTICELLULAR TUMOR SPHEROIDS. Jorge Vergen* and Michael G. Nichols, Department of Physics, Creighton University, Omaha.
- 9:55 5. DARK MATTER AND FIFTH FORCE. Aruna P. Wanninayake* and Gintaras Duda, Department of Physics, Creighton University, Omaha.
- 10:10 6. ESTIMATION OF THE NUMBER OF $\Phi \rightarrow K+K^-$ AND $\Phi \rightarrow KSKL$ OBSERVED IN 200GEV AuAu COLLISIONS AT RHIC. Jonathan K. Bruckman, Creighton University, Omaha.
- 10:25 7. GRAPHENE/SUBSTRATE CHARGE TRANSFER CHARACTERIZED BY INVERSE PHOTOELECTRAON SPECTROSCOPY. Lingmei Kong*, N. Wu, Z. Zhang, J. Xiao, and P. A. Dowben, Department of Physics and Astronomy, University of Nebraska–Lincoln; and C. Bjelkevig, S. Gaddam, M. Zhou, and Jeffry A. Kelber, Department of Chemistry, University of North Texas, Denton, TX; and Y. H. Lee and G. H. Han, Department of Physics, Department of Energy Science, Sungkyunkwan University, Suwon, Korea; and H. K. Jeong, Department of Physics, Daegu University, Gyeongsan , Korea.
- 10:40 8. EFFECTS ON THE ELECTRONIC BAND STRUCTURE OF EUROPIUM OXIDE FILMS UPON GADOLINIUM DOPING. Juan A. Colón Santana*, Department of Electrical Engineering; and Joonhee An, Ning Wu, Kirill Belashchenko and P.A. Dowben, Department of Physics and Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln; and X. Wang, P. Liu and Jinke Tang, Department of Physics & Astronomy, University of Wyoming, Laramie, WY; and Yaroslav Losovyj, Center for Advanced Microstructures and Devices, Louisiana State University, Baton Rouge, LA; and I.N. Yakovkin, Institute of Physics, National Academy of Sciences of Ukraine, Prospect Nauki 46, Kiev 03028, Ukraine.

- 11:00 MAIBEN LECTURE - OLIN HALL B
- 1:05 WELCOME
- 1:10 9. THE ELECTRONIC STRUCTURE OF A LOCAL CHARGE-TRANSFER-INDUCED SPIN TRANSITION MOLECULAR ADSORBATE. Xin Zhang*, Ning Wu, ZhengZheng Zhang, and Peter Dowben, Nebraska Center for Materials and Nanoscience, Department of Physics and Astronomy, University of Nebraska–Lincoln; and Jean-François Létard and François Guillaume, Groupe des Sciences Moléculaires ICMCB, CNRS , UPR CNRS 9048, Université Bordeaux I 87 Av. du Doc. A. Schweitzer, F-33608 Pessac, France; letard@icmcb-bordeaux.cnrs.fr, f.guillaume@ism.u-bordeaux1.fr; and Bernard Doudin, Université Louis Pasteur Strasbourg, Institut de Physique Appliquée de Physique et Chimie des Matériaux de Strasbourg, 23, rue du Löss B.P. 20, 67034 Strasbourg Cedex2, FRANCE; Bernard.Doudin@ipcms.u-strasbg.fr
- 1:25 10. The LOCAL STRUCTURE OF TRANSITION METAL DOPED SEMICONDUCTING BORON CARBIDES. Jing Liu*, P. A. Dowben, A. K. Rajapitamahuni, Andre Sokolov, Department of Physics and Astronomy; and Eric D. Shepherd and J. I. Brand, College of Engineering, University of Nebraska–Lincoln; and Guangfu Luo and Wai-Ning Mei, Department of Physics, University of Nebraska at Omaha; and Orhan Kizilkaya, Center for Advanced Microstructures and Devices, Louisiana State University , Baton Rouge, LA; and Sudarshan Karki and Anthony N. Caruso, Department of Physics, University of Missouri-Kansas City, Kansas City, MO.
- 1:40 11. ORDER-DISORDER TRANSITIONS FOR Au/Mo(112). Keisuke Fukutani*, Ning Wu, and Peter Dowben, University of Nebraska–Lincoln; and Yaroslav Losovyj and Natalia Lozova, Center for Advanced Microstructure and Devices, Louisiana State University, Baton Rouge, LA; and Ivan Yakovkin, Institute of Physics, National Academy of Sciences of Ukraine, Prospect Nauki 46, Kiev 03028, Ukraine.
- 1:55 12. STRUCTURAL AND MAGNETIC PROPERTIES OF COBALT ATOMIC CLUSTERS ON (110) SURFACE OF TUNGSTEN. Pavel Lukashev* and Renat F. Sabirianov Department of Physics, University of Nebraska at Omaha; and Axel Enders, Department of Physics and Astronomy, University of Nebraska–Lincoln.
- 2:10 13. THE TWIN PARADOX AS AN EXAMPLE OF NATIVE MATH PRESENTATION IN HTMLS. Adam N. Davis, Wayne State College, Wayne.
- 2:25 CLOSING REMARKS

EARTH SCIENCE

Chair: Crystal Bergman
School of Natural Resources
University of Nebraska–Lincoln
Olin Hall 224

- 1:00 p.m. OPENING REMARKS
- 1:05 1. ESTIMATING GREEN LAI IN MAIZE AND SOYBEAN FROM REMOTELY SENSED DATA. Anthony L. Nguy-Robertson*, A.A. Gitelson, Y. Peng, T.J. Arkebauer, and D.C. Rundquist, Center for Advanced Land Management Information Technologies, School of Natural Resources and Department of Agronomy and Horticulture, University of Nebraska–Lincoln.
- 1:25 2. REMOTE ESTIMATION OF CROP PRODUCTIVITY: FROM CLOSE RANGE TO SATELLITE OBSERVATIONS. Yi Peng*, A.A. Gitelson, A.L. Nguy-Robertson, D.C. Rundquist, J.G. Masek, S.B. Verma, and A.E. Suyker, School of Natural Resources, University of Nebraska–Lincoln.
- 1:45 3. THE APPLICATION OF DIATOM BIOSTRATIGRAPHY AND PALEOECOLOGY TO RESOLVE EARLY MIOCENE PALEOCLIMATE EVENTS. Ryan K. Farmer* and D.M. Harwood, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln; and S.M. Bohaty, School of Ocean and Earth Science, University of Southampton, National Oceanography Centre, Southampton, United Kingdom.
- 2:00 4. LATE NEOGENE ANTARCTIC ICE SHEET HISTORY REVEALED BY ANDRILL PROGRAM DRILLHOLES IN THE WESTERN ROSS SEA, ANTARCTICA. David Harwood* and Frank Rack, Department of Earth and Atmospheric Sciences and ANDRILL Science Management Office, University of Nebraska–Lincoln; F. Florindo, Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy; and R. Levy, GNS Science, Lower Hutt, New Zealand; and Tim Naish, Antarctic Research Centre, Victoria University of Wellington, Wellington, New Zealand; and Ross Powell, Northern Illinois University, the MIS and SMS Science Teams, c/o ANDRILL Science Management Office.
- 2:20 5. “RATTLESTONES” FROM THE DAKOTA FORMATION OF NEBRASKA AND THEIR RELEVANCE TO IRON-OXIDE-CEMENTED CONCRETIONS IN UTAH’S NAVAJO SANDSTONE. David B. Loope*, Richard M. Kettler, Karrie A. Weber, and Nathan L. Hinrichs, Department of Earth and Atmospheric Sciences and School of Biological Sciences, University of Nebraska–Lincoln.
- 2:40 6. AQUIFER MAPPING AND RECHARGE ESTIMATIONS IN GLACIATED AREAS OF EASTERN NEBRASKA. Karen Griffin O’Connor* and John B. Gates, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln.

- 3:00 7. PRELIMINARY EVIDENCE FOR MIOCENE TECTONISM IN NORTHWESTERN NEBRASKA. J.L. Balmat and Michael B. Leite*, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 3:15 8. USE OF STREAM CHARACTERISTICS TO ASSESS STRUCTURAL CONTROL OF DRAINAGE ON TRIBUTARIES TO THE WHITE RIVER, NORTHWESTERN NEBRASKA, USA. Kodi L. Young* and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 3:30 9. SPATIAL PATTERNS OF DROUGHT TRIGGERS AND INDICATORS. Joseph P. Robine*, D.J. Bathke, M.D. Svoboda, J. Nothwehr, C.J. Bergman, N.A. Wall, T.K. Bernadt, and M.J. Hayes, National Drought Mitigation Center and the School of Natural Resources, University of Nebraska–Lincoln.
- 3:50 10. AN OVERVIEW OF WATERSHED MANAGEMENT AND BASIN-LEVEL DROUGHT PLANNING IN THE UNITED STATES. Crystal J. Bergman*, M.J. Hayes, D.J. Bathke, and C.L. Knutson, National Drought Mitigation Center, School of Natural Resources; and Z. Tang, Community and Regional Planning, University of Nebraska–Lincoln.
- 4:05 CLOSING REMARKS and SECTION MEETING

TEACHING OF SCIENCE AND MATH

Chairperson: Julia Polak
Exeter-Milligan Public Schools, Exeter
Olin 325

- 9:00 1. MV OR ONE-HALF MV SQUARED? William M. Wehrbein, Department of Physics and Astronomy (Emeritis), Nebraska Wesleyan University, Lincoln.
- 9:15 2. STUDENT-CENTERED VERSUS LECTURE-BASED TEACHING IN A GENERAL STUDIES BIOLOGY COURSE. Wendy Jamison, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 9:30 3. APPLIED ELECTROCHEMISTRY IN THE UNDERGRADUATE LABORATORY: ANODIZING ALUMINUM AND THE INTERCALATION OF VARIOUS DYES. Jennifer Harney* and Mary Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 9:45 4. A LITERATURE-BASED, DISEASE-CENTERED MOLECULAR BIOLOGY COURSE. Ann Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron.

APPLIED SCIENCE AND TECHNOLOGY

Chairperson: Mary Ettel
Wayne State College, Wayne
Olin 325

- 10:00 1. SIMULATION OF AMERICAN RAKU FIRING, A REDUCTION ENVIRONMENT, IN A LABORATORY SETTING. Micala Allen and M.L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 10:15 2. AN EXPLORATION OF THE EFFECTS OF SELECTED MORDANTS ON COTTON FIBERS AND NATURAL DYE. Amy Maika, T. Reichter, and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 10:30 3. THE INTERACTION OF NATURAL DYES WITH SELECTED WOOL FIBERS. Tara Reichter, Amy Maika, and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN LH-B

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Jeff Isaacson, Department of Biology
Nebraska Wesleyan University, Lincoln

SESSION A

Olin LH-B

- 8:00 a.m. 1. EFFECTS OF NALTREXONE ON ANXIETY BEHAVIORS IN C57BL/J6 MICE. Jenna Specht*, Eric Garcia, and Frank Ferraro, Nebraska Wesleyan University, Lincoln.
- 8:12 2. OPTIMIZATION OF WESTERN BLOTTING TECHNIQUES FOR DETECTION OF PROTEIN MARKERS OF BOVINE LEUKEMIA VIRUS INFECTION. Cassandra S. Jordan* and J. Isaacson, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:24 3. TLR-3 EXPRESSION AND ACTIVATION OF TRANSCRIPTION FACTORS NF κ B AND IRF3 IN HUMAN BRONCHIAL EPITHELIAL CELLS. Allee Kuska*, B. Barent, K. Restau, and T. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:36 4. REGULATION OF PROTEIN MARKERS IN HUMAN BRONCHIAL SUB-MUCOSAL DENDRITIC CELLS. Chad R. Elder* and Therese M. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:48 5. BIOCHEMICAL EXTRACTION OF THE QUORUM SENSING MOLECULE IN *MYCOBACTERIUM SMEGMATIS* THAT DISPLAYS INCREASED PIGMENTATION IN *STREPTOMYCES COELICOLOR*. Caroline M. Schultz*, H. Schmidt, and A. McKinney, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 9:00 6. STEPWISE CLONING AND EVALUATION OF FRAGMENTS OF THE HUMAN N-CADHERIN PROMOTER. Kelsey Bryant*, Nicole Williams, and Kate Marley, Department of Biology, Doane College, Crete.
- 9:12 7. ENHANCING THE UNMETHYLATED PRODUCT IN METHYLATION SPECIFIC PCR OF THE HUMAN N-CADHERIN GENE. Nick Lukens* and Kate Marley, Department of Biology, Doane College, Crete.
- 9:24 BREAK
- 9:36 8. TRANSLATION OF BASIC STORZ CMAC INTUBATION USAGE VIDEO INTO FARSI FOR AFGHAN MEDICAL PERSONNEL. Ismatt R. Niazi*, Zhan Li, and Kirsten Boedeker, Nebraska Wesleyan University, Lincoln; and Ben Boedeker, Mary Bernhagen, and Nikola Milikovic, VA Medical Center, Omaha.

- 9:48 9. THE USE OF *SAMONELLA TYPHIMURIUM* InvB/InvC AS A POSSIBLE DRUG DELIVERY SYSTEM. Bethany Hippen* and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.
- 10:00 10. CLONING, OVER-EXPRESSION, AND PURIFICATION OF NUS-FREE InIB FROM *LISTERIA MONOCYTOGENES* AS A POSSIBLE DRUG DELIVERY VEHICLE. Ian Engebretsen*, Shawn Percy, and Doug Christensen, Department of Physical and Life Sciences, and Gustavo Zardeneta, Department of Chemistry, Wayne State College, Wayne.
- 10:12 11. DEVELOPMENT OF THE ARABIDOPSIS G-PROTEIN SIGNALING NETWORK DATABASE. Kelsey K. Augustin*, Wayne State College, Wayne; and Alan M. Jones, The University of North Carolina at Chapel Hill, Chapel Hill, NC; and Etsuko N. Moriyama, School of Biological Sciences and Center for Plant Science Innovation, University of Nebraska–Lincoln.
- 10:24 12. THE EFFECT OF PLASMID SIZE ON TRANSFORMATION EFFICIENCY. Neal Hahn* and Douglas Christensen, Department of Life Sciences, Wayne State College, Wayne.
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN LH-B
- 12:00 LUNCH
- 1:00 13. EFFECT OF INCLINE ON THE LOCOMOTOR COSTS OF CARRYING AN ENLARGED CLAW IN FIDDLER CRABS (*UCA PUGILATOR*). Katherine E. Thiesen* and G. Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:12 14. SCREENING FOR ANTIBACTERIAL ENDOPHYTIC FUNGI WITH LIVING TISSUE COLLECTED IN WYOMING AND WESTERN NEBRASKA. Van Tran* and J. Bricker, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:24 15. COLLECTION OF *CANNABIS SATIVA* IN LANCASTER COUNTY AND MEASUREMENT OF THC BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY. Brock Sutton, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:36 16. A STUDY OF ILLICIT DRUG CONTAMINATION FROM SITES UPSTREAM AND DOWNSTREAM OF WASTE WATER TREATMENT PLANTS OF LINCOLN, ASHLAND AND SEWARD, NEBRASKA. Rebecca E. Nelson, Department of Biology, Nebraska Wesleyan University, Lincoln.

- 1:48 17. CHARACTERIZATION OF ANTIBIOTIC RESISTANT BACTERIA FROM THE PLATTE RIVER. Alicia Newsome* and B. Mauck, Department of Biology, College of Saint Mary, Omaha.
- 2:00 18. EFFECT OF DISSOLVED LEAD ON PLANT GROWTH. Carolyn Behney* and P. Higley, Department of Biology, College of Saint Mary, Omaha, NE 68106.
- 2:12 19. A STUDY OF FLASH BEHAVIOR IN THE EASTERN COTTONTAIL RABBIT. Brian Pawloski, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:24 BREAK
- 2:36 20. TAXONOMIC IDENTIFICATION OF MEDICINALLY IMPORTANT ENDOPHYTIC ORGANISMS USING PCR AND BIOINFORMATIC TECHNIQUES. Whitney Fuller, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:48 21. A DESCRIPTIVE STUDY TO DETERMINE WHICH BAT SPECIES BREEDING IN LANCASTER COUNTY, *MYOTIS SEPTENTRIONALIS*, *LASIONYCTERIS NOCTIVAGANS*, *EPTESICUS FUSCUS*, *LASIURUS BOREALIS*, *LASIURUS CINEREUS*, AND *NYCTICEIUS HUMERALIS*, EMIT A PRESENCE OVER NEBRASKA WESLEYAN UNIVERSITY'S CAMPUS. Hollie Cotten, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:00 22. TAIL-FLAGGING AS A PURSUIT DETERRENT SIGNAL IN COTTONTAIL RABBITS. Desi Jones, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:12 23. THE REGULATION OF ARO80P IN *CANDIDA ALBICANS* AROMATIC AMINO ACID METABOLISM. Jeffrey J. Bunker*, S. Ghosh, B. W. Kebaara, K. W. Nickerson, and A. L. Atkin, School of Biological Sciences, University of Nebraska–Lincoln.
- 3:24 24. COLLECTION AND ISOLATION OF FUNGAL ENDOPHYTES FROM CO-LOCATED TERRESTRIAL AND EPIPHYTIC ECUADORIAN BROMELIADS. Heather C. Bearnese, Department of Biology, Nebraska Wesleyan University, Lincoln.

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Jeffrey Isaacson, Biology Department
Nebraska Wesleyan University, Lincoln

SESSION B

Olin 249

- 1:00 1. EFFECTS OF ISOLATION ON STRESS AND BEHAVIOR IN THE GUPPY, *POECILIA RETICULATE*. Anna Kokrda, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:12 2. IDENTIFICATION AND CHARACTERIZATION OF CELLULAR GENES EXPRESSED DURING EARLY PHASES OF REACTIVATION FROM LATENCY. Halie Bricker, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln.
- 1:24 3. *FRANCISELLA TULARENSIS* LIVE VIRUS STRAIN INFECTS ALVEOLAR EPITHELIAL CELLS AND INDUCES APOPTOSIS. Emily Prinz, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:36 4. CREATING A STICKY VIRUS: PCR MUTAGENESIS TO CONFIRM *COXSACKIEVIRUS* B3 BINDING SITES. Sydney Rees, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:48 5. OPTIMIZATION OF METHODS TO DETECT ACTIVATION OF TLR-3 AND EPITHELIAL BARRIER FUNCTION IN HUMAN BRONCHIAL EPITHELIAL CELLS. David Synhorst* and Therese McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:00 6. UPREGULATION OF PATTERN RECOGNITION RECEPTORS ON A MACROPHAGE RAW264.7 CELL LINE IN RESPONSE TO STIMULATION AND INFLUENZA INFECTION. Kara Maddox*, Alex Vogel, Jenna M. Canfield, Shirley A. Condon, and Deborah M. Brown, Nebraska Center for Virology, University of Nebraska–Lincoln.
- 2:12 7. DETERMING GENES RESPONSIBLE FOR QUORUM SENSING IN *MYCOBACTERIUM SMEGMATIS* USING *STREPTOMYCES COELICOLOR*. Ashley Shurts*, Ashley Urbach, and Angela McKinney, Department of Biology, Nebraska Wesleyan University, Lincoln; and Jeffrey Cirillo, Department of Microbial and Molecular Pathogenesis, Texas A&M University, College Station, TX 77843.
- 2:24 BREAK

- 2:36 8. FILM AND TRANSLATION OF STORZ CMAC VIDEO INTUBATION SYSTEM MAINTENANCE VIDEO FOR AFGHAN MEDICAL PERSONNEL. Zhan Li*, Ismatt R. Niazi, and Kirsten Boedeker, Department of Biology, Nebraska Wesleyan University, Lincoln; and Ben Boedeker, Mary Bernhagen, and Nikola Milikovic, VA Medical Center, Omaha.
- 2:48 9. COLLECTION, ISOLATION, AND IDENTIFICATION OF FUNGAL ECUADORIAN BROMELIAD ENDOPHYTES. Amy C. Gerdes, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:00 10. COSOLVENT STABILIZATION OF ALCOHOL DEHYDROGENASE. Matthew R. Kuhlenengel, Department of Chemistry, Nebraska Wesleyan University, Lincoln.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

Chairpersons: David Treichel and Nathaniel Fackler
Nebraska Wesleyan University, Lincoln

SESSION A

Session Chairperson, David Treichel
Olin 324

- 8:00 a.m. 1. DEVELOPMENT OF TRICARBOXYLATED ARENES AS FLUORESCENT CHEMOSENSORS FOR DIVALENT AND TRIVALENT CATIONS. Audrey T. Gallagher* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 8:12 2. DETECHIP: THE USE OF DIGITAL PHOTO ANALYSIS FOR A SENSING ARRAY. Jeff Hawken*, Marcus Lyon, Mark Wilson, and Andrea Holmes, and Sharmin Sikich, Department of Chemistry, Doane College, Crete.
- 8:24 3. ANALYSIS OF METHANOL IN BIODIESEL BY NEAR INFRARED SPECTROSCOPY. B. A. Bialas* and A. D. Gift, Department of Chemistry, Omaha.
- 8:36 4. DIAZONIUM SALTS IN MULTI-STEP ONE-POT CLICK REACTIONS: SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL EVALUATION. Jacqueline E. Reilly* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 8:48 5. *IN VIVO* SKIN FLUORESCENCE MEASUREMENTS TO DETERMINE EFFECTS OF SUN EXPOSURE. Cassie Reicks*, Jordan Groathouse, Mitch Trauernicht, Sharmin Sikich, Mark Wilson, and Andrea Holmes, Department of Chemistry, Doane College, Crete.

- 9:00 6. DETERMINATION OF VARIOUS ENERGY DRINK COMPONENTS USING REVERSED PHASE CHROMATOGRAPHY. Bobbi A. Stromer* and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney.
- 9:12 7. DEVELOPMENT OF A COLLEGE LABORATORY EXPERIMENT BASED ON pH DEPENDENCE OF PARTITION COEFFICIENTS FOR COMMON NSAIDS. Adam Mosel, Department of Chemistry, Nebraska Wesleyan University, Lincoln.
- 9:24 BREAK
- 9:36 8. FLUORESCENCE LIFETIME IMAGING FOR THE ASSESSMENT OF CELLULAR METABOLISM IN MULTICELLULAR TUMOR SPHEROIDS. Jorge Vergen* and Michael G. Nichols, Department of Physics, Creighton University, Omaha.
- 9:48 9. STARLIGHT SIMULATIONS FOR DETECTING AND ANALYZING ULTRA PERIPHERAL COLLISIONS AT RHIC. Gleb Bataikin, Department of Physics, Creighton University, Omaha.
- 10:00 10. THREE DIMENSIONAL IMAGING USING A CD-ROM DRIVE FRINGE PROJECTION INTERFEROMETER. Stephen Cannon, Department of Physics, Hastings College, Hastings.
- 10:12 11. PARTICLE IDENTIFICATION OF KAONS IN ULTRA-PERIPHERAL HEAVY ION COLLISIONS. Mark P. Ridder, Department of Physics, Creighton University, Omaha.
- 10:24 12. AERODYNAMICS OF A GOLF BALL: HOW DIMPLE DESIGN ALTERS DRAG AND LIFT. Kendall Murphy, Department Physics, Hastings College, Hastings.
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN B

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

Chairpersons: David Treichel and Nathaniel Fackler
Nebraska Wesleyan University, Lincoln

SESSION B

Session Chairperson, Nathaniel Fackler
Olin 324

- 1:00 p.m. 13. PREPARATION AND ANTIMICROBIAL ACTIVITY OF 1,2,3-TRIAZOLE AND TRIAZOLIUM SALTS: STRUCTURE ACTIVITY RELATIONSHIP OF BENZYL GROUP IDENTITY. Andrew C. Klick* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 1:12 14. NOVEL CIRCULAR DICHROISM SPECTROSCOPY TECHNIQUE FOR THE STUDY OF SECONDARY STRUCTURE OF PROTEINS ADSORBED TO SOLID SURFACES. Crystal Vander Zanden*, Mark Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete.
- 1:30 15. PREPARATION AND ANTIMICROBIAL ACTIVITY OF 1,2,3-TRIAZOLE AND TRIAZOLIUM SALTS: STRUCTURE ACTIVITY RELATIONSHIP OF TRIAZOLE COUNT. Rachel N. Fickes* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 1:42 16. USE OF CHROMATOGRAPHY TO CHARACTERIZE A SUBSTRATE BINDING CONSTANT FOR A HIS-TAG IMMOBILIZED ENZYME. Benjamin White*, A.M. Moser and F.A. Kovacs, Department of Chemistry, University of Nebraska at Kearney.
- 1:54 17. CONTRAST PHASE MICROSCOPY AND DIGITAL HOLOGRAPHY. Robert Thomen, Department of Chemistry, Creighton University, Omaha.
- 2:12 18. ABSOLUTE DETECTION EFFICIENCY OF A MICROCHANNEL PLATE DETECTOR. John E. Tiller*, Garek A. Bebee, and D. R. Sieglaff, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln.
- 2:24 BREAK
- 2:36 19. MEASURING THE NONERGODICITY IN GLASSES BY ENSEMBLE-AVERAGED PHOTON CORRELATION SPECTROSCOPY. Eric D. Svingen* and David L. Sidebottom, College of Arts and Sciences, Creighton University, Omaha.
- 2:48 20. RHO MESON PRODUCTION IN ULTRA-PERIPHERAL COLLISIONS AT THE RELATIVISTIC HEAVY ION COLLIDER. Jamison Duckworth* and Janet Seger, College of Arts and Sciences, Creighton University, Omaha.

- 3:00 21. CONSTRUCTION OF A PHOTOVOLTAIC ENERGY SYSTEM TO DETERMINE MAXIMUM EFFICIENCY. Jake Doyle, Department of Physics, Hastings College, Hastings.
- 3:12 22. DEVELOPMENT OF A FREQUENCY-DOMAIN PHASE-SENSITIVE FLUORIMETER TO QUANTIFY THE OXYGEN CONSUMPTION OF LIVING CELLS. Kristina Ward*, Lonza Ramsey, and Michael G. Nichols, Department of Physics, Creighton University, Omaha.
- 3:24 23. SEARCH FOR OXYGEN IN CALLISTO'S ATMOSPHERE. Mitchell J. Hain* and N. J. Cunningham, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln; and J. R. Spencer, Planetary Science Directorate, Southwest Research Institute, Boulder, CO; and J. C. Green and C. S. Froning, Center for Astrophysics and Space Astronomy, University of Colorado, Boulder, CO.
- 3:36 24. THE RELATIVISTIC HEAVY ION COLLIDER AND ULTRA PERIPHERAL COLLISIONS. Jhenieve Enriquez, Department of Physics, Creighton University, Omaha.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

Chairpersons: David Treichel and Nathaniel Fackler
Nebraska Wesleyan University, Lincoln

SESSION C

Session Chairperson, David Peitz
Olin 325

- 1:00 p.m. 25. UNIVERSAL PATTERNS OF CLUSTER GROWTH IN AQUEOUS SUGARS OBSERVED BY DYNAMIC LIGHT SCATTERING. Tri D. Tran* and Dave Sidebottom, College of Arts and Sciences, Creighton University, Omaha.
- 1:12 26. THEORY, EXPERIMENTATION, AND ANALYSIS OF THE DOMINO EFFECT. Chris Webber, Department of Physics, Hastings College, Hastings.
- 1:24 27. HARDWARE CONTROL SYSTEMS FOR THE STAR EXPERIMENT USING EPICS. Jordan Kellerstrass, Department of Physics, Creighton University, Omaha.
- 1:34 28. RHO PRODUCTION IN ULTRA PERIPHERAL PROTON-PROTON COLLISIONS AT RHIC. Jarrod K. Bang* and J. Seger, Department of Physics, Creighton University, Omaha.
- 1:44 29. A COMPARISON OF TIME- AND STRAIN-DEPENDENT OPTICAL STRETCHING METHODS. Anya Burkart* and Michael G. Nichols, Department of Physics, Creighton University, Omaha.

- 2:02 30. DETECHIP 1.2: AN IMPROVED MOLECULAR SENSING ARRAY. Marcus M. Lyon*, S. Sikich, J. Groathouse, M.V. Wilson, and A. E. Holmes, Department of Chemistry, Doane College, Crete.
- 2:14 31. AN INVESTIGATION OF THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AND SODIUM SULFATE AEROSOLS USING INFRARED SPECTROSCOPY. Yohei Kohno* and Joshua P. Darr, Department of Chemistry, University of Nebraska at Omaha.
- 2:24 BREAK
- 2:34 32. SYNTHESIS OF PENICILLIN DERIVATIVES AND THE USE OF PLANT EXTRACTS IN THE FIGHT AGAINST ANTIBIOTIC RESISTANCE. Kassandra Connell* and David Peitz, Department of Physical Science and Mathematics; and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.
- 2:44 33. SYNTHESIS AND CHARACTERIZATION OF ETHYNYLARENE COMPOUNDS AS SELECTIVE FLUORESCENT CHEMOSENSORS FOR DIVALENT ZINC, CADMIUM AND LEAD. Douglas E. Deever* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 3: 02 34. IMMUNOEXTRACTION OF NICOTINE FROM SERUM SAMPLES USING MAGNABIND® BEADS TO CREATE A STANDARD CURVE FOR NICOTINE QUANTIFICATION. Taylor L. Carlson* and Annette C. Moser, University of Nebraska at Kearney.
- 3:14 35. INFLUENCE OF POLYMERIC EXCIPIENTS ON CARBAMAZEPINE HYDRATE FORMATION KINETICS IN AQUEOUS SLURRIES. Amanda L. Riesberg* and A.D. Gift, Department of Chemistry, University of Nebraska at Omaha.
- 3:24 36. THE SYNTHESIS OF WILD PLUM. Mitchell Trauernicht*, Jordan Groathouse, and Andrea Holmes, Department of Chemistry, Doane College, Crete.
- 3:36 37. THE USE OF ATR FT-IR AND TLC TO QUANTITATE AND IDENTIFY ORGANIC COMPUNDS. Zach Sudbeck* and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.

JUNIOR ACADEMY OF SCIENCES

Aurietha Hoelsing, NJAS President, Omaha

- 8:30 – 9:00 a.m. Judges Check-In, Olin 219
8:30 – 9:00 Senior High Registration and Set Up Project Displays, Olin Hall Lobby
9:00 – 12:00 Senior High Competition (preliminary), Olin 124, Olin 131
- 12:00 – 1:00 p.m. LUNCH BREAK, Senior High, Story Student Center
- 1:00 – 1:30 Judges Check-In, Olin 219
1:00 – 1:30 Junior High Registration and Set Up Project Displays
1:00 – 4:30 Senior High Competition (Final), Olin 110
1:30 – 4:30 Junior High Competition, Olin 124, Olin 131
2:00 – 3:30 NJAS Board/Teacher Meeting, Olin 219
- 5:30 – AWARDS RECEPTION – First United Methodist Church
2723 N 50th Street, Lincoln, NE

PROCEEDINGS

AERONAUTICS AND SPACE SCIENCE

ENHANCING INTRODUCTORY COURSES WITH HANDS-ON PROJECTS

William E. Spurgeon, Division of Business and Information Technology, Western Nebraska Community College, Scottsbluff, NE 69361

The “Enhancing Introductory Courses with Hands-on Projects” grant is utilizing robot kits to give students hands-on experiences with building and programming robots. These kits were purchased from UNL’s Computer and Electronics Engineering Department, which is located at the Peter Kiewit Institute in Omaha. Students learn how to identify hardware and electronic components. The robot comes with a control program, written in C, which contains essential code for basic operations. Students can modify the code to extend the capabilities of the robot. Current projects include programming sound, paths, GPS and a robotic arm.

SIR: IMAGE ANALYSIS

Jonathan Spurgeon, Division of Math and Science, Western Nebraska Community College, Scottsbluff, NE 69361

This project involves the imaging of deep-sky objects, and an investigation into the data stored in the flexible image transport system (.fts) files. Values can be extracted from these files and used in calculations to determine the age of stars. The research makes use of the NASA/IPAC Extragalactic Database (NED) which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration. It also utilizes NASA’s High Energy Astrophysics Science Archive Research Center (HEASARC). Five parameters are necessary to determine the age of an object using this method. Two of these values can be determined using the equipment and data collected from Western Nebraska Community College. Cosmology calculators from the University of Wyoming, University of Colorado and UCLA are all utilized in this project. Information from the U.S. Naval Observatory (USNO) is also taken into account.

DARK MATTER ANNIHILATIONS AND THE OBSERVED POSITRON EXCESS FROM FERMI AND PAMELA

Katherine Garrett and Gintaras Duda, Department of Physics, Creighton University, Omaha, NE 68178

The composition of dark matter remains an unsolved mystery in astroparticle physics and cosmology. State of the art experiments are searching for dark matter using two different methods: direct detection, in which a WIMP-like particle interacts with a detector in the laboratory, and indirect detection, in which products of dark matter annihilations such as neutrinos, gamma rays, and antimatter are detected. Recent results from two indirect detection experiments, Fermi and PAMELA, show a flux of positrons above the expected background signal; this positron excess may point toward a primary source of positrons that could be explained by dark matter annihilations. No such excess is seen in the antiproton flux, however, so dark matter models must be finely tuned. Utilizing GALPROP to generate cosmic ray backgrounds and DarkSUSY to generate supersymmetric models in which the neutralino is the dark matter, we will present an investigation of the characteristics of a neutralino necessary to reproduce the observed positron excess.

CONSTRAINTS ON UNIVERSAL EXTRA-DIMENSIONAL DARK MATTER FROM DIRECT DETECTION RESULTS

Trevor J. Torpin and Gintaras Duda, Department of Physics, Creighton University, Omaha, NE 68178

Detection of dark matter is one of the most challenging and important problems in astro-particle physics. One theory that produces a viable particle dark matter candidate is Universal Extra Dimensions (UED), in which the existence of a 4th spatial dimension is theorized. The extra dimension is not seen because it is compactified on a circular orbifold whose radius is too small to be observed with current technology. What separates this theory over other Kaluza-Klein-type theories is that UED allows all standard model particles and fields to propagate in the extra dimension. The dark matter candidate in UED theories is a stable particle known as the Lightest Kaluza-Klein Particle or LKP, and the LKP can exist with sufficient relic density to serve as the dark matter. This work will present bounds on UED model parameters from direct dark matter searches such as the CDMS II.

PARTICLE DARK MATTER – BEYOND THE STANDARD MODEL

Gintaras Duda, Department of Physics, Creighton University, Omaha, NE 68178

The Standard Model of Particle Physics is the most successful physical theory ever devised; calculations agree with theory to the accuracy of measuring the distance between New York and Los Angeles down to the width of a human hair. However, the Standard Model does not contain any suitable candidates for dark matter. This talk will discuss and motivate extensions to Standard Model that provide dark matter candidates. In this manner, astronomical and cosmological data and evidence will be used to explore fundamental physics.

CONSTRAINING BAL QUASAR KINETIC LUMINOSITY WITH CIII* ABSORPTION

David C. Austerberry, Department of Physics, Creighton University, Omaha, NE 68178

It has been postulated that galaxy formation can be significantly affected by gas outflows from a quasar in the nucleus of a nascent galaxy. Numerical models of galaxy feedback showed significant feedback effects with this ratio set to $f = 0.05$ (di Matteo *et al.* 2005). Thus, a limit on the ratio of the kinetic luminosity to bolometric luminosity of an observed quasar is of interest if it is below a level critical to galaxy growth and evolution. The kinetic luminosity of an outflow is related to the covering factor, hydrogen column density, and the outflow velocity. Thus, for a given quasar, observations that constrain the combination of hydrogen column density, hydrogen volume density, and ionization parameter of the outflow can place the kinetic luminosity below this limit. The strength of absorption by C III* is an indication of the density of the gas surrounding the AGN since the abundance of this ion relative to other carbon ions is highly sensitive to gas density (Gabel *et al.* 2005). The restrictions applied by observed CIII*/Si IV column density ratios to quasar parameter combinations are determined using CLOUDY, a photoionization model. A proposal is for ground-based low-noise observations with a high-resolution echelle spectrograph of quasars selected based on their SDSS spectra is discussed.

MODELING THE TORI SURROUNDING ACTIVE GALACTIC NUCLEI WITH MASS OUTFLOWS USING NIR SPECTRA

Barbara Medvar and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

We present preliminary results of a study of the near infrared emission of broad absorption line (BAL) quasars to determine how they are related to the general population of quasars. We will be using the Clumpy program code to create models of the tori that surround Active Galactic Nuclei. We will compare these models to actual spectra obtained through the Spitzer Space Telescope. We intend to determine what effect the orientation and geometrical qualities of the tori have on the spectrum that is collected about the AGN. We will be studying both BAL as well as regular Quasars to ascertain any correlations between the two.

SLOSH DYNAMICS OF ORION'S SERVICE MODULE PROPELLANT TANK

Joan Yule, Linxia Gu, and the Microgravity Team, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

The goal of this project is to design a full-scale Orion service module propellant tank for understanding sloshing effects in reduced gravity. The agitation of liquid inside a tank may cause disturbances in the stability of the vehicle. With a large amount of propellant for the spacecraft, it is important to analyze the slosh dynamics to determine safe maneuverability in reduced gravity situations. Once the tank has been manually set in motion and excited to its natural frequencies, linear slosh analysis will be used to indicate slosh patterns via a data acquisition device. Different fill fractions within the tank will give a more accurate estimation of sloshing dynamics and stability of the spacecraft. In addition, microgravity tests will be performed aboard NASA's Zero Gravity plane conducted by the University of Nebraska Lincoln's Microgravity team.

DEVELOPING pH CHART FOR BIODIESEL TITRATION

Amanda Smith and Anthony Limato, Department of Biology, College of Saint Mary, Omaha, NE 68106

The conversion of waste vegetable oil (WVO) to a useable source of fuel requires a catalyst to promote the transesterification of triglyceride to biodiesel. There is a standard formula used for this process with one variable, changes in pH of the WVO dictate the need for additional catalyst to have a successful reaction. Currently the method used to determine how much additional catalyst needed is a titration using an alkali solution and an indicator. The goal of this project is to create a simple chart documenting the pH of incoming WVO and the additional catalyst needed to convert WVO to fuel. This will eliminate the process of titrating. This research should result in a faster process of converting WVO to useable fuel by eliminating the titration step and being able to simply measure the pH of the oil and refer to a chart for the amount of additional catalyst needed.

EFFECT OF DROPLET SIZE IN THE ROLE OF FUEL VAPOR ACCUMULATION EFFECTS IN DROPLET BURNING

Inkant Awasthi and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

Fuel vapor accumulation effects in isolated droplet burning have been examined using numerical solution to the axi-symmetric Navier-Stokes equations. The analysis has been performed for droplet sizes ranging from 10 μm to 1 mm. The vapor accumulation effects are found to be more profound for smaller droplets ($<100 \mu\text{m}$) and they affect their burning history significantly. Larger droplets are found to comply more with the classical d^2 -law soon after having a small initial transient. To quantify these effects, two suitable quantities, instantaneous and global reacted fractions have been defined and analyzed.

CHEMISTRY ANALYSIS WITH VERNIER

Alex Egentowich and Brena Mauck, Department of Biology, College of Saint Mary, Omaha, NE 68106

The human body must maintain homeostasis by keeping its pH level in the blood in a narrow range of between 7.35 and 7.45. The objective of this study is to develop a model system for the carbonic acid buffer system in the blood using a biochamber and Vernier instruments. The model system utilizes a carbonic acid buffer system combined with a universal indicator to allow students to observe pH changes both through changes in color and by a graph generated by the Vernier pH probe. A Vernier CO_2 gas sensor is used to measure and display CO_2 gas levels to mimic the effect of respiration on the pH of the blood. This study will create a better hands-on activity to aid in understanding this complex physiological system for the anatomy and physiology labs at College of Saint Mary.

EXPERIMENTAL INVESTIGATION OF PERFORMANCE OF ELECTROCHEMICAL MACHINING BY COATED ELECTRODES FOR APPLICATIONS IN AEROSPACE AND AIRCRAFT INDUSTRY

K. P. Rajurkar, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln, NE 68588; and A.K. Swain, Texas Tech University, Lubbock, TX 79409

This paper presents experimental results of electroplating of micro tool electrodes and their application to electrochemical machining operations. Micro tool electrodes were machined by wire electro discharge grinding process before coating. An in-house built electrochemical cell using additive free watts bath was used for pulse plating of nickel on tungsten micro electrodes. A pulse rectifier supplied by Rapid Power Technologies Inc., was used as power supply in the experiments to study the effect of the pulse parameters such as duty cycle, current density, pulse frequency, and plating time on the thickness, grain size, surface roughness, and composition of the nickel coating. The nickel coated tungsten micro tool was then used in pulse electrochemical machining of SS 303 workpiece. It was observed that the coated tool removes more material than the uncoated tool under similar conditions. Also the coated tool exhibited higher electrochemical stability and produced comparatively better machined surface in terms of dimensional and shape accuracy.

NANOSTRUCTURED ELECTRODES FOR SUPERCAPACITOR ELECTRICAL ENERGY STORAGE DEVICES

Robert Jacobberger, Paul Goodman, and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Supercapacitors offer high energy density, high power density, high specific capacitance, and fast charge/discharge capability for storing energy and delivering power. In space exploration, supercapacitors are important for their use as electrical energy storage devices because of their high efficiency, long cycle life-time, and small mass and volume. One-dimensional rare-earth hexaboride nanostructures are desirable components for durable supercapacitor electrodes because of their refractory nature, high surface area, high conductivity, and controllable geometry. Here, we report the development of rare-earth hexaboride nanostructured electrodes via chemical vapor deposition. By varying growth parameters, we demonstrate the ability to control the phase and dopant profile of these nanowires. Finally, we explore the viability of these materials as electrodes in electrical energy storage devices by incorporating them into active-electrolyte supercapacitors, pseudocapacitors, and solid-state lithium batteries.

EVALUATING THE ACCURACY OF COMMERCIALLY AVAILABLE WATER TESTING METHODS

Katie James and Jeremy Karr, Department of Biology, College of Saint Mary, Omaha, NE 68106

Accuracy is a necessity when taking samples and testing them in the field. This experiment was designed to determine the accuracy of several commercial water quality kits that have been used for the on-site testing of phosphates, nitrates, and pH. To assess the accuracy of the commercial water quality kits, standards with known phosphate and nitrate ion concentrations will be prepared. Colorimetric methods will be used to develop standard curves. Field samples will then be analyzed using the colorimetric methods as well as the commercial kits. Samples with known pH will be analyzed to determine the accuracy of the commercial water quality kits pH tests. These results will allow for an informed decision to be made upon choosing the most accurate commercial water quality field test kit for future College of Saint Mary's water analysis projects.

POLARIZING EFFICIENCY OF THIN FILMS OF IR806

Joshua Beck and Liubov Kreminska, Department of Physics and Physical Science, University of Nebraska at Kearney, NE 68845

The scattering of light, which passed through a thin film of IR806, was measured using an optical setup and a polarized light source. IR806 is a lyotropic chromonic liquid crystal substance that has been developed into thin films by fellow researchers. The light scattering was examined at many different angles of polarization. This was done using LabView as well as other computer environments to adjust the setup and take measurements, which were then stored directly to a computer for further analysis. The data, collected from several samples of different concentrations by mass, was then examined in order to determine if thin films of IR806, an LCLC, made an effective polarizer and how it compared to current commercial polarizers.

IMAGE ANALYSIS OF LIQUID CRYSTAL POLARIZERS

Jeremy Stromer and Liubov Kreminska, Department of Physics and Physical Science,
University of Nebraska at Kearney, NE 68845

The unique nature of lyotropic chromonic liquid crystals lends themselves to a variety of applications. One application of note is the use of lyotropic chromonic liquid crystals as linear polarizers. Our research is concerned with the development of a thin film polarizer using a particular lyotropic chromonic liquid crystal, the near-infrared dye IR-806. Thin films were produced with a pneumatic shearing device using differing concentrations of dye. The main focus of this project was the development of a method for analysis of thin film liquid polarizers. Pictures of the polarizers were taken under a polarizing microscope with a CCD camera. An algorithm for analyzing the intensity of the light in each image was written in MATLAB and then images were then inputted into this algorithm for analysis. This allowed for a new graphical approach for determining the quality of the polarization of our films. We were able to compare the efficiency of the liquid crystal polarizers with commercial polarizers.

POSITIONAL AVERAGE STRUCTURE FROM AN INCOMMENSURATELY MODULATED CRYSTAL OF PROFILIN:ACTIN

Jason Porta, Department of Biology, University of Nebraska Medical Center, Omaha, NE 68198

Modulation of protein crystals is seldom reported, mainly due to a lack of methods for solving these unique structures. We report here the incommensurately modulated average structure of profilin:actin and the methods that were used to carry out the analysis. Crystal modulation is characterized by a loss of short-range translational symmetry, where a single unit cell is no longer sufficient to accurately describe the structure. Such a loss of periodicity is often caused by dynamic processes within the crystal arising from, for example positional modulations. Experimentally, the incommensurately modulated state is characterized by the appearance of distinct satellite reflections surrounding the main Bragg reflections on the diffraction pattern that cannot be indexed with a supercell. In order to fully describe a modulated structure, and hence the dynamic processes within the crystal, one must explore higher-order space over multiple unit cells. By careful examination of atomic positions over higher dimensional space, a modulation function can be calculated that traces the atomic disorder. Such a function is periodic, but incommensurate with the crystal lattice. As a first step to solving this function for PA crystals, we have determined the average structure of the modulated state. Main and satellite reflections were integrated with Eval15 and scaled with SadAbs to 3.0 Å. The average structure was then solved using the Phenix crystallographic software suite. Fourier electron density maps indicate the whole structure moves with major motion in actin subdomains 2 and 4. Superposition with the periodic profilin:actin structure and analysis by DYNDOM confirm these observations by showing the rotation of these domains. The modulation is in the b direction, which corresponds to the ribbon of actin molecules along this crystallographic axis. Analysis of these domain movements give insight into the long sought after globular (G) to fibrous (F) actin transition.

GAS EMBOLIC FACTORS IN CARDIOVASCULAR HEALTH

Eric Cutler and Linxia Gu, Department of Mechanical Engineering, University of Nebraska-Lincoln, NE 68588

Gas bubbles can be introduced into the blood stream through a variety mechanisms (atmospheric depressurization, surgical procedures, hemodialysis, etc.). The short term effects of these embolisms can be extremely apparent and hazardous and have consequently been thoroughly studied. However, the long term health implications for subjects who experience frequent gas embolisms (astronauts, aviators, commercial divers, marine construction workers, etc.) are not well understood.

Vascular properties are affected by the mechanical stresses exerted on blood vessels. Several studies have shown that insufficient shear stress causes stenosis in arteries. Thus, in this project gas emboli were induced at a controlled rate and volume into a vascular system simulator. By measuring its effects on pressure and flow velocity, the relationship between wall shear stress and gas embolus presence were determined. This information may reveal important health implications of repeated compression cycles.

HYDROSTATIC INDIFFERENCE POINT MODEL OF THE HUMAN VENOUS SYSTEM

Brian Steinert, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

Using a tilt table to simulate zero gravity on the human body is based on the hydrostatic indifference concept, which is a location within the body where little change in vessel volume and wall tension occurs. Venous pressure decreases above, and increases below the hydrostatic indifference point (Hinghofer-Szalkay, 2011). At zero gravity, the hydrostatic indifference point is eliminated because there is no pressure gradient due to gravity. In order to simulate zero gravity on earth for the venous side of the cardiovascular system, the hydrostatic indifference point needs to be shifted in line with the heart. The goal is to develop a model that will be able to demonstrate the hydrostatic indifference concept. The first step to understanding hydrostatic indifference in a complex system such as the venous side of the cardiovascular system is to analyze simple cylindrical tubes. Once cylindrical tubes are analyzed, the concepts can be applied to more complex vessel systems.

THE INTEGRATION OF PROPANE FLAMING AND MECHANICAL CULTIVATION FOR EFFECTIVE WEED CONTROL IN AGRICULTURE

Brian Neilson, Chris Bruening, and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

The concept of flaming for weed control is to expose weeds to intense heat over a short duration. Exposure to 800°C for 0.1 second can cause plant cell membranes to rupture. The plant subsequently loses water and dies. Mechanical cultivation is another weed control technology which was used widely prior to development of effective herbicides. Combining flaming and mechanical cultivation has great potential for use by organic farmers. A prototype hood and torch mount system was developed during spring 2010 and mounted on a row crop cultivator. Field studies were conducted during summer 2010 to determine the flamer-cultivator's effectiveness. The combination of flaming and cultivation applied twice proved more effective than flaming or cultivation alone. Weed control levels in corn reached 95 percent at 28 days after treatment, with no adverse effect on crop yield. Work is currently under way to design a safer, more fuel-efficient torch for this equipment.

AERONAUTICS AND SPACE SCIENCE
SESSION B

THE EFFECTS OF MASAI BAREFOOT TECHNOLOGY (ROCKER BOTTOM) SHOES ON JOINT KINEMATICS AND KINETICS

Neil B. Huben, Sara A. Myers, and Nicholas Stergiou, Nebraska Biomechanics Core Facility,
University of Nebraska at Omaha, NE 68182

Medium and long-term space flight is associated with the manifestation of muscular atrophy. Muscle atrophy is correlated with increased rate of fatigue and gait impairment, as determined by decreased lower extremity peak forces and powers. The microgravity induced muscle atrophy impairs gait during space flight as well as upon returning to Earth's atmosphere and everyday life. There is a need to design a low cost, effective rehabilitation treatment to assist post-flight astronauts return to pre-flight functional status. The current study explores the effect of wearing rocker bottom shoes on the neuromuscular mechanisms of gait in healthy individuals by evaluating lower extremity joint muscular responses and their contributions during walking. While changes in basic gait characteristics have been assessed while wearing the rocker bottom shoes, the lower extremity joint muscular responses (joint moments) and contributions (joint powers) have never been investigated. Determining these mechanisms is essential in order to determine if rocker bottom shoes can be an effective rehabilitation device for post space-flight microgravity induced muscular atrophic astronauts.

ELASTIC BAND-BASED RESISTANCE TRAINING AS A METHOD OF MAINTAINING MUSCULAR STRENGTH AND MASS IN HEALTHY ADULTS

Jon Carey, Sara A. Myers and Nicholas Stergiou, Nebraska Biomechanics Core Facility,
University of Nebraska at Omaha, NE 68182

One consequence of space travel for astronauts is muscle atrophy caused by the lack of gravity and muscle disuse. A number of exercise methodologies have been utilized to mitigate this phenomenon, including cable/band resistance-based machines, the interim and advanced Resistive Exercise Devices (iRED and aRED), and treadmills. However, recent research shows that muscle atrophy is still an issue for International Space Station occupants. This study proposes a novel use of elastic bands as an additional method of resistance training. Intervention subjects who participated in an eight week elastic-band based training program will be compared to a Control group, to determine the bands' training effect on muscle mass maintenance. It is hypothesized that Intervention subjects will demonstrate differences in muscular strength and mass as compared to the baseline condition and the Control group outcomes. Elastic band based- training may be a valuable addition to existing muscle retention strategies.

THE EFFECTS OF AUDITORY OSCILLATIONS THAT INCLUDE CHAOS

Nate Hunt, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

An exciting new avenue in the investigation of human gait involves the presence of chaos. Chaos has been shown to be present in gait and also has been proposed as a highly beneficial property, allowing the walking cycle to be quickly adaptable to unexpected changes in the environment and body orientation. This project in a sentence is: Measuring the effects of various levels of chaotic auditory inputs on chaotic changes and motor learning rates in both human subjects and a computer model while learning a new motor skill.

1. I will be investigating the effects of auditory oscillations that exhibit chaos on subjects learning a new motor skill and on the spatio-temporal variations in the motor outcomes.
2. A morphologically similar neuro-musculo-skeletal model controlled by a neural network will be developed in parallel and will receive analogous chaotic oscillatory input.

EPISODE SIMULATION OF ASIAN DUST STORMS WITH AN AIR QUALITY MODELING SYSTEM

Cui Ge, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68588; and MeiGen Zhang, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China

A dust deflation module was developed and coupled with the air quality modeling system RAMS-CMAQ. Then the system was applied to East Asia to simulate Asian dust aerosol generation, transport and dry/wet removal processes in the period of 14-25 March 2002 when two strong dust storms consecutively occurred. Model results were compared against hourly PM_{10} concentrations and daily air pollution index (API) values for PM_{10} . The comparison shows that the modeled values were generally in good agreement with observed ones, and the model reasonably reproduced two dust storm outbreaks and generally captured the dust onset and cessation timings at each observation site. Besides, hourly averaged values of aerosol optical thickness (AOT) are calculated and compared with observations in order to assess the model's capability in estimating dust aerosol column burden.

ARCHITECTURAL STANDARDS DEVELOPMENT FOR LONG TERM PARTIAL GRAVITY HABITATS

Matthew Carper and Ram Bishu, Department of Industrial Engineering, University of Nebraska–Lincoln, NE 68588

In January 2004 president of the United States, George W. Bush proclaimed that he wants humans to expand our presence over the solar system. This proclamation was broken into three parts, the last of which was returning a human to the face of the moon. Part of getting back to the moon may encompass establishing long term habitats for astronauts in partial gravity environments. The main issue with establishing long term habitats in the partial gravity of the moon is that there is no prior experience to gain insight from to make the most efficient use of habitable volume; as the longest stay on the moon to this date has been no more than a hand full of hours during the Apollo missions. The focus of the dilemma at hand is making the most efficient use of habitable volume. The motivation for efficiently devising habitats is the premium in cost and feasibility attached to transporting large items into space. The goal of this research is to devise architectural standards for habitat design that can be augmented into the current HIDH manual. The current HIDH manual as of 2010 provides architectural guidelines with the main focus being zero gravity environments, such as the International Space Station. These guidelines provide a good baseline of knowledge, but may not be relevant to partial gravity environments.

The approach that will be taken in this work is to devise lists of activities that may be performed by astronauts living in partial gravity environments. This list will include but not be limited to, eating, sleeping, hygiene, exercise, maintenance and experimentation. Once a list is compiled, anthropometric data at 1g will be used to define the volume of space required to perform the desired activity. With volumes defined, activities will be compared to identify which ones can be performed within the same volume. From this, recommendations for the required volume will be defined as a guideline for design or partial gravity habitats. This research is the first step in understanding the requirements of space needed to sustain life for long duration in partial gravity.

ANALYSIS OF HYPERSPECTRAL IMAGERY TO MAP INVASIVE BLACK MANGROVE IN COASTAL TEXAS

Alissa C. Hart and John F. Schalles, Department of Biology, Creighton University, Omaha, NE 68178

Our primary objective was to determine the extent of the invasive saltwater halophyte *Avicennia germinans*, (common name Black Mangrove) within the Redfish Bay unit of the Mission-Aransas National Estuarine Research Reserve in Texas. Serving as a possible harbinger of climate change, tropical Black Mangrove have largely displaced salt marsh vegetation in Redfish Bay. These mangrove now pose a threat to nearby marshes at Aransas NWR, which serve as critical winter habitat for the endangered Whooping Crane. To better understand invasion patterns, hyperspectral AISA imagery and field surveys were conducted in 2008 to delineate the extent and size classes of mangrove. The VARI-green vegetation index was established as the best predictor of canopy height. Flight lines were masked to isolate mangrove stands from other habitats, and synoptic mapping achieved by mosaicing all 13 flight lines. Median height within the stand was 80 cm, with taller trees generally closest to larger water channels.

REMOTE SENSING OF SURFACE VISIBILITY FROM SPACE

Amy Gehring and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln, NE 68588

Accurate measurement of atmospheric visibility is important for the safety of both civic and military aviation and ground transportation. Currently, measurements of visibility are limited by a lack of spatial coverage for remote regions, oceans, and places where visibility is important but not measured, such as around highways and national parks. To address this problem, this study will correlate aerosol optical depth (AOD) measurements and surface visibility data for the contiguous United States in order to establish a method for measuring surface visibility using remote sensing techniques. This new method will then be used to determine global visibility trends for the years 2001-2010. AOD data from the MODerate Resolution Imaging Spectroradiometer (MODIS) are used in this study. Meteorological measurements of visibility and relative humidity are taken from the National Oceanic and Atmospheric Association (NOAA) National Data Center's Climate Data Online (NNDC-CDO) as well as various other sources.

IDENTIFICATION OF ALKALIPHILIC BACTERIA FROM WESTERN NEBRASKA

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Southwestern Nebraska is dotted with hundreds of alkaline lakes, ranging from pH 9-11. The bacteria that grow in these lakes have adapted to the alkaline conditions and are alkalitolerant (able to live in both alkaline and more neutral environments) or alkaliphilic (adapted to live only in alkaline environments). The purpose of this study was to identify alkaliphilic bacteria and to eventually study the adaptations these bacteria have made in order to survive in an alkaline environment. Water was collected from several ponds and lakes along Highway 2 near Antioch, NE. The pH value of these bodies of water ranged from pH 9-11. Bacteria were then grown on plates of defined media at pH 7, pH 9, and pH 11. Bacteria that could grow at pH 9 or pH 11 but not at pH 7 were considered to be alkaliphilic. The genomic DNA from these bacteria was harvested and amplified in PCR reactions using the universal bacterial primers for 16S rDNA. This amplified DNA was then sequenced in an attempt to identify the alkaliphilic bacteria. Tentatively identified bacteria include *Bacillus pseudofirmus*, an alkaliphilic and halotolerant bacteria, a species of *Exiguobacterium*, a genus that includes alkaliphilic,

psychrophilic and thermophilic bacteria, *Halomonas variabilis*, a salt tolerant, Gram – bacteria, *Alteromonadales* bacteria JK1, a Gram – bacteria that has been previously isolated from alkaline lakes, several species of *Paenibacillus* bacteria, and a species of *Planomicrobium*. These bacteria will be further studied to determine how they adapt to their alkaline environment.

AUTOMATED, BOAT-BORNE REMOTE SENSING OF WATER QUALITY IN A GEORGIA TIDAL WATERSHED

John P.R. O'Donnell, Department of Environmental Science, and John F. Schalles, Department of Biology, Creighton University, Omaha, NE 68178

Data for this project were collected in the Duplin River tidal watershed at Sapelo Island National Estuarine Research Reserve, Georgia in summer 2010. The Duplin has strong tidal forcing, with amplitudes of about 1.8 to 3.2 meters. As an automated, close-range, boat-borne remote sensing approach we recorded GPS position, water reflectance (Ocean Optics spectrophotometer) and seven water quality variables (YSI 6600 sonde) in longitudinal tracks of the Duplin under different tidal stages to examine whole system and sub-watershed spatial and temporal patterns. Tributary runoff (visible as plumes) and Duplin longitudinal behavior appear diagnostic for spatial variations in such ecological properties as groundwater seepage, nutrient-constrained algal growth, and water source and residence times. We were successful in capturing spatial variability; in general the Upper Duplin had lower salinities, lower plankton chlorophyll and optical turbidity, and warmer temperatures than the Lower Duplin. Individual tributaries had more variable properties.

TRACKING WHOOPING CRANES WITH WIRELESS SENSOR NETWORKS

David Anthony, Paul Bennett, Mehmet C. Vuran, Sebastian Elbaum, and Matthew Dwyer, Department of Computer Science and Engineering, University of Nebraska–Lincoln, NE 68588

Whooping Cranes are an endangered, migratory species of bird that is indigenous to North America. This project uses wireless sensor networks to gather data in three areas that are of prime interest to conservationists. First, track the cranes during their migration to determine where they nest. Second, determine where the birds die so that a cause of death can be determined. Third, gather flight telemetry so that their flight behaviors can be analyzed.

To gather the data a custom hardware and software tracking platform was constructed. This platform utilizes a GPS and solid state compass to gather information on the birds and report the findings to scientists via GSM and Zigbee radios. This platform is significantly more powerful and cheaper than existing commercial solutions.

In the future, more intelligent and adaptive sensing schemes will be utilized to save power. Novel testing methods will be developed to ensure the correct behavior of the platform.

MAPPING ZONES OF GROUNDWATER DISCHARGE WITH STREAMBED TEMPERATURE MEASUREMENTS, CHADRON CREEK, NORTHWESTERN NE

Joseph J. Reedy, Michael B. Leite, Jennifer L. Balmat, and Kodi Young, Department of Geosciences, Chadron State College, Chadron, NE 69337

In an effort to further define and understand the groundwater-surface water interactions of Chadron Creek, the spatial distribution of groundwater discharge zones within the stream was mapped near the stream's head using a cost effective thermal profiling method. Measurements were taken approximately every meter, at two points in the stream; creating two-point transects perpendicular to

the flow. The measurements were taken 0.1 meters below the stream surface and at uniform streambed depths of 0.1 meters and 0.2 meters. Preliminary data for a 45 meter reach of the stream reveals an area where the maximum streambed temperature is more than four standard deviations greater than the mean temperature at that depth, indicating a groundwater discharge zone. The use of streambed temperature as a marker for groundwater discharge appears highly effective in small streams, provided sampling is conducted at a relatively high resolution.

PRELIMINARY CORRELATION OF REMOTELY-SENSED LINEAMENTS TO FAULTS ON THE PINE RIDGE IN NORTHWESTERN NEBRASKA

Jennifer L. Balmat, and Michael B. Leite, Department of Geosciences, Chadron State College, Chadron, NE 69337

Preliminary mapping of the Pine Ridge south of Chadron, Nebraska, provided the opportunity for ground verification of remotely-sensed lineaments. Large-scale, long lineaments identified using Landsat imagery and defined here as those greater than 10 km in length, were difficult to identify in the field. Fine-scale short lineaments identified using DOQ's and defined here as those less than 10 km in length, were successfully verified in the field study area. Dominant east-west striking normal faults provide structural control of valleys and stream tributaries, as well as correlate to fine-scale lineaments. However, not all faults found in the field were identifiable as lineaments on remotely sensed imagery. Understanding the subsurface structures represented by the large-scale lineaments requires further investigation.

ESTIMATING CORN YIELD FOR NEBRASKA USING WEATHER DATA AND THE LAND SURFACE TEMPERATURE AND EVAPOTRANSPIRATION DERIVED FROM LANDSAT SATELLITE DATA

Vijendra K. Boken, Chelsea Martin, Nicholas Volpe, and Ryan Levell, Department of Geography and Earth Science, University of Nebraska at Kearney, NE 68849; and Joseph D. Nigro, Department of Science Systems Applications, and Compton J. Tucker, Department of Hydrospheric and Biospheric Sciences, NASA Goddard Space Flight Center, Greenbelt, MD 20771

Corn is the major crop of Nebraska and contributes significantly to the state's economy and its yield estimates, particularly in the case of dryland corn estimates, need improvement. The yield models usually employ data relating to planting date, weather conditions, and recently, the vegetation indices derived from the satellite data. Earlier crop models have used evapotranspiration (ET) observed only at point locations. In the present study, we estimated the land surface temperature (LST) as well as ET using Landsat Thematic Mapper (TM) data during the cropping season thus having much higher spatial resolution. Several variables were derived using data pertaining to corn yields, weather, LST, ET, NDVI, and planting dates for 2008 and 2009, and 2010. Using a multiple regression approach, a model was developed to predict dryland corn yield for Nebraska. The funding for the project was provided by the NASA Nebraska Space Grant office.

REMOTE SENSING AND GIS AS TOOLS TO ASSIST NEBRASKA'S EMERGING GRAPE AND WINE INDUSTRY

Ting Chen and Donald Rundquist, School of Natural Resources, University of Nebraska–Lincoln, NE 68588; and Craig Romary, Nebraska Department of Agriculture, Lincoln, 68509

In recent years, Nebraska has experienced the development and growth of a wine and grape industry. This phenomenon includes the planting of many vineyards in various parts of the state. The

objectives of the current project were to: 1) identify and map the locations of Nebraska's vineyards; 2) develop a web-deliverable database application aimed at providing useful, location-specific information available to both crop growers and pesticide applicators; and 3) provide a web- and mapping service to include aerial views of vineyard operations and a geographic information system (GIS) for spatially oriented data management. The geospatial technologies, remote sensing and GIS, were important tools in project completion. The presentation provides an overview of wine-grape geography in the state as well as summary of the database and interactive-mapping capabilities.

INCREASING STUDENTS' AWARENESS ABOUT SCIENCE AND SUSTAINABILITY

Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha, NE 68106

Sustainability is about meeting our current resource needs without compromising the ability of future generations to meet their own needs. At College of Saint Mary, I am working on a project to increase student's understanding of our earth's limited capacity to support all forms of life and to provide for the needs of human society. In fall 2010, with the support of NASA Nebraska Space grant, I along with three CSM students attended the Association for the Advancement of Sustainability in Higher Education (AAASHE) conference and American College and University President Climate Commitment (ACUPCC) conference in Denver. Attending these conferences allowed us to generate new ideas to organize events on campus which will stimulate the critical thinking of our students and make them aware of the current events in the area of environmental sustainability. This presentation will involve highlights of planned events, learning outcomes and continued challenges in the campus environment.

CRYOCOOLER VALIDATION FOR THE VASIMR ISS DEMONSTRATOR MISSION

Eldon Summerson, Kevin Watts, Andrew Kelley, Joe Bartles, Andrea Gilkey, Khoa Chu, Derek Fierstein, Kyrik Weidman, and Carl A. Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

An important component of Ad Astra's prototype VASIMR rocket is the cryocoolers used to supercool the high-temperature superconducting magnet arrays that electromagnetically contain the plasma stream. This project evaluated the feasibility of using a commercially available cryocooler by testing its performance characteristics in a microgravity environment. As predicted the device performed slightly more efficiently in the absence of gravitational forces. Additional microgravity testing has been conducted for this device to fully validate its performance in a rigorously relative environment in order to establish this device at full test readiness level in anticipation of the 2014 test of the VASIMR engine aboard the ISS.

CONTROL AND MECHANICAL DESIGN CONSIDERATIONS FOR A SELF-RECONFIGURABLE MODULAR ROBOT FOR SPACE APPLICATIONS

S.G.M Hossain and Carl A. Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

Scientific instrument payload is an important issue influencing the cost of space exploration. To reduce this cost, modular and reconfigurable systems are finding application. This robotic hardware would ideally be small and lightweight, and software should enable some dynamic task adaptation. Robots with self-reconfiguration capability can address these needs by performing various tasks in a modular and robust way. Taking this into consideration, a self-reconfigurable modular robot was designed and developed to be low-cost, taking into account the principles of design for manufacture

(DFM) and design for assembly (DFA) so that overall system robustness could be achieved through greater fault tolerance (quasi-disposable modules). The robot features a microcontroller-based control system, proximity sensing, and radio communication such that each module can maneuver individually or as interconnected systems. Modules connect to one another using docking ports, enabling creation of self-reconfigurable modular assemblies for task adaptation as well as various locomotion gaits.

DYNAMICALLY RECONFIGURING MODULAR ROBOTS FOR EFFICIENT MANEUVERABILITY IN INITIALLY UNKNOWN TERRAINS

Zachary Ramaekers and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182; and Carl Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

We consider the problem of efficiently navigating a modular self-reconfigurable robot (MSR) on an initially unknown terrain such as the Lunar or Martian surface. An MSR is composed of multiple modules which can be re-organized to achieve different formations such as a chain formation or a circular formation, depending on the mobility requirements of the terrain. Existing techniques for maneuvering MSRs use pre-determined and hand-crafted movements for each module to bring about a desired gait pattern in the overall MSR. The problem with such hard-coded maneuvers is that they can result in inefficient motion, or could even prevent the MSR from moving in tight spaces. To address this problem, we have investigated techniques from game theory and multi-agent planning which allow the modules of an MSR to autonomously reconfigure based on their perceived environment and desired motion. We have developed a coalition game based framework that allows a set of modules to determine a configuration with the best ‘value’ that they can organize themselves into. However, the noise in the readings of the different sensors of the modules can result in erroneous parameters being used by the modules while computing this best valued configuration. We model the sensor noise as uncertainty in the configuration determination process and use a Markov decision process (MDP) to determine the configuration that gives the best expected value under uncertainty. Our algorithms were evaluated on the Webots robotic simulation platform while using a model of a modular robot called ModRED that is being developed as part of this project.

INVESTIGATING THE IMPACT OF DISTRACTION ON REMOTE SURGICAL SKILLS LEARNING IN TELEMEDICINE

Irene H. Suh and Ka-Chun Siu, College of Public Health, University of Nebraska Medical Center, Omaha, NE 68198

Although operating rooms are generally full of distractions, little is known how distractions affect remote surgical skills learning. In this project, we investigated the effect of distractions on robot-assisted surgical (RAS) performance. Fourteen medical students performed a suture tying task with the da Vinci Surgical System (dVSS) under three types of distractions: passive (listening to noise with normal heart rate), active (listening to noise with alternating heart rates and reporting when the heart rate changed) and interactive (reviewing a patient’s history and answering questions). Kinematics of dVSS instruments were analyzed. A one-way ANOVA with repeated measures revealed a significant distraction effect in the active and interactive distractions compared to the passive distraction. Time to task completion was increased by 20% for active distraction and 31% for interactive distraction. RAS performance was negatively affected by distraction. Understanding how surgeons respond to distractions is important for remote surgical skills learning in telemedicine.

CLOSE-RANGE SPECTRAL ANALYSIS OF WINE-GRAPE LEAVES

Dominic Biondo and Donald Rundquist, School of Natural Resources, University of Nebraska–Lincoln, NE 68588

There has been relatively little use made of remote sensing in viticulture. Some work has been done on applying remote sensing to vineyard site selection, monitoring vine growth, and identifying stressors. But, little basic research has been conducted on the subject of spectral reflectance at leaf level. This project involved data collection using a field spectrometer providing 2,000+ individual channels of information, and analysis of leaves from several different grape cultivars in an attempt to detect per-cultivar differences in spectral response. Attention was also given to pigment content and composition, as well as leaf thickness. Results include spectral discrimination of varieties, with the greatest separation in the near-infrared. Chlorophyll content was predicted within ± 3 SPAD units. The results thus far for leaf thickness are inconclusive. Much more research remains to be done, but the findings of the project are generally encouraging.

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

BUILDING A COMMUNITY OUTREACH PROGRAM

Carolyn Behney and Jeremy Karr, Department of Chemistry, College of Saint Mary, Omaha, NE 68106

The community outreach program aimed at enhancing science education to kindergarten through middle school aged children. This was accomplished by engaging students with hands on science projects. Topics were covered in open learning environments with students divided into mixed aged and ability groups. Students were encouraged to question and hypothesize. Science laboratory projects consumed a majority of the time spent with the students. Completed projects were sent home; therefore allowing the students to continue the conversation of science beyond the classroom.

COMPARATIVE ANATOMY AND DISSECTION: PIG, RABBIT, AND HUMAN

T'Essence Bessick and Jeff Keyte, Department of Arts and Sciences, College of Saint Mary, Omaha, NE 68106

The College of Saint Mary has just opened its brand new cadaver lab for the Spring semester of 2011. In order for the lab to be useful to students in Anatomy and Physiology, the cadaver must be dissected and prepared so that demonstration of anatomy and anatomic relationships can be accomplished during limited laboratory time for our 80+ anatomy and physiology students. An excellent way to prepare for human dissection is to practice dissecting, anatomical discrimination, demonstration techniques and anatomical identification using other mammals. To this end, a near term fetal pig and a large rabbit were dissected and prepared for demonstration to faculty and other students. These skills were then applied to the human cadaver. The similarities and contrasts between the different specimens sheds light on common biological organization as well as the role of differentiation and its causes in the specializations and differences in species.

CHEMICAL DEMONSTRATIONS

Emily E. Duval Carmenaty and Jeremy Karr, Department of Chemistry, College of Saint Mary, Omaha, NE 68106

This project is designed to help nursing students to have better understanding of General Chemistry through series of simple experiments, videos, images or examples. This way the students will visualize what is explain theoretically in the book. The students have a laboratory section where they put theory into practice. Performing chemical demonstrations simultaneously with the presentation of new material in lecture will offer the students another means of retaining the material. This project is new and needs further development, which can be archived by testing it, to see where the chemical demonstrations could improve to help the students.

UNDERSTANDING AND DEVELOPING HPLC METHODS

Chelsea P. Dean and Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha, NE 68106

My project involved understanding the basic principle used in High Pressure Liquid Chromatography (HPLC) and learning the operating procedure for the HPLC instrument by using standard samples and protocols. I have developed the experimental procedures for determining the amount of vitamin C in fruit juices and fresh oranges. After standardizing the procedure, I will write the necessary experimental protocols for inclusion in the laboratory manual for current and future students use. This project is helping me to improve my understanding of scientific skills by allowing me the opportunity to fully employ the scientific method and also increasing my fundamental understanding of chemistry and separation methods.

THE INTEGRATION OF IPAD TECHNOLOGY INTO STEM EDUCATION COURSEWORK

Neal Grandgenett and Neal Topp, Department of Teacher Education, and Robert Shuster, Department of Geology, and Dana Richter-Egger, Department of Math and Science, and Michael Matthews, Department of Mathematics, University of Nebraska at Omaha, NE 68182

The iPad and similar hand-held technologies represent a significant potential for the STEM Education classroom. They are inexpensive, convenient and high-powered computing devices, with the promise of helping teachers to reach students in ways that might not be possible with more expensive and less convenient technologies, such as desktop and laptop computers. This project assembled a team of 18 educators to investigate and plan for the integration of iPad technology into selected STEM courses at UNO. The project was led by the Office of STEM Education at UNO and represents a collaboration between faculty in two colleges at the University of Nebraska at Omaha (the College of Education and the College of Arts and Sciences) as well as a faculty member from the UNL 4H Extension Office and one from the UNL Center for Research on Children, Youth, Families and Schools. The faculty met together monthly to collaboratively plan how to use iPad technology to help integrate NASA-related imagery, information-related tools, and mobile application (app) resources into STEM Education coursework. This poster session will discuss promising “apps” for STEM learning identified by these educators.

SURGICAL ROBOTIC TOOL EXCHANGER

Anna Horst, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68555

The objective of this project was to design, simulate, and test miniature *in vivo* robots to support surgery during long-duration space missions. The project explores the use of a new technique called Natural Orifice Transluminal Endoscopic Surgery (NOTES). The student's role in this project was to design and build a tool exchanger which houses six surgical tools that can be interchanged during surgery without extracting the robot. During the eight months of work, the tool exchanger has been designed to include its preliminary set of designs for the surgical instruments. The casing for the tool exchanger and surgical instruments has been made and is in the process of being assembled. Before final completion, the tool exchanger will need to be fully assembled and tested multiple times, both on bench top and in animal surgery.

ARTIN-SCHREIER-WITT EXTENSIONS IN CHARACTERISTIC ZERO

Alexander James, Department of Computer Engineering, University of Nebraska at Omaha, NE 68182

There are striking similarities between the set of integers and the set of polynomials with coefficients in a finite field. For example, since long division is possible in both, both are principal ideal domains. As a result, there is a rich vein of mathematics that has been mined from the boundary between integers -- rationals -- algebraic number fields -- characteristic zero and polynomials with coefficients in a finite field -- rational functions -- function fields -- characteristic p . This talk concerns one such "mining" project. On the characteristic p side of things: In 1927, Emil Artin and Otto Schreier proved that every cyclic degree p extension of a characteristic p function field is generated by a root of what is now known as an Artin-Schreier equation. This result was generalized by A. A. Albert in 1934 and H. L. Schmid in 1936. Note that Schmid's work led Ernst Witt to develop his famous Witt Vectors, a construction of fundamental importance for modern algebra and some of the most recent developments in arithmetical algebraic geometry. On the characteristic zero side of things: In 1956, George Whaples of University of Massachusetts and Robert E. MacKenzie of Indiana University replicated the result of Artin-Schreier in characteristic zero local fields. However, no-one has, as yet, similarly replicated the results of Albert-Schmid. Thus this project. This is a talk on recent progress.

INCORPORATING MATLAB IN CALCULUS

Samantha Marquez and Jing Chang, Department of Mathematics, College of Saint Mary, Omaha, NE 68106

MATLAB is a program widely used in Mathematics. At College of Saint Mary, it has been integrated into Calculus series. Some course specific short introductory tutorials and exercises are needed to better help new users to quickly master the basics of the program. The purpose of this project was to have the student to develop a series of MATLAB tutorials and exercises for Calculus I and II.

DESIGN AND IMPLEMENTATION OF A SIX DEGREE OF FREEDOM MINIATURE *IN VIVO* SURGICAL ROBOT FOR USE IN LONG-TERM SPACE FLIGHT

Ryan McCormick, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

As NASA manned space flights continue to increase in duration, an increased chance of a medical emergency emerges during the mission. Currently, NASA lacks the capability to accommodate a medical emergency on long term space flights. One possible solution to this problem is through the use of a miniature *in vivo* surgical robot that could be inserted through a single incision into a patient by a trained crew. Once inserted, this robot could be controlled by a surgeon on Earth. This research group has developed a miniature *in vivo* robot with six degrees of freedom and remote surgical user interface. This robot has been designed to reach all four quadrants of the abdominal cavity while providing sufficient speed, strength, and dexterity. The effectiveness of this robot has been confirmed through a successful single incision cholecystectomy in a live porcine model.

EXPLORATIONS IN STEM: AN EDUCATIONAL SCIENCE LITERACY PROGRAM

Ryan J. Tefft, Department of Geology; and Neil B. Huben and William E. Tapprich, Department of Biology, University of Nebraska at Omaha, NE 68182

“Explorations in STEM” is a program aimed toward advancing the development of middle school age youths in a) STEM literacy, b) the inquiry-based nature of the scientific process, and c) STEM career awareness. A total of 100 MS students (Grades: 6-8) and 4 MS teachers, are currently enrolled in the program, which is conducted by University of Nebraska-Omaha (UNO) STEM undergraduates in Tri-Beta National Biological Honor Society. The program stimulates and augments existing MS science curriculum, reinforces fundamental scientific concepts and provides hands-on experiments (i.e. VEX Robots), field trips (i.e. UNO Mallory Koutnze Planetarium), and expert guest speakers (i.e. UNO and UNMC STEM researchers). To assess the impact of the program, participating MS students and teachers have completed periodic surveys (i.e. Baseline, 3-months, etc). The surveys analyze multiple topics, including MS student’s interest in STEM course work and STEM careers, MS student’s perception of scientists, and MS student’s STEM academic performance.

MINIATURE *IN VIVO* SURGICAL ROBOT FOR LONG-TERM SPACE FLIGHT

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The objective of this study is to demonstrate the effectiveness of using an *in vivo* multi-functional miniature robot platform to perform surgery during long-term spaceflight. A miniature robotic platform that is completely inserted into the peritoneal cavity through a single incision provides a method to perform surgery during emergency medical situations in space where a surgeon is not accessible. The robotic platform consists of a multi-functional robot and a remote surgeon interface. The robot has two arms each with four degrees of freedom and specialized end effectors. The end effectors can be interchanged with different surgical tools to perform specific surgical tasks. During the current work, new kinematic arrangements were analyzed and a completely new robotic prototype was built. This prototype improved upon previous versions by significantly reducing the size while improving the workspace. This robot has been demonstrated in multiple non-survival procedures in a porcine model. For each procedure, the robot was completely inserted through a single small incision. During the experiments, the robot was shown to improve triangulation and better enable the performance of complex surgical tasks when compared with standard laparoscopic tools.

GAIT ABNORMALITIES IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Astronauts suffer from extreme muscle wasting and weakness from unloading and disuse during spaceflight. Similar muscle wasting and weakness results from oxidative stress in patients with chronic obstructive pulmonary disease (COPD). Therefore, COPD patients can serve as a model for how muscle wasting and weakness potentially affects skeletal muscle performance in astronauts returning from space flight. Skeletal muscle performance in humans can be quantified through gait analysis. Twenty subjects walked at their self-selected pace along a ten meter pathway while kinematics and kinetics were recorded. Group means from the lower extremity were subjected to independent t-tests. Peak hip extension torque at early stance and peak hip flexion torque at late stance were significantly increased as compared to controls. These data are the first to demonstrate that patients with COPD possibly use a different gait strategy than healthy individuals. This knowledge can lead to generating a screening process for astronauts.

ANTHROPOLOGY

UNEARTHING AGRICULTURAL FACTORS, HEALTH INDICATORS, AND DEVELOPMENT CONCERNS IN SOUTH WOLLO, ETHIOPIA

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Although many studies have focused on the plight, poverty, and severe malnutrition of rural Ethiopians, few have managed to incorporate qualitative and quantitative data. This project is unique in that it combined both types of data, through the use of anthropometric measurements and a structured questionnaire, to explore the link between agriculture, development, and nutrition. Additionally the research design incorporated feedback from local development agents, university officials, and community leaders. A survey of 120 households in two districts of South Wollo revealed that a majority of households suffer from severe malnutrition. Anthropometric measures showed wasting and stunting to be prevalent. Furthermore, interviews with farmers suggest improvements in agricultural extension and health education are desperately needed.

DIET AND DISEASE: SUBSISTENCE CHANGE AND TUBERCULOSIS AMONG THE OMAHA AND PAWNEE

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My paper focuses on the change in subsistence patterns among the Omaha and Pawnee of Nebraska in the late nineteenth century and how their changing food base and lifestyle affected health. I believe, along with crowding onto reservations with poor sanitary conditions, that there is a correlation between the percentage of native people living on government rations of wheat flour, beef, bacon, pork, sugar and coffee and the number of cases of tuberculosis, diarrhea, dysentery and scurvy reported among them. I have found, using the Annual Report of the Commissioner of Indian Affairs as a primary source that a correlation exists between a poor diet of sub-standard government food and rates of tuberculosis. I believe that this study is especially significant because of the correlations that can be made between diet and tuberculosis in the nineteenth century and diet and diabetes in the twentieth- and now twenty-first centuries. Changes in lifestyle certainly contributed to both the spread of tuberculosis and the unhealthy personal life choices that can lead to diabetes. As with tuberculosis, a shift to western-derived nutrition plays a significant role in the occurrence of diabetes. Much like with diabetes today, federal officials in the early reservation era at the time believed native peoples to be susceptible to tuberculosis because of a “consumptive taint” or genetic predisposition to the disease. Today we know that is not such a simple, racially-determined explanation. Could this be true of diabetes as well? These are connections I hope to shed some light on.

LOCAL FOOD ENVIRONMENTS AND OBESITY IN CHILDREN IN RELATION TO SOCIOECONOMIC STATUS

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Obesity has become a worldwide health problem, especially within the United States. There are a number of factors that cause obesity. Genetics, prenatal and environmental factors are just a few of the underlying causes of obesity. The environment is the most dynamic cause of obesity. This research is specifically looking for a connection between food environment and children's BMI in regard to socioeconomic status. The research looks at the food environment surrounding public elementary schools in Lincoln, Nebraska. I hypothesize that there will be a significant difference in the number of fast food restaurants located in low SES neighborhoods compared to high SES neighborhoods. This difference will be related to a significant correlation between high BMI rates in low SES schools. The food environment data showed the highest number of fast food restaurants, restaurants, specialty stores, convenience stores and bars located in the neighborhood of the low SES school, with the numbers falling as SES increased. The mean BMIs between the schools showed that the low SES school had the highest BMI. The results of the regression model showed that sex was a significant indicator of BMI. Within each school males had a higher mean BMI, except for the low SES school where females had a higher mean BMI. Further research of overweight and obesity rates in children is needed to understand the relationship the environment and other factors, like SES, have on obesity. Continued research in this area will help shape better policies to reduce the prevalence of obesity in children and adults and improve local food environments.

SEEKING DEEP TIME: REPORT OF THE 2010 ACTIVITIES OF UNL FIELD SCHOOL IN ARCHAEOLOGY IN THE SEARCH FOR MIDDLE HOLOCENE AGE CULTURAL DEPOSITS IN THE SALT CREEK DRAINAGE, SE NEBRASKA

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The Middle Holocene is of interest because it provides an analog (albeit imperfect) for developing conditions resulting from ongoing global climate change. In 2010, the UNL Field School in Archaeology focused in part on seeking out and characterizing Middle Holocene age cultural deposits along Salt Creek in SE Nebraska. In general, such deposits have been found to be well preserved in alluvial settings but, from upland settings, some materials have been reported as well. This paper summarizes methods utilized and results obtained, placing the latter in the context of current knowledge about the Early Archaic, associated with the Middle Holocene, in eastern Nebraska.

SLING TECHNOLOGY: MODELING OF CAPABILITIES AND EXPERIMENTATION

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The sling is known to many Americans only as the weapon of David from the Old Testament. It is the poor man's weapon, the shepherd's weapon, the boy's weapon (toy). People often consider this artifact, to the extent they consider it at all, to be of little importance in hunting or warfare or indeed culture in general. Yet the simple sling has a long record as a recognized weapon of war. Especially in Peru, Europe and the Middle East, the humble sling may have, at times, shaped warfare as much as the bow. In other regions, and at other times, the sling may have seen more use in hunting. As of today, however, the performance of this weapon is poorly understood. I will examine the literature to date, offering critiques of the methods and math of several authors, before presenting my own hypothetical modeling of sling effectiveness. This research will present both range and impact as critical components of understanding slings as weapons. Citing experiential exercises in sling manufacture and use I undertook, I briefly point a way forward for future technological experimentation. Finally, I will relate what preliminary results can be gleaned from presently ongoing experimental research.

BEING BOTH MAN AND WOMAN: THE CULTURAL ONTOLOGY OF DIMORPHIC GENDER ROLES AMONG THE BERDACHE AND BABAYLAN

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The oppositional binaries, of sex and gender into crude categories of male/masculine and female/feminine accounts for little cultural variation in regard to sexual identity. The Berdache of the Great Plains Indians (or "Two-Spirits") and Babaylan from the Visayan islands of the Philippine archipelago affirm the cross-cultural existence of an institutionalized dimorphic gender role which incorporates both masculine and feminine social behavior to promote social organization within their respective cultural communities, and used this inter-connected identity in the face of cultural assimilation amongst their colonial inquisitors. The Berdache or "two-spirits" occupy an alternative or third gender role in which traits of men and women are combined with those unique to berdache status which involved religious, spiritual, and sexual roles. Babaylan in the Visayan dialect loosely translates to "priestess" in English, and is a pre-colonial prestige role of women whose status was equal to men. The researcher looks into the cultural ontology of women berdaches like Brown Weasel Woman (later called Running Eagle) of the Blackfoot and Woman Chief of the Crow, and Filipino men such as Papa Isio and Dios Buhawi

(male leaders who fought for religious freedom, agrarian reform, and nationalism during the Spanish colonization of the Philippines) who dressed as women to invoke the Babaylan spirit. This paper describes the Berdache and Babaylan by assessing their gendered roles as institutionally legitimized within the social organization, albeit how it also differs from a distinctive “male” or “female” role within their cultural communities. My paper analyzes the existence of dimorphic gender roles through describing the cultural ontology of the Berdache and Babaylan examples to attest the notion that an inter-connected identity of sexuality was also utilized to assert cultural identity amidst colonial assimilation.

WOMEN’S WORTH: A WESTERN MISCONCEPTION

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Focusing on gender relations and dominance within the Gusii of Kenya, Tombema, Kaihsienkung, and India cultures this paper will focus on bridewealth and dowry, specifically what it means in terms of “women’s value” or status within these cultural groups from a feminist perspective. The dominance of the male perspective in academics is one cause for women’s domestic or ‘secondary’ subsistence work being given lower status. Women’s contributions to subsistence especially domestically (in the home) are great. This paper will focus on two points. First is the lack of research done on the subject of bridewealth and dowry; the second point is to look at recent research that is appreciating and acknowledging women’s domestic contributions in more than just a reproductive capacity. Bridewealth and dowry are very fascinating topics since they are so variable between societies. Bridewealth and dowry should be considered further and in contemporary society, in how women are being valued in relation to their contribution to male’s production in society.

EVOLUTIONARY SOCIAL SCIENCE AND THE ENVIRONMENTAL CRISIS: WITH A FOCUS ON POPULATION AND CONSUMPTION, GENDER ISSUES AND CRITICAL QUESTIONS FOR RESEARCH

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Two behaviors that have a direct effect on a wide range of environmental problems are fundamental to evolutionary social science: fertility and resource consumption. They are understudied from an evolutionary perspective. Parting ways with the standard social science model, which relies mostly on education and moral suasion, the evolutionary model (EM) says we have to integrate into policy ideas the fact that humans do not naturally want to limit consumption or population. Overexploitation of resources often occurs with loss of local control and pronounced inequality in wealth and power. The individual perceives his/her interests lie in maximum exploitation. In stratified societies, the EM says that individuals are not swayed by appeals to group benefits, unless backed up by powerful laws, so the best way to stop environmental degradation is to mandate the internalization of environmental costs. Also, in industrial societies, fertility can rise with increasing resources and yield 5-15 times the consumption per capita as in developing countries, confounding the demographic transition.

Outside of marketing, little research has been done on consumption by gender in industrialized countries: How might optimal foraging modeling be applied to consumption by sex? Much such research has been dominated by aggregate measures yielding per capita rates, but some have begun looking at households. Research should begin to sort out consumption and makeup of households, such as life-history changes. Promising research would involve connecting the ecological footprints of various kinds of households and their production/consumption dynamics (ecological costs/benefits) with varying levels and scales of resource use.

A RE-EXAMINATION OF THE NATURE OF MALE PARENTAL INVESTMENT

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The role of male parental investment has recently been a subject of much research and debate in anthropology. By understanding the role of male parental care, its evolutionary development, function to the individual, and implications to the larger society, anthropologists can make better sense of observed cultural phenomena (Lancaster and Lancaster, 1983). This paper will review the anthropological literature published on the different facets of male parental investment, and overview major trends in the research. The role of mating and parenting effort (Trivers, 1972), cross-species comparisons of male parental care (Gubernick and Terefi, 2000), and possible hormonal causations for male parental care will be addressed (Booth, Carver and Granger, 2000). As a proxy for investment male hunting will be examined against two competing hypotheses used to elucidate that activity, the corporative pair-bonding model (Gurven and Hill, 2009) and the signaling model (Hawkes, O’Connell and Coxworth, 2010). It will be demonstrated that the assumptions found in the “show-off” hypothesis do not adequately explain hunting in terms of male parental investment. From this analysis it is proposed that male parental investment is best explained in terms of a combination of the pair-bonding model and a bargaining-model where males seek equilibrium between mating and parenting effort based on available environmental, both physical and social, constraints. Only by adjusting to these given circumstances can males effectively maximize their reproductive potential.

FIFTH GRADE AS A RITE OF PASSAGE

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This study is about discovering “the nitty-gritty” of everyday life” (Willis & Trondman, 2000) of a 5th grade classroom in one of the Catholic Schools in the U.S. Midwest. As a beginning ethnographer, I aimed to experience and learn about a Catholic-based education through the lenses of the school educators and the students. Similar to Peshkin (1986) who wants to experience what it feels like to be in a Catholic School in Gods choice: The total world of a fundamentalist Christian School, I wanted to explore “being there”(Geertz, 1988) by observing how the teachers and the students weave and connect relation between their religious beliefs and the school subjects. My study specifically took place in a fifth grade classroom because my informant Sister Principal claimed that it would be the best representation of their religious based education. With this study, I intended to discover what an ordinary fifth grade education looks like in a Catholic School. My data collection consisted of field notes, interview transcriptions and informal conversations. The data analysis was achieved through open and closed coding, domain and theme analyses. Eight core themes emerged from the analyses. The everyday life of a 5th grade classroom in a Catholic school includes the beginning of a teeter-totter, 5th grade as a rite of passage, safety net, sister as a witness and a teacher, silence, liberating feeling, sailors-the fifth graders, and we all are the same. I believe this preliminary study contributes to our knowledge by offering a window into American religious education. Additionally, it gives us the opportunity to explore and unfold Catholic-faith based education –by leaving the prejudices and preconceptions aside- through the lenses of the people that actually make it a way of life.

DUALITY OF THE KIRPAN: USING SEMANTICS TO EXAMINE THE ROLE OF FUNCTIONING IN DEFINING AN ARTICLE OF FAITH AMONGST KHALSA SIKHS

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Baptized members of the Sikh religion, termed Amritdhari, represent the orthodox perspective on the Sikh religion and must follow the so-called five Ks (kesh, uncut hair and beard; kanga, wooden comb; kara, iron bracelet; kachera, special underwear; and kirpan, strapped sword) to evidence their faith and commitment. The kirpan presents an interesting issue in that a majority of Amritdhari Sikhs considers it not to be a weapon, but rather an article of faith while holding that it must function as an edged implement to be compliant with the requirements of the faith. This seeming juxtaposition is initially confusing, but can be explored and understood through the extrapolation and application of concepts of linguistic semantics to interpreting an actual artifact instead of a word or language. By applying these principles and understanding the kirpan's duality, the role of function in defining the kirpan can be understood. This understanding then provides the basis for exploring the pressures exerted on the Amritdhari Sikhs by communities that do not see the kirpan as anything but a weapon and the implications of using other "forms" of the kirpan to address both the requirement of the faith and the opinions of non-Sikhs.

LOST OR REVIVED: THE PATHS OF ENDANGERED LANGUAGES

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This paper examines how endangered languages are viewed in various sections of the world and what the people and their governments are doing about preserving them, using Moroccan Berber languages, Welsh, Hawaiian, Native American languages and Hebrew as examples. Many endangered languages are lost every year due to lack of usage and interest, the remaining speakers are elderly making it difficult to track them down and document the language for linguists before the speakers are gone. Languages like Hawaiian and Welsh have been revived by community members and now have strong cultural ties and benefits to their speakers. Both languages were suppressed by the governments, but were able to triumph in later years bringing the languages into widespread use, including being currently taught in schools. By examining revivals of endangered languages and why other endangered languages have been lost due to lack of speakers, usage, political turmoil and persecution, I find the elements of what can keep a language alive and thriving and the causes for the breakdown of many indigenous languages. With the governmental push for more critical language skills, I also discuss the possibilities of English use and prestige decreasing in the future, while Hindi, Arabic, Russian and Chinese speakers grown in number and prestige, thus engulfing those endangered indigenous languages.

FIFTY YEARS OF THE CENTRAL KALAHARI GAME RESERVE (1961-2011): A HISTORY OF LAND USE, CONTESTED RESOURCES, LEGAL RIGHTS, AND JUSTICE AMONG INDIGENOUS PEOPLES

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Located in Central Botswana, the Central Kalahari Game Reserve (CKGR) is the second largest conservation area on the African continent. Under the recommendation of field anthropologist and then Bushmen Survey Officer George Silberbauer, the CKGR was officially established in 1961 to serve as a protected area for habitats, wildlife, and people. Most importantly to Silberbauer, the overarching goal driving the formation of the CKGR was to ensure the viability and livelihood of long-term residents and others using this region, many of whom were either full-time or part-time hunter-gatherers or small-scale agropastoralists coping with the changes that were swirling around them in this rapidly developing nation. This inquiry explores the history of land and resource use, legal rights, and justice among indigenous peoples occupying the Central Kalahari Game Reserve over the past fifty years (1961-2011). We identify and discuss key events during this period and examine the implications of recent legislation and legal rulings, most notably the CKGR Legal Case of 2006 —brought by San and Bakgalagadi residents against the government of Botswana— and its aftermath. We question whether Botswana governmental policies of assimilation and sedentarisation of indigenous peoples is an effective means of ensuring that these groups have a voice in decision-making and an equitable chance at a sustainable future.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION A

A SURVEY OF MIDWESTERN LEOPARD FROGS (*RANA PIPIENS* AND *RANA BLAIRI*) FOR EVIDENCE OF GONADAL DYSGENESIS AMONG MALES

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We examined 33 ethanol preserved adult male specimens containing both *Rana pipiens* and *Rana blairi* for evidence of feminization. We examined gross morphological appearance of the reproductive system for abnormalities and used a freeze microtome to make 30 micron histological sections of the testes to search for evidence of oocytes. Voucher slides of testes sections were photographed and stored as digital images. Specimens were collected in agricultural regions of western Nebraska where there has been long-term agricultural use of atrazine, a broad leaf herbicide. Atrazine has been illegal in the European Union since 2003 because of consistent water contamination and health related concerns; however it remains a common herbicide in the midwestern United States. In eastern Nebraska, atrazine concentrations were measured to be above the United States' Environmental Protection Agency's maximum contamination limit of 3 ug/L, or 3.0 ppb (Nebraska Groundwater Report, 2007). Lower atrazine concentrations of 0.1 ppb have been shown to induce gonadal dysgenesis in lab-reared ranid frogs by converting testosterone to estrogen during development (Hayes et al, 2002). Our soil and water samples from western Nebraska were determined using an ELISA kit. Atrazine values varied from 0.10 ppb to 4.35 ppb atrazine (C. Driscoll 2010). Of the 33 male ranid frogs examined, we found no gross morphological abnormalities and no evidence of oocytes.

LIFE HISTORY OF *SPEA BOMBIFRONS*: LONGEVITY, A FIRST LOOK

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We examined 14 adult *Spea bombifrons* from a single breeding site, an agricultural field near Ogallala, Keith County, Nebraska. Our study had two goals: 1) to provide a more detailed understanding of the life history of *S. bombifrons* and 2) to look for indications of feminization in males. Skeletochronological techniques were employed to estimate individual ages based on lines of arrested growth (LAG) to determine population structure. Linear regression was used and no significant relationship was found between age and snout vent length (SVL). Atrazine has been implicated in gonadal dysgenesis in frogs. Waterborne atrazine activates the gene producing aromatase during amphibian development converting testosterone to estrogen and has been documented in ranid frogs to result in the presence of oocytes in testes. Our analyses of soil samples from corn fields in the area of our study site using an ELISA kit were found to contain residual atrazine levels ranging from 0.1 – 4.5 ppb. Despite this exposure, testicular sections revealed large numbers of sperm ampullae, but no presence of oocytes.

ADHESIVE TARSAL SETAE IN MALE TIGER BEETLES: STRUCTURE, FUNCTION, AND EVOLUTION

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There has currently been a resurgence of research into the molecular forces that allow various animals, such as geckos and insects, to adhere to smooth surfaces. The recent findings have shown that the most common force being utilized by both geckos and insects is van der Waal's force. Thus far it has been demonstrated in a few beetle and fly groups, and its functional mechanisms have had limited examination. We have examined six *Cicindela* species and our observations have not only revealed that adhesive setae are found exclusively on the front tarsi of males, but that they have the ability to readily adhere to smooth surfaces. We suspected that these adhesive setae are used primarily to grasp females for mating and have measured setal origination points on five male specimens and the center-to-center distance of the hexagonal pits on the elytral surface of the female specimen of *Cicindela formosa formosa* Say. We found there to be a strong correlation between the setal origination pit distance and the center measurements on the hexagonal pits on the female elytra. This may provide evidence that the setal distribution is species-specific and that the density of the setae may provide maximum adhesion contact with the elytral pits. Future studies may use slow motion photography to observe setal/elytral interaction, as well as other species-specific patterning that may represent a pre-zygotic factor that limits cross-species matings in the same habitat prior to mandibular insertion into the female coupling sulci.

A TALE OF TWO PRAIRIES: REGAL FRITILLARIES AT TWO EASTERN NEBRASKA PRAIRIE PRESERVES

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We present the results from a 13-year study of Regal Fritillary butterflies (*Speyeria idalia*), a prairie-specialist species of conservation concern, at two tallgrass prairie preserves in eastern Nebraska, Allwine Prairie (a 64 hectare restored prairie) and Bauermeister Prairie (a 12 hectare prairie remnant). Each site is subdivided into areas designated for control burns on a three-year rotation. Relative Regal Fritillary population counts are presented based on Pollard Transects conducted once per week for 20 weeks each summer from 1998 to 2010. The population at Allwine Prairie has been stable with a marked increase in numbers in the past three years. The population at Bauermeister has declined, perhaps to local extinction, probably as a result of inconsistent management practices. Seasonal flight phenologies are presented along with data on year-to-year variations in numbers. Effects of burns on Regal Fritillary numbers at specific areas within each prairie are presented: in every case, relative numbers of butterflies decreased in an area in the year of a burn, with numbers recovering in the two succeeding years. Results from a Mark-Release-Recapture study conducted in 2009 at Allwine Prairie are presented, providing estimates of total population number, adult lifespan, and within-prairie movement. We also present data on nectar plant usage by Regal Fritillaries based on observations conducted from 2002 to 2010; wild bergamot and common milkweed were the most frequently visited flowers.

THE RELATIONSHIP BETWEEN 20-HYDROXYECDYSONE AND REPRODUCTIVE BEHAVIOR AND PHYSIOLOGY IN WOLF SPIDERS

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Ecdysteroids are a group of hormones that are found in arthropods and are typically implicated in various developmental processes, primarily molting, as well as various aspects of reproduction and behavior. Previous experiments with the spider *Tegenaria atrica* suggest that the ecdysteroid 20-hydroxyecdysone (20E) is involved in reproductive behavior and physiology, but little is known about its role in other spiders. We explored the role of 20E in three species of *Schizocosa* wolf spider by using radioimmunoassay to quantify the levels of 20E in the hemolymph of adult females from different reproductive treatments and age groups. In *S. uetzi*, we found no difference in 20E levels of age matched females that were exposed to mature male conspecifics versus those that were not exposed to mature male conspecifics. In *S. rovneri*, we found no difference in 20E levels of mated versus unmated females. In both species, we also found no correlation between 20E level and female age post maturation. However, in *S. avida*, we found that 20E levels decreased with age during adulthood. *Schizocosa avida* is the only species for which we obtained 20E levels within the first week of sexual maturation, suggesting that the hormone may have been elevated in early adulthood due to its role in regulating the previous molt.

THE ROLE OF LIGHT IN *JUNIPERUS VIRGINANA* (EASTERN RED CEDAR) INVASION IN TALLGRASS PRAIRIE

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Eastern red cedar is a common invasive tree in tallgrass prairie. Although native, its abundance has increased in the past century probably due to fire suppression. Eastern red cedar encroachment leads to a decrease in native prairie species diversity and abundance because it inhibits the growth of plants in its understory. We studied Eastern red cedar invasion at the University of Nebraska at Omaha's T. L. Davis Preserve near Elkhorn, NE. We asked the general question of whether soil quality or light limitation was responsible for the lack of understory growth. A greenhouse bioassay did not provide a strong indication that Eastern red cedar soils discouraged growth of other herbaceous species. Thus, we set up a field study to see whether light limitation could explain variation in understory plant cover beneath Eastern red cedar stands. We measured photosynthetically active radiation (PAR) and understory stem density in 40 different stands, spanning a variety of light conditions on both N-facing and S-facing slopes. Results suggest that PAR levels affect the understory stem density, with plots that receive more PAR generally having more understory plants. We found that PAR was especially important in promoting understory growth on north-facing slopes, where light is likely more limiting than on south-facing slopes. We also found that on south facing slopes, where light is less of a limiting factor, understory success was dependent on the height of the lowest tree branch. Trees with low branches tended to have less understory growth. Our results suggest that light limitation is a key factor in explaining the variation in, and often complete lack of, understory plant growth in Eastern red cedar stands in tallgrass prairie.

OUTER BARK ANNUAL GROWTH RINGS CORRELATED WITH WOOD RINGS IN HACKBERRY *CELTIS OCCIDENTALIS*

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Hackberry (*Celtis occidentalis*) is a common species of deciduous tree in eastern Nebraska. Besides having many interesting relationships with other members of a deciduous forest community, it is readily identified by a ridged adnate exterior bark. A stand of younger trees in a protected gully in Omaha was used when it was noted that the bark showed especially distinctive layering. In the fall of 2009 closer examination of this bark revealed ridges (rings) which correlate well with the annual growth in the wood rings of the tree. An increment borer was used to obtain cores of bark and wood which were then photographed and enlarged for a comparison. In addition emergent ridges of bark were removed from the main bark surface. It was noted in the two-year study that a ring of bark was indeed added each year and its cellular thickness closely correlated with the amount of wood produced each year. Years with better growing conditions produced correspondingly thicker bark layers. While bark layers generally accumulated one to two millimeters, wood was produced at a rate of two to three times that yearly. An average of 20 years of growth was followed in samples. Bores taken at about chest height frequently ended in decayed inner wood. Growth of these trees was influenced by competition with other nearby trees. It was noted that exterior bark aging was done with relative ease with younger trees, but that in older trees external bark layers were blurred and cores were necessary to see layers. Older trees with lichens and growing in more exposed areas proved to be poor candidates to study layers as they showed more bark weathering.

FUNGAL DIVERSITY OF A COTTONWOOD ROOT SYSTEM

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Mycorrhizal fungi are symbiotic partners of plants that facilitate nutrient uptake. Historically, most research on mycorrhizal fungi has been based on the microscopic examination of morphology. This is problematic because many fungi are morphologically similar, resulting in an underestimation of fungal diversity. A better estimate of diversity can be obtained using molecular techniques, as even fungi that appear morphologically identical often vary substantially at the molecular level. In our research, we use environmental PCR to investigate fungal diversity in a single cottonwood tree. Cottonwood trees (*Populus* spp.) are a model system for studying mycorrhizal fungi diversity, as they are known to harbor both major classes (ectomycorrhizae and arbuscular mycorrhizae). In addition, cottonwood trees have extensive networks of roots that extend several meters vertically and horizontally. These roots intercept soil layers that vary in texture, organic matter, and water content. Therefore, we expect the assemblage of fungi to differ throughout this root network because different species are likely better suited to acquiring resources under various conditions. We sampled from eight spatially distinct locations within the root system of a single cottonwood tree. DNA was extracted from four of these and a 1.4 kb region of the internal transcribed sequence (ITS) and large subunit (LSU) of the ribosomal RNA (rRNA) was amplified. Thus far we have more than 45 fungal sequences, most of which are closely related to other uncultured mycorrhizal fungi sequenced from geographically distinct locations. Preliminary comparisons of sequences at spatially distinct locations within the root system will be discussed. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources, the UNK Undergraduate Research Fellows Program and Research Services Council, and the Platte River Crane Trust.

ANTIBIOTICS FROM NATIVE PLANTS FOR USE AGAINST MRSA

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Methicillin resistant *Staphylococcus aureus* (MRSA) is a severe and growing health care concern throughout the United States. We are attempting to find new antibiotics from native plants that will impede the growth of MRSA. Native plants were selected on the basis of their reported use against boils and other skin infections in the oral tradition of the Lakota people. *Zigadenus venenosus*, Death Camass, members of the *Astragalus* genus, and members of the *Oxytropis* genus were collected on Lakota tribal lands with the permission of Lakota elders. An introduced plant, *Ranunculus testiculatus*, was also collected because of the availability of the plant and previous interest in this plant and its toxicity. MRSA was obtained from Veterans Hospital in Hot Springs, South Dakota, and the Indian Health Hospital in Pine Ridge, South Dakota. MRSA specimens were also obtained from the skin and nasal passages of students in the Microbiology and Pathogenic Microbiology Labs at Chadron State College. Potential MRSA specimens were Gram stained and tested on Staphyloslides to assure that they were *S. aureus*. *S. aureus* samples were further tested using the Kirby Bauer method to determine if the bacteria were methicillin resistant. After this, the methicillin resistant bacteria were tested using multiplex PCR to determine which version of the *mec* chromosomal cassette (which contains the genes for methicillin resistance) the bacteria contained. Plant extracts will next be used in Kirby Bauer testing to determine if the MRSA bacteria strains are susceptible to potential antibiotic compounds produced by our plant specimens.

SIDEROPHORE PRODUCTION BY ALKALINE-SALINE LAKE BACTERIA

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The Sandhills of western Nebraska contain numerous hyper alkaline-saline lakes that range in pH from 7 to above 12, are iron poor and shallow. These lakes are of considerable interest because hyper alkaline-saline lakes are some of the most productive aquatic systems in the world. Little is known about the microbial communities of these lakes, or how they are able to obtain the necessary iron for high productivity. The purpose of this study is to investigate the iron scavenging abilities of the microbial community. Siderophore producing bacteria were isolated from 8 Sandhills lakes, ranging from hyper alkaline-saline to freshwater. Using 16S rDNA sequencing, the most common isolate from the hyper alkaline-saline lakes was found to be 99% similar to *Burkholderia cepacia*. Siderophores produced by *B. cepacia* includes pyochelin, salicyclic acid, cepabactin, and ornibactin. Column chromatography was used to purify potential cepabactin from our isolates, but so far none have been positive for cepabactin production. Hydroxamate and catecholate identification procedures are being developed to determine the family of siderophore being produced. Once the family type is known, more specific purification assays can be done. By understanding the siderophores produced in alkaline-saline conditions, we will have a better understanding of the nutrient cycle in these unusual environments. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

STRUCTURAL CHARACTERIZATION AND ANALYSIS OF PRE-QUEUOSINE RIBOSWITCH

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Located in the 5' untranslated region of bacterial mRNAs, each riboswitch is composed of an aptamer domain and an expression platform. When a specific ligand binds to the aptamer, a conformational change is induced downstream in the expression platform, thus inhibiting transcription and/or translation of the mRNA and ultimately production of the ligand itself. Therefore, riboswitches provide an effective negative feedback mechanism that reduces or shuts down the production of a particular metabolite in response to its abundance in the cell. The pre-queuosine riboswitch regulates the cellular production of pre-queuosine, a precursor of queuosine, which ultimately is incorporated into the anticodon of tRNA to form queuosine-tRNA, allowing wobble base-pairing to occur. Since wobble base-pairing is the cell's natural mechanism to recognize multiple codons using a single anticodon, queuosine and pre-queuosine production are crucial to bacterial translation. Our project aims to elucidate the structure of the pre-queuosine riboswitch bound to its metabolite using X-ray crystallography, with the long term goal of developing antibiotics that mimic pre-queuosine to inhibit this essential pathway. We have subcloned the DNA sequence of interest, transformed the target plasmid into bacteria, optimized the large-scale production of highly purified and concentrated pre-queuosine riboswitch RNA, and started testing different conditions to crystallize the riboswitch-ligand complex. Once a crystal is successfully grown, we can use X-ray crystallography to deduce the atomic-level structural details of the riboswitch-ligand interaction.

The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NIH.

A PUTATIVE MAMMALIAN RIBOSWITCH IN THE SPERMINE BIOSYNTHETIC PATHWAY

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Riboswitches are found in the 5' untranslated region of mRNAs that bind cellular metabolites and induce a conformational change in the mRNA, subsequently modifying the expression of the coding region nearby. This coding region is involved in the synthesis of the same metabolite it binds, and this system provides an efficient feedback mechanism of genetic control. Various riboswitches have been described as effective controls of genetic expression in bacterial cells, but we propose here a potential mammalian riboswitch. We are investigating the structure and function of a potential mammalian riboswitch conserved over a wide variety of species and thought to control polyamine biosynthesis. Polyamines are essential for cellular proliferation and differentiation, and therefore they play a key role in cancer and tumor development. The goal of this project is to solve the crystal structure of this putative riboswitch RNA bound to the polyamine spermine. Preliminary results have aided in determining the optimal chemical conditions necessary for crystal growth. Results will render a better understanding of the binding properties of the metabolite to the RNA and may aid in development of synthetic ligands/metabolites for use as cancer therapies.

The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NIH.

EVOLUTIONARY CONSERVATION OF A POTENTIAL MAMMALIAN RIBOSWITCH

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It is increasingly apparent that noncoding RNAs (RNA sequences that do not go on to encode for proteins) have essential roles in cellular processes. Riboswitches are one type of noncoding RNA sequence found in untranslated regions of mRNAs. Many riboswitch RNAs undergo conformational change upon binding to a specific cellular metabolite. The interaction modulates expression of the adjacent coding region, which typically produces a protein enzyme required for synthesis of the metabolite, thereby providing an efficient feedback mechanism of genetic control. To date, riboswitches that bind to a diverse set of ligands have been identified in bacteria. Only one of these riboswitches has been identified in eukaryotic plants and fungi. We are interested in identifying riboswitches in animals. We are investigating the structure and function of a potential riboswitch conserved among a wide variety of species and thought to control polyamine biosynthesis. We hypothesize that the potential riboswitch RNAs from diverse organisms will bind specifically to ligand and demonstrate conformational change upon ligand binding. We are utilizing equilibrium dialysis to demonstrate specific binding of ligand and in-line probing to observe conformation changes in the RNAs. Our preliminary results indicate that the RNAs from diverse species possess similar binding ability. Future studies will investigate this conserved sequence element from other organisms using similar techniques. The identification of riboswitches amongst animals suggests that such RNAs could be therapeutic targets for modulating gene expression.

The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NIH.

***PSEUDOMONAS SYRINGAE* INDUCES REDUCTION IN HISTONE H3 ACETYLATION IN A TYPE III SECRETION DEPENDENT MANNER**

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Pseudomonas syringae, a gram-negative plant pathogen, employs a type III secretion system (T3SS) to inject type III effector proteins (T3Es) into plant cells in order to cause disease. The specific molecular function of most T3Es remains elusive, but it now appears that many effectors suppress components of plant innate immunity in order to further disease development. Recent studies have revealed a subset of effectors from several human pathogens that contribute to disease progression by either directly or indirectly modifying host chromatin. We think it is likely that T3Es of *P. syringae* are involved in the alteration of host chromatin and thereby the expression of genes involved in the innate immune response in a manner that facilitates the survival and proliferation of the pathogen. To evaluate whether *P. syringae* induces chromatin modifications in Arabidopsis in a T3SS dependent manner, we vacuum-infiltrated plant leaves with the wild type strain DC3000, a hrcC mutant strain that cannot inject T3Es, several poly T3E mutants, and a buffer only control, and collected leaves after 20 hours. To evaluate the possibility that detected chromatin changes were PAMP-induced, we also infiltrated a closely related, non-pathogenic bacterium, *Pseudomonas fluorescens*, and a strain of *P. fluorescens* that expresses a functional T3SS. Immunoblot analysis of chromatin extracted from infiltrated plant tissue was used to detect specific histone modifications and determine if the different bacterial treatments

elicited changes in global chromatin modifications. We found a decrease in histone H3 K9 acetylation in plants treated with DC3000. This change in acetylation was absent in plants treated with the buffer control, the *hrcC* mutant or the nonpathogen, *P. fluorescens*, suggesting an essential role for the T3SS and its effectors. Because this histone modification is usually associated with actively transcribed genes, we are investigating the likelihood that reduced H3K9 acetylation occurs along genes involved in the innate immune response. We have determined optimal conditions for Chromatin Immunoprecipitation (ChIP) assays, and preliminary data using real-time PCR suggest a decrease of H3K9 acetylation along promoter sequences of a subset of innate-immunity related genes. Collectively our data suggest that during the interaction of *P. syringae* with its host, injected T3Es are involved in either directly or indirectly reducing H3K9 acetylation along the genome.

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NATIVE STRUCTURE OF THE 5' NONTRANSLATED REGION OF THE *COXSACKIEVIRUS* B3 GENOME AS DETERMINED BY CHEMICAL PROBING

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Coxsackievirus B3, strain 28 (CVB3/28) is a positive-sense RNA virus from the Picornaviridae family that causes myocarditis and pancreatitis. The native structure of the 5' non-translated region (5' NTR) of the CVB3/28 genome is necessary to promote replication and is also required for virulence. While the nucleotide sequence of this segment of the CVB3/28 genome is known, its structural orientation has not yet been determined. The current study aims to determine the native structure of the 5' NTR by examining the secondary and tertiary interactions occurring within the region. These interactions are currently being examined and analyzed by chemical probing of the full length and fully folded 5' NTR RNA. A complete understanding of the native structure of the 5' NTR region will yield insight into host-virus interactions and will be useful in identifying the mechanism(s) involved in CVB3/28 virulence. This information may then be used to aid in the development of novel therapeutics against the CVB3/28 virus.

PUTATIVE DNA MOTIF ASSOCIATED WITH *T. GONDII* BRADYZOITE INDUCTION

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T. gondii is an apicomplexan parasite which infects humans and a wide variety of other mammals. In the United States, it is a leading cause of congenital defects. We are investigating the formation of the bradyzoite, or chronic, stage of *T. gondii*. This stage is completely resistant to chemotherapy or other form of clearance, and has recently been associated with host behavioral changes. We are particularly interested in studying a novel CT-rich DNA motif found upstream of recently identified bradyzoite-specific genes, which may serve as a transcription factor binding site responsive to bradyzoite transition initiation. Initial studies suggest the binding of yet unknown transcription factors present only in the bradyzoite stage to this conserved motif. Our current study involves measuring transgene expression under the control of motif-containing and known stage-specific promoters.

CHARACTERIZATION OF rRNA INTRONS IN FUNGI

Travis Kirchner and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney, NE 68849; and Jolanta Miadlikowska, Ester Gaya, and François Lutzoni, Department of Biology, Duke University, Durham, NC 27708

There are two types of introns found in the rRNA of lichen-forming fungi, canonical group I introns and small insertions. Group I introns are auto-catalytic RNAs that are sporadically distributed among nuclear rRNA and organellar genes in plants, fungi, and protists. The small insertions in rRNA were thought to be spliceosomal introns and are largely restricted to lichen-forming fungi. However, these insertions have also been hypothesized to be degenerate group I introns. This project aims to differentiate between these two possibilities using both bioinformatic and biochemical approaches. The first aim is to assemble a compilation of rRNA introns from an alignment of more than 3000 fungal sequences. From this assembly, we have found that introns occur in at least 70 discrete positions in the rRNA small subunit (SSU) and at least 50 positions in the large subunit (LSU). Based on this compilation, potential insertions that represent the transition from canonical group I introns to spliceosomal introns are being identified. The second aim of the project is to characterize splicing in a subset of these introns. Group I introns and canonical spliceosomal introns splice using different mechanisms, thus understanding splicing in potential intermediates may be important for understanding the transitional stage. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources and the UNK Undergraduate Research Fellows Program.

CHARACTERIZATION OF MUTANTS DEFICIENT IN RNA INTERFERENCE IN GREEN ALGAE

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RNA interference (RNAi) is a highly conserved mechanism of gene expression regulation in eukaryotes. Since its discovery, RNAi has been primarily utilized as a method for studying gene function in reverse genetics, though its potential for application is much greater. Proposed technologies are widespread: from being used as a therapy for genetic diseases to transgenic crops. However, the basic RNAi mechanisms are just beginning to be explored and an understanding of them is necessary to design improved, RNAi-based technologies. We are using the unicellular green algae *Chlamydomonas reinhardtii* as a model organism for the study of RNAi mechanisms. In this alga, we have developed a procedure to screen for RNAi-defective mutants and have identified several genes involved in various aspects of RNAi. From this screening, we have identified four mutants with single insertions bearing the RNAi phenotype. The screening results as well as information on the mutant strain, MUT116, will be presented.

THE CCR4-NOT CO-ACTIVATOR FUNCTIONS IN GCN4 REGULATED GENE EXPRESSION AFTER TRANSCRIPTION

Dhananjay Nawandar, Andrew Seberg, Naomi Barcomb and Mark J. Swanson, Department of Biology, University of Nebraska Omaha, NE 68182

Amino acid starvation in the yeast *Saccharomyces cerevisiae* leads to a global reduction in translation due to the phosphorylation of the alpha subunit of eukaryotic translation factor 2 (eIF2 α). Even during this global reduction in translation, some mRNAs need to be translated more efficiently to overcome the starvation, including the mRNAs regulated by the Gcn4 protein. Gcn4 is a transcriptional

activator, regulating the activities of about 500 genes in yeast, including the genes encoding amino acid biosynthetic enzymes. The CCR4-NOT complex is one of the six known co-activators of Gcn4. Along with transcriptional activation of the Gcn4 regulated genes, this complex has also been shown to have a post-translational role in mRNA degradation. Very little is known about the role of this complex after transcription and before translation. We are studying the post-transcriptional regulation of the Gcn4 regulated genes by the CCR4-NOT complex. Different methods of inducing amino acid starvation have been used by numerous labs, but most of these methods have been limited to studying the mRNA levels of the Gcn4 regulated genes. We are trying to determine the best conditions to induce amino acid starvation in yeast, taking into consideration the both mRNAs and the proteins of Gcn4 regulated genes, along with the eIF2 α phosphorylation levels.

IDENTIFYING ELEMENTS OF POST-TRANSCRIPTIONAL REGULATION IN THE GENERAL AMINO ACID CONTROL PATHWAY OF *SACCHAROMYCES CEREVISIAE*

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Starvation for any amino acid in the baker's yeast *Saccharomyces cerevisiae* triggers general amino acid control (GAAC), which results in the production of all amino acid biosynthetic enzymes. When GAAC is initiated, global translational activity is reduced to conserve amino acids. However, some protein levels increase during GAAC, including those for amino acid biosynthetic enzymes, indicating some level of translational control. It is known that Gcn4 activates the transcription of genes involved in general amino acid control. However, it is unknown how these transcripts are translationally regulated. Our aim is to identify translational regulators by determining genes downstream of Gcn4 in the GAAC pathway. Initially, genes involved in the GAAC pathway were identified by a genomic wide screen for haploinsufficiency on media including ethionine (ETH) and Sulfometuron methyl (SMM). Twenty of these strains were selected based on known associations with the nuclear pore complex or the ribosome, two likely sites of post-transcriptional regulation. *GCN4* was over-expressed in these strains, which were subsequently tested for sensitivity on SMM and ethionine containing media. The *RPS10a* and *KEM1* heterozygous deletion have been fully rescued by *GCN4* over-expression, while *MYO3*, *BBC1*, and *RPS10b* were only partially rescued. This indicates that *KEM1* has a function upstream of *GCN4* translation, while *MYO3*, *BBC1*, and *RPS10b* act in either a downstream or alternative pathway of GAAC. Also, haploid deletions of paralogs *RPS10a* and *RPS10b* were both sensitive to starvation. However, *RPS10a* haploid deletion was fully rescued by *GCN4* uORFless transformation while *RPS10b* was only partially rescued. It is unknown how the roles of *RPS10a* and *RPS10b* may differ in GAAC.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

OPTIMIZATION OF AN IN-CELL WESTERN ASSAY FOR HIPPOCAMPAL NEURONS IN PRIMARY CULTURE

Tobiah B. Elbert and Janet Whitson, Department of Natural Science, Concordia University, Seward, NE 68434

Alzheimer's disease (AD), the most common form of dementia, is an incurable, degenerative, and terminal brain disease. In 2010, the disease was the 7th leading cause of death and afflicted an estimated 5.3 million Americans. It is believed that amyloid peptide A β 42 contributes significantly to AD development. Research has shown that the toxic impact of this species is initially synaptic in nature, and, although it remains extracellular, it can ultimately lead to neuronal cell death. The In-Cell

Western assay, using an Odyssey infrared imaging system, is a quantitative immunostaining technique that may be adapted for studying the effects of A β 42 on neuronal cells, specifically primary cultures of hippocampal neurons. Here, we will present the optimization for said technique. Our optimization will emphasize the following four parameters: cell density, rinsing, primary and secondary antibody dilutions, and days *in vitro*. Cell density will be empirically determined for ideal imaging conditions; with initial target densities for the selected 96-well plates lying between 15,000 and 20,000 cells per well. Frequency and magnitude of washings will be optimized to provide the least disturbance, as excessive rinsing can lead to cell detachment from the well. Optimal primary and secondary antibody dilutions will be determined empirically to provide ideal imaging conditions, with general parameters ranging from 1:50 to 1:200, and 1:200 to 1:1,200 respectively. Days *in vitro* will affect quality of imaging and observable data. This will be determined empirically to satisfy an *in vitro* period between 1 and 3 days.

OMEGA-3 TO OMEGA-6 RATIOS: LACK OF EFFECT ON LEARNING AND MEMORY

David Pattison, Kimberly Miller, Timothy von Behren, Mallory Hicks, Jacky Potane, Justin Boutwell, Rebecca Aldrich, and Janet Whitson, Department of Natural Science, Concordia University, Seward, NE 68434

Alzheimer's disease (AD) is widely recognized as a debilitating brain disorder robbing the affected individual of cognitive function. Since inflammatory processes are known to play a significant role in the progression of AD, it is often categorized as an inflammatory disease of the brain. In light of this, a number of studies have focused on the therapeutic potential of anti-inflammatory compounds in animal models of AD. Two of these compounds have also received much attention in the popular media. They are omega-3 and omega-6 fatty acids. Omega-3 fatty acids (n-3), commonly available in fish oil and flaxseed, are known anti-inflammatory agents that may or may not influence the inflammation associated with AD. Omega-6 fatty acids (n-6), which are highly concentrated in corn and safflower oil, have for many years been assumed to offer anti-inflammatory protection to the same extent as that of n-3. In line with this assumption, the n-3 to n-6 ratio in the standard American diet (SAD), which has been reported to range anywhere from 1:20 to 1:40, has been little cause for alarm. However, recent research has shown that n-3 and n-6 function distinctly in cellular metabolism. Specifically, n-6 metabolism demonstrates an increased inflammatory potential compared to the metabolism of n-3. Furthermore, research has shown a decrease in inflammation in response to n-3 consumption in conditions such as arthritis. As a result, the popular media advocates the consumption of n-3 not only to improve physical performance, which is a scientifically supported claim, but also to improve cognitive performance, an element lacking in clarity. The primary focus of our experiment was to determine whether the popular notion that n-3 is beneficial and n-6 is detrimental to cognitive performance was accurate, or merely the result of unsound extrapolation. In addition, we sought to examine the effects of extreme diets with unbalanced n-3/n-6 ratios that could relate to the SAD. Our hypothesis was that n-6 would be detrimental to learning, memory, and spatial reasoning, while n-3 would have positive effects on these parameters. The three groups of Sprague Dawley rats used in this experiment were given feed laced with predetermined isocaloric ratios of n-3 to n-6 for two months before testing occurred. Our study differed from previous work in that we did not create a condition of n-3 or n-6 deficiency. Similar to previous work, we approached the relationship between n-3 and n-6 from a ratio rather than concentration perspective. Learning and memory were assessed using the Hebb-Williams maze series. The results from this study showed no significant effect on either learning or memory from altering the n-3/n-6 ratio in the diets of rats not already deficient in n-3.

THE USE OF COARSE GRAINED NORMAL MODE ANALYSIS IN UNDERSTANDING A β PROTOFIBRIL DYNAMICS

Curtis Scott Jordan and Patricia Soto, Department of Physics, Creighton University, Omaha, NE 68178

Alzheimer's disease is a tragic and debilitating neurological disorder currently affecting about 5 million people over the age of 65 in the United States. At the molecular level, the disease has been tied to the presence of extracellular senile plaques (or amyloid fibrils) and oligomers that result from the aggregation of the A β peptide. In this study, coarse-grained normal mode analysis has been used to gain insight into A β protofibril's conformational dynamics under various cell milieu conditions. The first nontrivial eigenmodes suggest that polymorphism and physicochemical surroundings modulate A β protofibril plasticity trends. In the presentation we will discuss collective motions of the protofibril structures supported by observations of atomic position fluctuations. The implications of the work behind this project will open the door to potential avenues of pharmaceutical control against fibrillogenesis, making strides towards a deeper understanding of Alzheimer's disease.

ELASTICITY OF ALZHEIMER'S A β PROTOFIBRILS STUDIED WITH FULLY ATOMISTIC NORMAL MODE ANALYSIS

Trang Doan, Department of Physics, and Patricia Soto, Physics Department, Creighton University, Omaha, NE 68178

Accumulation of beta amyloid peptide (A β) into extracellular senile plaques in the brain has been linked to neurotoxic effects in Alzheimer's disease (AD) patients. Despite a wealth of research effort focused on preventing, stopping or reversing A β aggregation, an effective mechanism against fibrillogenesis is lacking. An atomic picture of the conformational dynamics of A β pre- and proto fibrillar species promises to shed light into effective inhibition and disassembly pathways against fibrillogenesis. In this study, solid state NMR derived quaternary structures of model Alzheimer's A β protofibrils are examined using fully atomistic normal mode analysis. Our goal is to test whether protofibril polymorphism modulates the elasticity of amyloid structures at the atomic level. In the presentation we will discuss trends in conformational flexibility of protofibril structures and potential implications in terms of A β fibril (dis)assembly and toxicity.

IDENTIFICATION AND CHARACTERIZATION OF PRION INHIBITOR BINDING REGIONS FOR THE AGAAAAGA PEPTIDE

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Prions are infectious agents responsible for transmissible spongiform encephalopathies, a fatal neurodegenerative disease in mammals, including humans. Previous literature indicates a link between short peptide sequences and an inhibitory effect on the conversion process of the prion protein. The prion protein in its native state is not harmful; however, conversion to the misfolded state causes neurodegenerative disorders. The AGAAAAGA sequence was specifically identified as an inhibitor that binds to the monomer prior to conversion. We sought to determine what specific region of the prion protein is most conducive to AGAAAAGA peptide binding. The precise initial structure of the peptide itself was important to note, as the peptide sequence often assumes an entirely different structure than the same sequence when part of the larger molecule. Five structures were tested, generated by the

Robetta server. The structures of these ligands and the prion protein were first mapped using AutoGrid. Then, docking calculations were performed using the free software Autodock 4.2. to identify binding regions or docked structures. Identifying relevant contacts between prion protein residues and the bound ligand further defined these regions. To follow up on the top docked candidates, molecular dynamics simulations, using the software Gromacs, were used to study the stability of the bound complexes.

ROLE OF EGFR IN HAIR CYCLING AND INFLAMMATION IN THE SKIN

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Mutations that increase EGFR (epidermal growth factor receptor) activity contribute to cancer. EGFR inhibitors are in clinical trials for the treatment of cancer; however, cancer patients treated with EGFR inhibitors and mice with decreased EGFR activity develop folliculitis, an acne type rash. We used skin-targeted Egfr mutant mice to investigate mechanisms through which reduced EGFR activity leads to perifollicular inflammation. Transcriptional profiling using hair follicle RNA from Egfr mutant and control animals revealed altered expression of multiple mast cell-associated genes upon genetic deletion of Egfr, suggesting that mast cells may be involved in the inflammation. Further investigation revealed that mast cell infiltration occurred subsequently to defective hair follicle involution in Egfr mutant skin. Neutrophils were also associated with aberrant hair follicles in Egfr mutant mice. These data suggest that hair follicle defects resulting from abrogation of EGFR cause folliculitis. Additional experiments are planned to further characterize inflammatory cell populations in Egfr mutant skin and to identify signal transduction mechanisms responsible for this phenotype.

CHARACTERIZATION OF THE 6Q DELETION IN FOLLICULAR LYMPHOMAS BY NEXT GENERATION DNA SEQUENCING

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Follicular lymphoma (FL) is the second most common form of non-Hodgkin lymphoma. Though FL is typically an indolent cancer, 30% of cases transform into a more aggressive lymphoma, such as diffuse large B-cell lymphoma (DLBCL), which has a poor overall survival. One of the most common early events in the progression of FL is the loss of regions within chromosome 6q. Due to the high frequency of 6q aberrations, it is believed that crucial tumor suppressor genes reside within 6q. To better understand the role genes in this region play in tumorigenesis and patient survival, 35 genes from ten FL patients were sequenced using next-generation DNA sequencing. Of the 35 genes sequenced, eight contained mutations that resulted in protein truncation. The mutations found in two candidate genes, BCLAF1 and PRDM1, were also studied in greater detail to better understand the consequences of the mutations on gene expression.

ENVIRONMENTAL STRESS REGULATION EFFECTS ON GLUCOSE TOLERANCE IN KK-A^y MICE WITH NON-INSULIN DEPENDENT *DIABETES MELLITUS*

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Diabetes is a heterogeneous metabolic disorder that is caused by desensitization of target cells to glucose or malfunctions in the secretion of insulin from pancreatic β cells. Due to these dysfunctions, diabetics experience a rise in blood glucose levels. Our study focused on Type II diabetes because it

is becoming more prevalent and is known to be caused by insulin resistance to target cells. Type II diabetes is also linked to co-morbid diseases. Our study used KK-Ay mice, which are engineered to develop an onset of both obesity and diabetes. The mice were subjected to rigorous physical activity through swimming. Swimming exercise was used to determine the effects that exercise has on increased glucose levels. The purpose of this study is to expand on results obtained by Chakraborty et al. (2009), which suggest diet alone lowers blood glucose levels. It is expected that exercise will significantly lower blood glucose levels the same as if not more than diet alone. Results will provide evidence for proper diabetes control and will provide background information for future studies testing for the effects that exercise and diet have on combating type II diabetes.

MEASURES FOR BOOLEAN PROTEIN INTERACTION NETWORKS

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Boolean networks have been used to model the complex interactions of signal transduction in a cell with promising results. One way to characterize the interactions in these networks is to apply qualitative entropy measures to observe whether their behavior over time is repetitive, follows a pattern, or is more complex. There are several different techniques to measure whether a time-series is random or has recurring patterns. To examine which were most appropriate for use on these Boolean protein networks, the measures were first tested on simple Boolean networks known as cellular automata. The specific measures we tested are sample entropy, approximate entropy and detrended fluctuation analysis (DFA). In the presentation we will discuss the various measures as well as their implications about the behavior of complex Boolean protein interaction networks.

DOMAIN SPECIFIC ASSEMBLY FOR NEXT GENERATION SEQUENCING

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Next generation sequencing has become a major focus in many recent biological research applications. Various assemblers have been developed to address the problem of short read assembly. However, each sequencing project consists of multiple variables including read length, error rate, coverage, and domain properties. In this work, we propose a graph theoretic assembler called Merge and Traverse that adapts to the dynamic nature of sequence assembly by relying on multiple parameters to control the assembly process. We hypothesize that the optimal values of these parameters are dependent upon domain specific features such as genome type and sequencing characteristics. The ability to capture and quantify optimal assembly parameters dependent upon domain type will provide the foundation for a knowledge-based approach for the assembly process. This will allow for the assembler to be applied in an intelligent and customized manner to a wide variety of datasets, resulting in more efficient assembly tactics and improved assembly quality. We tested the proposed assembler on various datasets with a variety of different domain specific characteristics and the obtained results verified our hypothesis and domain specific assembly produce better results as compared to domain independent ones.

IDENTIFYING BIOLOGICALLY RELEVANT SUBSYSTEMS USING CORRELATION NETWORKS

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Correlation networks present an innovative tool to analyze various types of biological data. In particular, they present a useful tool to take advantage of the massive expression data collected by many researchers over the last fifteen years. While these gene expression experiments interpret gene expression levels, they also produce data overload. Correlation networks can manage this overhaul of data, determine relationships of co-expression between genes, identify the most important genes of a system, and find potential subsystem or clusters associated with specific biological functions. Our model of a correlation network represents genes as nodes and creates edges to display the correlation between every pair of genes given gene expression data. The produced networks can help in identifying element (nodes) and subsystems (cliques) of interest. However, such networks are notoriously dense and complex, creating a need for tools that automate the process of size reduction, classification, and identification of basic structural components. In this work, we design and implement a set of tools to automate the process of identifying biologically relevant structures/subnetworks in correlation networks.

BIOLOGICAL AND MEDICAL SCIENCES **SESSION D**

ROLE OF PROSTANOID RECEPTORS IN THE INHIBITORY EFFECT OF SYNTHETIC ISOPROSTANE, AG113 ON POTASSIUM-INDUCED [³H]D-ASPARTATE RELEASE IN ISOLATED BOVINE RETINA

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We investigated the role of prostanoid receptors in the inhibitory effect of the synthetic isoprostane (IsoP), AG113 on K⁺-induced glutamate release (using [³H]D-aspartate as a marker) in isolated bovine retina. Isolated neural retinae were incubated in oxygenated Krebs solution containing 200nM of [³H] D-aspartate for 60 mins and then prepared for studies of neurotransmitter release using the superfusion method. Release of [³H]D-aspartate was evoked by iso-osmotic concentration of K⁺ (50mM)-stimuli applied at 80-88 mins (S₁) and 116-124 mins (S₂) after the onset of superfusion. Both AG113A and AG113B attenuated K⁺-induced [³H]D-aspartate release from retina without affecting basal tritium overflow. AG113A exhibited a biphasic response, with the maximal inhibitory effect of 36% (n=7; p<0.001) being achieved at 0.01μM while AG113B achieved a maximal inhibitory effect of 26% (n=3; p<0.01) at the 0.1μM concentration of the isoprostane. The prostanoid antagonists, AH608 (EP1-3/DP1), BAY-u3405 (DP2 and AH23848 (EP4) did not reverse the inhibitory effect of AG113A on K⁺-induced D-aspartate release. On the contrary, EP1 antagonists, SC19220 and SC1322 completely reversed the inhibitory effect of AG113A on the neurotransmitter release. In conclusion, prostanoid EP1-receptors mediate the inhibitory effect of AG113 on K⁺-evoked [³H]D-aspartate release in isolated bovine retinae.

LINKING FUMONISIN EXPOSURE TO NEURAL TUBE DEFECTS

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Corn (maize) is a world-wide food staple, ingested by millions of people and animals daily. *Fusarium verticillioides* is a fungus that grows on corn, producing a mycotoxin called fumonisin (FB). Consumption of fumonisin-contaminated maize has been shown to cause numerous health problems in both humans and animals, and ingestion of fumonisin-contaminated food during early pregnancy has recently been associated with increased risk for having a child with a neural tube defect (NTD). NTDs are a type of birth defect that occurs when the neural tube does not close properly during embryonic development, and includes malformations such as spina bifida and anencephaly (exencephaly in mice). We are using the inbred LM/ Bc mouse model to uncover the mechanism(s) responsible for FB-induction of NTDs. Fumonisin is known to inhibit the enzyme ceramide synthase, which converts sphinganine to dihydroceramide in *de novo* sphingolipid biosynthesis. Sphingolipids are important components of the plasma membrane, and play a role in cell survival, proliferation, migration, differentiation, and death. Fumonisin inhibition of ceramide synthase leads to (1) increased accumulation of upstream sphinganine and (2) depletion of downstream ceramide. The sphinganine that accumulates can be phosphorylated by sphingosine kinase to form sphinganine-1-phosphate (Sa-1P), which then acts as a ligand for a family of 5 G-protein-coupled 'S1P' receptors. S1P receptors are expressed in the neural folds of mouse embryos during the time of neural tube closure. Compounds that target S1P receptors are currently an active area of pharmacological research for the development of immunosuppressant drugs. Fingolimod (FTY720) is an S1P receptor agonist that recently received FDA approval for the treatment of multiple sclerosis. Similar to sphinganine, FTY720 is phosphorylated by sphingosine kinase to form FTY720-P, which binds 4 of the 5 S1P receptors. Administration of FTY720 to pregnant mice results in offspring with NTDs, suggesting that agonism of S1P receptors by FTY720-P or by Sa-1P (after fumonisin) may be one possible mechanism for the failure of neural tube closure. The other possible mechanism involves the depletion of ceramide subsequent to fumonisin inhibition of ceramide synthase. Ceramide appears to play a role in cell cycle regulation and the formation of primary cilia. As the cells enter mitosis (G2/M transition), primary cilia disassemble. Signaling via primary cilia on neuroepithelial cells is important for proper neural tube closure, and the absence of primary cilia is associated with increased risk for NTDs. Fumonisin exposure has been shown to impair ciliogenesis in cultured kidney cells, and it also impairs ciliogenesis in the neural tube of exencephalic LM/Bc mouse embryos. Sonic Hedgehog (Shh) is a signaling molecule that plays a role in neural tube patterning and closure through its interaction with receptors on primary cilia. Immunohistochemical examination of Shh protein in the neural tube of E9.5 LM/Bc mouse embryos demonstrates differences in expression patterns between control, FB1-, and FTY720- treated mice. In summary, gestational exposure to fumonisin may cause NTDs by (1) increased accumulation of Sa-1P and agonism of S1P receptors, or (2) depletion of ceramide, altered cell cycle regulation, and impaired ciliogenesis.

EFFECT OF TIMP-2 IN TRUNK NEURAL CREST PATHFINDING

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Previous studies suggest tissue inhibitor of metalloproteinase-2 (TIMP-2) plays a role in neural crest (NC) pathway choice. TIMP-2 expression by cranial NC correlates positively with taking the dorsolateral pathway. However in the trunk where TIMP-2 is not expressed in NC cells, NC cells initially take the ventromedial pathway. Here, we tested whether misexpression of TIMP-2 in trunk NC cells redirects NC cell migration into the dorsolateral pathway. A bicistronic vector driving both TIMP-

2 and green fluorescent protein (GFP) expression or one lacking the TIMP-2 sequence was introduced by *in ovo* electroporation into NC precursors at the future wing bud axial level. Embryos were then reincubated for 24 hr and those exhibiting GFP expression were fixed, immunostained as whole mounts for GFP and NC cells (HNK-1 antibody), embedded, and sectioned. Pathway choice of trunk NC cells was scored as either taking the ventromedial, dorsolateral, or both. Results suggest misexpressing TIMP-2 in trunk NC precursors promotes a dorsolateral pathway route. Whether TIMP-2 misexpression redirects migration of all NCs or selectively promotes the early immigration of melanogenic NC precursor cells (that normally take the dorsolateral pathway later in development) is unknown and awaits further study. Supported by NIH (P20-RR016469) from the INBRE Program of the National Center for Research Resources.

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DICER, DON'T LEAVE HOME WITHOUT IT

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Dicer, a ribonuclease type III, is required to process and regulate small regulatory RNAs, microRNA (miRNA) in particular. miRNA are non-coding RNAs that form protein effector complexes and regulate gene expression. They participate in the regulation of almost every cellular process investigated up to this point (Krol et al., 2010). In particular, Dicer and its regulation of miRNA function correlates to essential cellular processes such as cellular differential, survival, and apoptosis. This project investigates the role of Dicer and miRNAs in the neurogenesis, neuronal differentiation, and neurodegeneration of the central nervous system

To analyze these effects, conditional Dicer null mutants under the control of developmentally regulated promoter, *Atoh1*, have been generated in mice. A Cre-lox system under the control of the *Atoh1* promoter was used to eliminate the expression of Dicer in *Atoh1* expressing cells in mice. *Atoh1* is expressed in and regulates neurogenesis of granule cells progenitors of the cerebellum. The *Atoh1*-Cre Dicer null mice, while born viable, demonstrate unsteady movement, lack of balance, ataxic behavior, and extreme seizures and frequently die by approximately 4 weeks of age. Statistical analysis of motor behavior was conducted using the Catwalk. The results show a significant difference in initial contact time between the mutant and wild type mice ($p = 0.0004$). Further, mutant mice demonstrate an increase in maximum contact ($p = 0.0003$) and in paw angle relative to the horizontal plane ($p = 0.0013$). These data suggest a loss of balance and coordination in mutant mice as they transverse the path. Immunohistochemical analysis of cerebellar tissue from *Atoh1*-Cre Dicer null mice demonstrate a dramatic disruption in the migration and development of cell layers as compared to controls. Immunohistochemical data correlates well with the abnormal behaviors observed in the *Atoh1*-Cre Dicer null mice. RT-PCR and western blots analysis confirms that there are significant differences in mRNA and protein expression of *Zic2* and calbindin in mutant mice. *Zic2* and calbindin are specifically expressed in granule and purkinje cells, respectively. Granule cell and purkinje cell organization is necessary for the proper function of the cerebellum, which contributes to motor coordination, posture, and equilibrium. *In situ* hybridization will be utilized to assess expression levels of Dicer and miRNAs in *Atoh1*-Cre Dicer null mutant and control mice. Taken together, these data should provide insight into the role that miRNA plays in neurogenesis, neuronal differentiation, and neurodegeneration in the cerebellum.

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RT-PCR ANALYSIS OF MICROGLIAL NEUROTROPHIC PROPERTIES

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Neuronal differentiation, survival, axonal sprouting, and recovery from central nervous system injury may be enhanced by soluble signaling molecules secreted by immune cells. Microglia are the secretory immune cells of the brain. While once considered to be cytotoxic, a growing body of work suggests that activated microglia can play a role in promoting neuronal survival and neurogenesis. We have previously reported data demonstrating changes in microglial cytokine synthesis in response to neuronal damage. To address the neurotropic role of microglial secretions, conditioned media from co-cultures in which microglia were suspended above damaged or undamaged neurons were analyzed for microglia-derived cytokines using ELISA. Microglia activated by neuronal damage displayed significant increases in MCP-1, RANTES and MIP-1 α and significant decreases in IFN γ , TNF α and IL-6. We have used RT-PCR to verify our ELISA analysis of microglial cytokine secretion in response to neuronal damage. RT-PCR analysis has also been used to verify western blot data suggesting an increase in neurogenic protein expression in damaged neuronal cultures following exposure to activated microglia. Our future directions are to investigate the cellular mechanisms which underlie differential cytokine expression and production in activated microglia in conjunction with determining how the increased or decreased expression of neurogenic genes promotes neuronal survival and differentiation.

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INNATE IMMUNE RESPONSE TO *CYTOMEGALOVIRUS* IN MACROPHAGES

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Cytomegalovirus (CMV) is a herpes type virus that has been associated with approximately 25% of congenital deafness cases. Scientists believe that the virus crosses the placenta from the maternal bloodstream into the fetus, causing a change the shape of the newly forming temporal bone making the fetus incapable of hearing. Often the virus enters the body through a pulmonary route, but how the infection moves from the lungs to the rest of the body is unclear. To study the progression of CMV infection, we infected murine alveolar macrophages with murine CMV (MCMV). The supernatant was collected and analyzed by ELISA to determine what the cells were producing in reaction to the virus. We found that the cells were producing KC, TNF and MCP-1, indicating that the cells were able to be infected. Photos of the fluorescence labeled virus after infection indicated that the cells were also able to fight off and kill the virus. Because MCMV infects murine alveolar macrophages, these cells may be responsible for transporting the infection from the lungs to the bloodstream and to the rest of the body. The macrophages also are involved, though, in the body's natural defense against the virus.

PRODUCTION AND PURIFICATION OF NORA VIRUS ORF 3 PROTEIN

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Nora virus is a single-stranded RNA virus and is also a novel picorna-like virus that is able to infect *Drosophila melanogaster* in both naturally occurring and laboratory-evolved populations. It is unlike most other picorna-like viruses in that it has four open reading frames (ORFs), in contrast to one long ORF found in traditional picornaviruses. The coding potentials of the ORFs are not well characterized, but ORF 3 is believed to encode the capsid protein. The site of virus replication is thought to be in the midgut of the host. To begin to characterize the site of replication and viral titers over time, protein studies utilizing a monospecific antiserum need to be performed. The purpose of this study was to generate monospecific antisera to Nora virus by cloning ORF3 in a solubility vector with an N-terminal His tag and to express the recombinant protein. The His-tagged recombinant Nora ORF 3 protein was purified and injected into mice to make monospecific antisera. The resulting antisera will be used for protein characterizations of Nora virus and its relationship with *D. melanogaster*. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

HIV-1 PROTEIN CONCENTRATION AND GENE REGULATION ALTERED UPON TREATMENT WITH ANTIRETROVIRAL NANOPARTICLES

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Current antiretroviral drugs (ART) for HIV-1 need to be taken every day. As a result, treatment strategies are often unsuccessful due to lack of resources or drug fatigue. However, nanoparticles may serve as an improved drug carrier system for HIV-1 treatment. In these studies antiretroviral nanoparticles (ART-NP) have been designed to carry three different antiretroviral drugs, ritonavir, lopinavir, and efavirenz. The use of three drugs is important to reduce potential drug resistance by HIV-1. Past experiments have shown that ART-NP can continually release the three drugs in PBMC cells for up to 28 days, whereas free ART drugs only remained in the cells for 48 hours. We have assessed viability of immune cells which are the targets of HIV-1 infection following treatment with ART-NPs. Our data show no significant changes in viability or immune function as assessed by CellTitre Glow and ELISA analysis. Western blot analysis is currently being used to determine whether treatment with ART-NP can reduce HIV-1 load following infection in immune cells. We hypothesize that the HIV-1 proteins will be reduced in cells treated with ART-NP. The U937 human monocytic cell line, and the H9 human T cell line were infected with HIV-1 NL4-3. Following infection, cells were treated with ART-NP, free ART drug, blank nanoparticles, or left untreated. Subcellular fractionation of cellular lysates was used to separate cytoplasmic, membrane, nuclear, cytoskeletal, and chromatin-bound nuclear cellular materials. Western blot analysis of p17, p24, and gp120 viral proteins will be used to determine whether ART-NP treatment reduces viral replication in infected cells. HPLC will be done on the extracts to determine in which part of the cell ART drug is most concentrated. Future experiments will be directed at determining whether ART-NPs act prophylactically by blocking HIV-1 infection of immune cells. The evidence obtained from this project will be useful to help determine whether ART-NP will be useful as a therapeutic agent for HIV-1.

This publication was made possible by Grant Number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NCRR or NIH.

THE DEVELOPMENT OF AN AUTOMATED PIPELINE FOR GENOME WIDE ASSOCIATION

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Genome Wide Association (GWA) refers to the approach of connecting genetic markers to phenotype in a population. GWA studies can be performed in two distinct manners. One method is to compare entire genomes of individual under study to find long stretches characteristic of a trait. The second method compares Single Nucleotide Polymorphisms (SNPs) of the population of interest. In the recent years, the latter approach has become more popular. In the SNP approach, researchers look at positions in the genome where different individuals carry genetic variants. Recently, many studies have been conducted to relate genetic variations to disease phenotype. Common variants have already been associated with a wide range of traits and conditions. These range from autoimmune diseases, arthritis, asthma, to the optimum racing distance of thoroughbred racehorses. In this project, we present an automated pipeline for supporting GWA studies. We developed a web based pipeline that takes short reads sequence data obtained from next-generation sequencing machine for a protein coding genes of HIV, assemble these short reads, identify positions of the variants in the assembled fragments and calculate statistics related to how often such variations appear among the input set. This web-based system will allow researchers to study correlations between genetic variants and associated drug resistance phenotype of HIV.

EFFECTS ON LONGEVITY OF *DROSOPHILA MELANOGASTER* AFTER USING MUTATIONAL INSERTIONS TO KNOCKOUT GENES

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Aging is the time-dependent decline in overall biological function as an organism progresses through life. By observing the absence of a gene that is highly up-regulated or down-regulated in relation to lifespan, it may be deduced that these certain genes have a direct effect on longevity. The purpose of this study was to determine if candidate aging genes directly affect longevity by knocking-out their functionality. Longevity assays were performed using *Drosophila melanogaster* strains with mutational insertions for the candidate genes neuropeptide-like precursor 3 (Nplp3) and CG4269, as compared to a the wild-type Canton-S strain. The longevity assays were performed until the last *D. melanogaster* died (63 days) and dead flies were counted every 3 days. Each treatment group was carried out in triplicate. Survival curves were created by calculating the percent of survival of *D. melanogaster* for each 3 day period. The assays suggest a decrease in lifespan in virgin flies with Nplp3 knocked out, and an increase in lifespan in mated flies with CG4269 knocked out. This implies that not only genotype, but also status of mating (virgin or mated) plays a role in longevity. Additional analyses using quantitative reverse transcription - polymerase chain reactions (qRT-PCR) are underway to determine if genes involved in regulation of Nplp3 are differentially expressed in the Nplp3 knock-out lines over time. From this research, new information may be provided regarding the role of genetic regulation of the aging process. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

CHARACTERIZATION AND EXPRESSION OF *SIMULIUM VITTATUM* (BLACK FLY) SILK GENES: AN EXAMINATION OF SILK GENETICS AND EVOLUTION

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Black Flies of the dipteran family Simuliidae are notorious for being harmful biting pests and a major transmitter of the devastating parasite *Onchocerca volvulus*, which causes Onchocerciasis, or River Blindness. Conversely, the Black Fly possesses great ecological significance, especially in boreal biomes. Of notable interest is the key role of Black Fly larvae which serve as aquatic prey and suspension feeders. Black Fly larvae utilize silk to facilitate feeding, locomotion, and cocoon production; thus, the ability to produce silk during the larval stages is crucial to Black Fly survival. Despite the necessity of silk in the Black Fly lifecycle, Black Fly silk genetics is currently not well studied. Through this project we aim to bring to light a better understanding of Black Fly silk genetics through the cloning, expression, and characterization of the Black Fly silk genes. Currently, we have cloned, amplified, and sequenced the cDNA of three Black Fly silk proteins of variable size, named p13, p32, and p55. We strongly propose that the cDNA qualify as true silk gene sequences as they are abundant in the codons which code for glycine, alanine, and serine amino acids and possess the characteristic repetitive residue patterns of silk protein. We have also identified several alleles for p32 and p55 silk genes, but only one allele for p13. In the future, we will express the silk genes using the *Pichia pastoris* yeast system to study the physicochemical properties of the silk protein. Additionally, we have cloned and amplified the genomic DNA of the three silk sequences. We will compare the cDNA and genomic DNA to determine silk gene structure. As a long term goal, we seek to elucidate the evolutionary history of the Black Fly silk genes by comparing the silk genes of *Simulium vittatum* with that of another very closely related silk-producing species, *Simulium tribulatum*.

SEQUENCING THE GAPDH GENE IN *MEDACAGO LUPULINA*

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We sequenced the GAPDH gene from *Medicago lupulina*, also known as black medic, a perennial plant with yellow flowers. Like other legumes it has nitrogen-fixing bacteria called rhizobia located in its roots. It is found in North America in meadows and woodlands. Glyceraldehyde 3-phosphatedehydrogenase (GAPDH) is an enzyme which is involved in glycolysis. It is used in the breakdown of glyceraldehyde 3-phosphate to 1,3-bisphosphoglycerate, producing one NADH in the process. GAPDH has also been shown to be important in other cellular processes such as DNA repair, cytoskeletal binding, and has been linked to some diseases, such as Huntington's disease. First we isolated the DNA using the Biotechnology Explorer™ GAPDH PCR Module and then amplified the GAPDH gene using a nested PCR technique. It was then transfected into a plasmid vector and transformed in competent *E. coli* cells. The *E. coli* was sent to Los Alamos National Lab in New Mexico for sequencing of the transfected GAPDH gene. After performing a BLAST, the sequence was found to be 85% similar to GAPDH genomic DNA of *M. truncatula*, and 93% similar to GAPDH mRNA from *M. sativa*.

CHEMISTRY AND PHYSICS
CHEMISTRY

DEVELOPMENT AND OPTIMIZATION OF THE ENTRAPMENT METHOD FOR USE IN THE ANALYSIS OF DRUG-PROTEIN INTERACTIONS IN HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY

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One desirable feature in the immobilization of a protein (or other ligand), for chromatographic binding studies is to have this protein in a final form that closely mimics the behavior of its native form. In covalent immobilization methods, multisite attachment and random orientation often lead to a decrease or complete loss in the ligand's activity. In this work, a new immobilization method, entrapment, was developed and optimized for use in high performance affinity chromatography (HPAC). Entrapment occurs through the covalent linkage of an oxidized polysaccharide (glycogen) to a hydrazide-activated silica support in the presence of the protein. This approach was tested and evaluated by using human serum albumin (HSA) as a model ligand. Method optimization was done through investigation of the effect of pore size, initial concentrations of protein and glycogen, and oxidation level of glycogen on the final support. This method was initially tested for viability in drug-protein interaction studies and then implemented through the analysis of several different drug and protein combinations. The entrapment method has been shown to produce supports with comparable immobilized protein content, and association equilibrium constants, while the average specific activity for entrapped HSA was found to be significantly higher than previously reported values. The major advantage of entrapment is that the ligand remains in an active and soluble form in the matrix, important for the use in HPAC drug-protein interaction studies. Funding for this work was provided by NIH grants R01DK069629 and R01GM044931.

A STUDY OF OXYGEN VACANCY DEFECTS IN NANOSTRUCTURED CERIUM OXIDES

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Cerium oxide is an important catalyst with applications in many critical chemical reactions such as three-way catalysis for treating the exhaust gas from combustion engines, petroleum cracking and water gas shift reaction. Here we report that high density of oxygen vacancy defects (OVDs) can be introduced by a low pressure thermal activation process for nanostructured cerium oxides. Activated cerium oxide nanotubes and nanoparticles are shown to have increased Ce^{3+} character and enhanced oxidation catalysis activity when compared to those of similar samples activated under atmospheric pressure or bulk cerium oxide. Different types of OVDs and the local atomic structures of these nanostructured cerium oxides were studied and confirmed by transmission electron microscopy, extended x-ray absorption fine structure spectroscopy and computation modeling.

CARBONYL ^{13}C CHEMICAL SHIFTS, $\text{n}\rightarrow\pi^*$ INTERACTIONS, AND PROTEINS

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A putative $\text{n}\rightarrow\pi^*$ interaction between adjacent carbonyls in the peptide backbone of proteins has recently been suggested to stabilize secondary structure elements such as α -helices, 3_{10} -helices and twisted β -sheets. Such a novel stabilizing electronic interaction would have a profound effect on our current understanding of protein folding and stability. Local modifications to the surrounding electronic environment due to such an interaction are expected to induce a chemical shift change for the ^{13}C resonance of the accepting carbonyl carbon. A detailed analysis of high-resolution X-ray crystal structures reveals the existence of conformations consistent with $\text{n}\rightarrow\pi^*$ interactions with a mean downfield carbonyl ^{13}C chemical shift of ~ 2.5 ppm. However, quantum chemical calculations using pairs of formamide monomers suggest the observed downfield carbonyl ^{13}C chemical shift can be explained by an electrostatic dipole-dipole interaction, and provide no evidence to support a significant $\text{n}\rightarrow\pi^*$ interaction between adjacent carbonyls.

NMR METABOLOMICS AS A NOVEL TOOL TO STUDY PANCREATIC CANCER

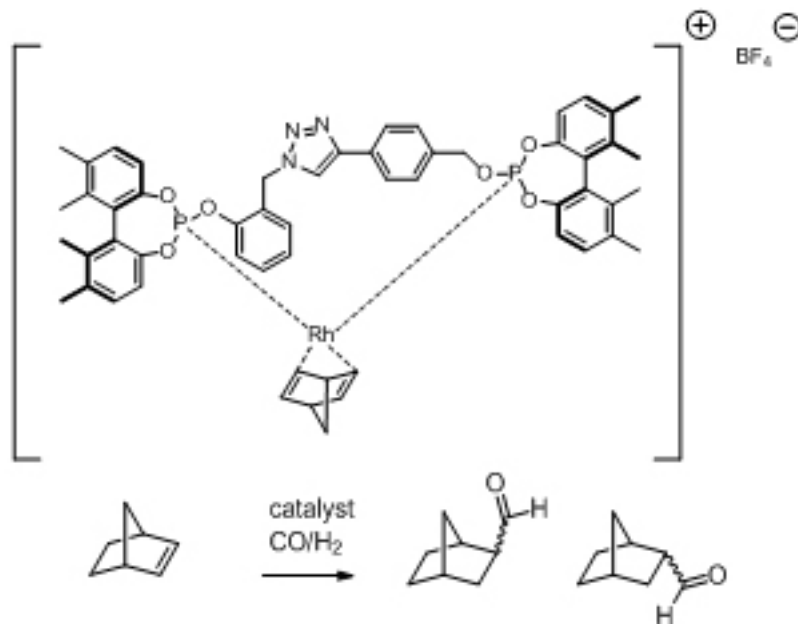
Teklab Gebregiworgis, Bo Zhang, and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304; and Panjak K. Singh, Salk Institute, University of Nebraska Medical Center, Omaha, NE, 68198

Pancreatic cancer has the lowest five-year survival rate (5.5%) and is the fourth leading cause of cancer death in the U.S. The challenges of diagnosing the disease, limited surgery options and drug resistance have been difficult to overcome; thus new methodologies are urgently needed to identify new therapeutic targets, to discover novel drugs, and to develop early-detection diagnostic tools. Epithelial-mesenchymal transition (EMT) is emerging as a novel target for pancreatic cancer. EMT expressing cells have a greater tumor growth rate and metastasis. MUC1 has been recently found to enhance invasiveness of pancreatic cancer cells by inducing EMT. MUC1 is over-expressed in the S2-1013 cell line and is currently being investigated using our differential NMR metabolomics technology. The metabolome of S2-1013 cells has been compared to the pancreatic cancer cell line, Neo S2-101. After lysing the cells, proteins are precipitated using methanol and the metabolome is extracted using an aqueous phosphate buffer. The cell-free lysate is then analyzed using 1D ^1H and 2D ^1H - ^{13}C HSQC NMR experiments. Principal component analysis (PCA) is used to study broad similarities and differences between the metabolomes based on relative clustering patterns in a PCA scores plot. NMR experiments combined with metabolomics databases are then used to identify and quantify metabolite concentration changes. A metabolic network was generated using Cytoscape that identified metabolites associated with amino acid metabolism, amino sugar and nucleotide sugar metabolism, glycogen degradation, glycolysis, gluconeogenesis, starch and sucrose metabolism, and glycerophospholipid metabolism as being altered in MUC1 overexpressing cells.

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CATALYST DESIGN FOR ASYMMETRIC HYDROFORMYLATION

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The hydroformylation reaction is a useful and atom economical way to elongate a carbon chain and install aldehyde functionality through carbon-carbon bond formation. Hydroformylation is widely used in industrial synthesis, particularly in precursor synthesis. Remarkably, not many substrates have been studied in the asymmetric variant of hydroformylation. Our group has previously developed modular catalysts which allow the exploration of a diverse set of catalyst scaffold modifications and their effect on asymmetric reactions. Preliminary results of screening several substrates with these catalytic systems will be discussed.

DEVELOPMENT OF PORPHYRIN-BASED METAL-ORGANIC FRAMEWORKS WITH COORDINATIVELY UNSATURATED METAL CENTERS

Haemi Chung and Wonyoung Choe, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

The development of metal-organic frameworks is one of the most active areas in materials research due to their fascinating structural architectures and topologies, as well as their potential applications, including gas storage and catalysis. Metalloporphyrin linkers are interesting molecular building blocks because the metal center in the porphyrin ring can provide an additional control to the pore surface of MOFs. Previously, we have developed a series of highly tunable three dimensional porphyrin paddlewheel frameworks (PPFs), assembled from meso-tetra(4-carboxyl)porphine (TCPP) and paddlewheel secondary building units (SBUs) with pyridyl-based pillars. As a continuing effort to engineer pore surfaces, we have designed and synthesized two new porphyrin molecular building blocks, tetra-4-(4'-carboxybiphenyl)porphyrin and tetra(4-carboxy-3,5-dimethylphenyl)porphyrin. Here we report the synthesis and characterization of two new porphyrin based frameworks. Possible applications for these porphyrin framework systems will be also discussed.

AFFINITY SORBENTS FOR EXTRACTION AND CONCENTRATION OF ENVIRONMENTAL CONTAMINANTS

Efthimia Papastavros and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304; and D.D. Snow and D.A. Cassada, Water Center, School of Natural Resources, University of Nebraska–Lincoln, NE 68583-0844

Emerging contaminants have been the focus of extensive research over the last decade. These substances are of concern because their fate and environmental effects are not yet well understood and regulations are not in place for their control. They comprise a wide variety of organic chemicals including pharmaceuticals, personal care products and steroids. These compounds enter the environment from various sources such as feedlot runoff, municipal wastewater treatment plant effluent and land application of biosolids. Emerging contaminants are typically present in trace amounts and need to be monitored in surface water, soil, sediment and groundwater. Liquid chromatography-tandem mass spectrometry (LC/MS/MS) is commonly used for the analysis of environmental samples with solid phase extraction (SPE) being used for the extraction and concentration of analytes. However, more efficient and selective methods of extraction are sought because of the complexity of wastewater matrices. Affinity-based sorbents such as immunosorbents have been used off- and on-line with HPLC and LC/MS as an alternative to SPE and show potential for use with large sample volumes. Immunosorbents are supports containing immobilized antibodies that selectively bind to analytes of interest. Another, low cost option for affinity-based extraction is bovine serum albumin (BSA), a serum protein known to bind a variety of drugs and hormones. Preliminary results indicate that BSA can be used in a concentrator column to effectively extract carbamazepine from water. Although it has lower binding capacity than a C18 concentrator column of the same dimensions, as determined from frontal analysis experiments, its advantage lies in its greater affinity for the analyte.

EXPLORING COBALT AS AN ALTERNATIVE BIS-OXAZOLINE COMPLEX

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Zinc has been successfully utilized with bis-oxazoline (BOX) to create a heterolytic complex with excellent selectivity. This concept was applied to supramolecular self-assembled ligand systems, which showed high enantioselectivity for hydroboration of styrene derivatives. This research focuses on the search for a better catalyst system, with cobalt metal as an alternative to zinc with the BOX complex. The preliminary results for include discussion of the cobalt-BOX complex stability and structure.

PORPHYRINIC METAL-ORGANIC FRAMEWORKS FOR DETECTION OF EXPLOSIVES

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A luminescent metal-organic framework, PPF-27 (PPF = porphyrin paddlewheel framework), is constructed from zinc-metallated *meso*-(tetracarboxyphenyl)porphyrin ligands, $Zn(COO)_4$ paddlewheel secondary building units, and 4,4'-bipyridine pillars in a multistep synthesis. PPF-27 is capable of detecting nitro-based explosive vapors like 2,4-dinitrotoluene through fluorescence quenching. Because of the highly porous nature of this type of solids, PPF-27 exhibits very fast detection times and high sensitivity.

ANALYSIS OF THE EFFECTS OF GLYCATION ON THE BINDING OF SULFONYLUREA DRUGS TO HUMAN SERUM ALBUMIN

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Diabetes is a group of disorders that involve an insulin deficiency or a resistance to insulin. The resulting effect of these disorders is glucose intolerance, or hypoglycemia, which in turn causes a build up of glucose in the blood stream. The increase in the concentration of glucose results in glycation, which can lead to the non-enzymatic addition of glucose to serum proteins. The purpose of this report was to describe the use of high-performance affinity chromatography to examine the binding of gliclazide, a second generation sulfonylurea drug, to *in vitro* glycated human serum albumin (HSA). Gliclazide is an oral hypoglycemic drug that is often used to treat type II diabetes. In this study, protein supports were prepared by the Schiff base method by attaching normal HSA or HSA at various stages of glycation to silica. Frontal analysis was used to find the association equilibrium constants and binding sites for gliclazide to HSA. Competition studies were carried out through the zonal elution method to study the effects of glycation on specific binding sites on HSA. The results were compared to those of previous studies that examined the binding of two other sulfonylurea drugs, tolbutamide and acetohexamide, to the same protein. The information obtained through such experiments can be useful in allowing physicians to predict how drug binding in serum may change at various stages of diabetes.

DETECTION OF MERCURY (II) USING CHELATION ENHANCED QUENCHING CHEMOSENSOR

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As one of the major industrial pollution resources, mercury (II) results in significant impact on the environment and on human health. In the past years, developing rapid detection methods with a high sensitivity for mercury (II) analysis has attracted great attention. In our group, we developed a pyrene-containing fluorescent sensor based on 2,3,3-trimethylindolenine. This sensor showed high affinity to Hg^{2+} over other cations such as K^+ , Na^+ , Ca^{2+} , Mg^{2+} , Pb^{2+} , and Cu^{2+} under physiological condition. It makes this compound a useful chemosensor for Hg^{2+} detection in hydrophilic media.

DETERMINATION OF β -SECRETASE BINDING SITE CHARGES EMPLOYING MD SIMULATION AND MOLECULAR DOCKING

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The accumulation of β -amyloid peptide ($\text{A}\beta$) results in the formation of insoluble plaques in Alzheimer's disease (AD) brain patients. β -secretase, also named BACE1, is an aspartic acid protease and a significant key enzyme for the production of $\text{A}\beta$ peptide. The two aspartic acid residues, Asp32 and Asp228, reside in the binding domain of BACE1. The exact protonation states of Asp32 and Asp228 are controversial, although it is generally believed that the net charge of catalytic site of Asp diad is -1.

In order to determine the protonation states of β -secretase binding site, we employed docking study and molecular dynamic (MD) to two conformational states (open and close) of β -secretase with different charged-status. A data set of reported active inhibitors and drug like molecules were docked to

β -Secretase binding site and the enrichment factor (ER) was used to evaluate the effect of charged-status on binding. Our data suggest the protonated Asp32 and deprotonated Asp228 in the open conformation, whereas the close one prefers deprotonated Asp32 and protonated Asp228.

DETECTION OF HETEROGENEOUS DRUG-PROTEIN BINDING BY FRONTAL ANALYSIS AND HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY

Zenghan Tong, K.S. Joseph, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Frontal analysis is a method that is often used in affinity chromatography to characterize the properties of a column and to obtain measurements of binding affinity and activity for immobilized ligands. Many previous applications of frontal analysis in affinity chromatography have used this approach to examine ligands that have a single type of binding site for an analyte. However, there have been several recent studies that have also used this method to study multi-site systems with heterogeneous interactions. This study examined the use of frontal analysis and high-performance affinity chromatography for detecting heterogeneous binding in biomolecular interactions, using the binding of acetohexamide with human serum albumin (HSA) as a model. It was found through the use of this model system and chromatographic theory that double-reciprocal plots could be used more easily than traditional isotherms for the initial detection of binding site heterogeneity. The deviations from linearity that were seen in double-reciprocal plots as a result of heterogeneity were a function of the analyte concentration, the relative affinities of the binding sites in the system and the amount of each type of site that was present. The methods developed in this work for the detection of binding heterogeneity are not limited to drug interactions with HSA but could be applied to other types of drug-protein binding or to additional biomolecular systems with heterogeneous binding.

IDENTIFICATION AND ANALYSIS OF THE PRODUCTS REMOVED FROM HUMAN FEET BY AN ELECTROLYSIS FOOTBATH

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The “electrolysis footbath” is advertized among alternative therapy healthcare providers as able to remove “toxins” from the body, including heavy metals. There does not seem to be much indication in literature that the reality of these claims has been tested with the identification of the metals or organic toxins, although there seems to be an ample supply of testimonials indicating improvement in the health of the patients. Using Atomic Absorption Spectroscopy to identify metals and Gas Chromatography-Mass Spectrometry to identify organic compounds, we will attempt to determine what is being removed from the bodies of individuals, both healthy and ones in need of treatment. At this point, we have calibrated a background of metal concentrations that are produced by running the footbath without feet using Atomic Absorption Spectroscopy. As a result of this background data, we have determined that significant amounts of metals, namely chromium, copper, and iron, are produced by a blank run of the footbath. Also, a dramatic color change was seen over the course of the footbath session, which is presumably caused by the production of iron (III) hydroxide. After obtaining further background data for organic compounds using Gas Chromatography-Mass Spectrometry, we will begin running tests on healthy individuals. Data from these individuals will be our control and will determine the direction of further research.

OPTIMIZATION OF POLYMERIZATION CONDITIONS FOR AFFINITY MONOLITH COLUMNS CONTAINING IMMOBILIZED PROTEINS

Erika Pfaumiller and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Monolithic supports in chromatography consist of a single block of a porous polymer or porous silica. Monoliths have been of great recent interest in HPLC as supports that allow fast separations and minimal operating pressures. One area of interest in which monolith columns have been used is with affinity ligands, giving a method known as affinity monolith chromatography (AMC). Much of this work has used a co-polymer mixture of glycidyl methacrylate (GMA) and ethylene dimethacrylate (EMA), which has been shown to be highly effective in the immobilization of proteins such as human serum albumin (HSA). This study uses a combinatorial approach to optimize and improve upon the organic monoliths that can be used for the immobilization of HSA or other similar proteins for use in AMC. Co-polymers based on GMA and EDMA were utilized. The porogens: cyclohexanol and dodecanol were used as co-solvents and their ratio was varied to generate a library of monoliths. Recent advances include utilizing the optimized monoliths to study the ability to separate glycosylated HSA from non-glycosylated HSA using immobilized 3-aminophenylboronic acid.

ANALYSIS OF PROTEIN PHOSPHORYLATION IN PROTEIN DATABANK

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Cell signaling transduction often is mediated via protein phosphorylation. Protein phosphorylation is involved in many cellular processes, such as DNA replication, gene transcription, cell growth and metabolism, cell adhesion and intercellular communications. In mammalian cells, intracellular signal transduction is governed by phosphorylation on serine, threonine, and tyrosine, resulting in the phosphorylated pSer, pThr, and pTyr, respectively. In prokaryote microorganisms, the phosphorylation process can also be mediated via phosphorylated aspartic acid (pAsp), cysteine and histidine (pHis). This report surveys the distribution of phosphorylated amino acids over 40,000 structures in the protein databank (PDB). The conserved sequential motif for different phosphorylated residues will be presented.

A NOVEL ELECTROCHEMICAL PEPTIDE-BASED SENSOR FABRICATED USING IMAC CHEMISTRY FOR THE DETECTION OF ARAH2 ANTIBODIES

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Here we report an alternate peptide immobilization strategy for the electrochemical peptide-based biosensing platform. Unlike the previously established sensor fabrication strategy that requires direct alkanethiol modification of the methylene blue (MB)-labeled peptide probe, this platform utilizes thiolated molecules terminated with organic chelating molecules such as nitrilotriacetic acid (NTA) and imidazole, which in presence of divalent cations such as Zn^{2+} , Ni^{2+} , and Co^{2+} , which can efficiently capture His-tagged modified peptide probes. Our results suggest that we have successfully immobilized His-tagged MB on an electrode. This sensor has an added facet in that the His-tagged peptide is displaced by a competing ligand and the electrode can be re-used for a new peptide. This versatile sensor fabrication strategy will ultimately be implemented to the fabrication of an anti-peanut allergen antibodies sensor using a His-tagged peptide epitope from a major peanut allergen (Arah2).

CHEMISTRY AND PHYSICS

PHYSICS

SCANNING TUNNELING MICROSCOPES – OUR EYES AND HANDS INTO THE NANOWORLD

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There is presently a lot of excitement among the scientific community as well as the public about the new possibilities offered by nanoscience and nanotechnology. Progress in nanoscience depends critically on tools to image and manipulate matter with nanometer- and sub-nanometer accuracy. Of particular importance in nanoscience is the so-called scanning tunneling microscope. Its extreme sensitivity allows researchers to routinely image single atoms and molecules. But it can also be used as a tool to create from bottom-up larger structures like Legos, using atoms and molecules as building blocks. In this talk, I will introduce the basics of a scanning tunneling microscope through a series of images and animations, and will show how such microscopes are currently used for research on the nanometer and even the atomic scale. I will highlight major achievements and discoveries made with scanning tunneling microscopes, including single-atom manipulation and magnetic imaging with atomic resolution. I will present examples of our current research at the University of Nebraska – Lincoln, including our studies of the self-assembly of single molecules into 2D and 3D ordered networks.

A LABVIEW® PROGRAM IMPLEMENTED TO EXTRACT ABSOLUTE PHASE FROM AN INTERFEROGRAM OBTAINED WITH A DIGITAL HOLOGRAPHIC MICROSCOPE

Semere M. Woldemariam, Department of Physics, Creighton University, Omaha, NE 68178

Holographic interferometry is a good technique for measuring optical path variations, which are caused by deformations of translucent bodies or refractive index variations in transparent media. In this technique, the optical path variations are stored in the interference patterns of the hologram. Lately, different algorithms have been developed to retrieve the absolute phase difference, and thus optical path difference, from the interference pattern. A LabVIEW® program that implements Fourier Fringe Analysis, extracting a wrapped phase from a digital interferogram, and a Quality Guided Algorithm, which unwraps the wrapped phase, has been developed. This technique of finding unwrapped phase has previously been used to estimate the surface topography from interferometric synthetic aperture radars. It has also been used to study small structural variations of translucent bodies and also to investigate the growth of transparent crystals. In our lab we are now using it to measure the refractive index of biological cells.

DYNAMIC LIGHT SCATTERING STUDIES ON ALKALI-MODIFIED BORATE LIQUIDS

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The structure of oxide glasses consist of continuous random network of covalent bonds that promotes a high glass transition temperature and “strong” viscoelastic behavior in the liquid state. This network structure can, however, be modified by the addition of alkali oxides which either increase or decrease the average density of network forming bonds and modify the viscoelastic properties of the corresponding liquid. We report results of an ongoing dynamic light scattering study of the viscoelastic relaxation of alkali-0 modified borate glassforming liquids near the glass transition temperature.

FLUORESCENCE LIFETIME IMAGING FOR THE ASSESSMENT OF CELLULAR METABOLISM IN MULTICELLULAR TUMOR SPHEROIDS

Jorge Vergen and Michael G. Nichols, Department of Physics, Creighton University, Omaha, NE 68178

Intrinsic fluorescence of reduced Nicotinamide Adenine Dinucleotide (NADH) within a cell can be used to characterize its metabolic state. Previous studies have used fluorescence lifetime imaging (FLIM) to show that the average NADH fluorescence lifetime in living tissue varies as a result of metabolic state and disease progression. We demonstrate an innovative method using FLIM to image EMT6 tumor spheroids which show a similar metabolic profile to the cell types used in previous studies. By analyzing experimental data taken from cross-section images of tumor spheroids, we have been able to identify and characterize free and bound NADH sub-populations within the cell. Our analysis further indicates that it is possible to quantify variations of average NADH concentrations with metabolic state as well as the localization of various free and bound NADH sub-populations within the cell. Methods for determining the identity of various NADH-enzyme binding partners will also be discussed.

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DARK MATTER AND FIFTH FORCE

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Several dark matter models have been introduced recently that involve new scalar particles. For example, if dark matter decays into a new light boson that is constrained to decay into leptons, the PAMELA positron excess can be explained. This work involves using both historic and modern searches for fifth forces to constrain new dark matter models that introduce new, light, scalar particles. Limits on such models from laboratory 5th force searches will be presented; additionally, astrophysical constraints will be explored.

ESTIMATION OF THE NUMBER OF $\Phi \rightarrow K+K^-$ AND $\Phi \rightarrow KSKL$ OBSERVED IN 200GEV AUAU COLLISIONS AT RHIC

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Ultra-peripheral collisions of nuclei have no physical overlap of the nuclei. The nuclei interact through large electromagnetic fields. These fields are treated as a flux of photons, which scales as Z^2 , making heavy ion collisions an attractive tool for studying photoproduction. At RHIC (Relativistic Heavy Ion Collider), these collisions are done with heavy ions (e.g. gold, copper, etc.) accelerated to relativistic speeds ($v > .99c$). Individual photon energies can exceed 3GeV, allowing for the production of a wide range of particles. This talk will focus primarily on the underlying physics of these types of reactions and the techniques used for analyzing the data. The possibility of measuring the photoproduction of Φ -mesons in ultra-peripheral collisions at STAR through the $\Phi \rightarrow K+K^-$ and $\Phi \rightarrow KSKL$ decay channels will also be discussed using simulated kinematics and simulated detector acceptance of these particles. The extrapolation factor for full rapidity and a new efficiency corrected number of ρ -mesons will also be discussed.

GRAPHENE/SUBSTRATE CHARGE TRANSFER CHARACTERIZED BY INVERSE PHOTOELECTRON SPECTROSCOPY

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Wave vector-resolved inverse photoelectron spectroscopy (IPES) measurements demonstrate that there is a large variation of interfacial charge transfer between graphene and various substrates. IPES measurements of CVD single layer graphene on BN(0001)/Ru(0001), Ru, Ni(poly), and Cu(poly) indicate a substrate-to-graphene charge transfer of approximately 0.07, 0.06, 0.03 e⁻ per carbon atom respectively and a charge transfer of 0.02 e⁻ from graphene to the MgO substrate per carbon atom. IPES and photoemission data also indicate that graphene/MgO(111) has a band gap. These data demonstrate that IPES is an effective method for precise measurement of substrate/graphene charge transfer due to the extreme surface sensitivity of IPES.

EFFECTS ON THE ELECTRONIC BAND STRUCTURE OF EUROPIUM OXIDE FILMS UPON GADOLINIUM DOPING

Juan A. Colón Santana, Department of Electrical Engineering, and Joonhee An, Ning Wu, Kirill Belashchenko and P.A. Dowben, Department of Physics and Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln, NE 68588; and X. Wang, P. Liu and Jinke Tang, Department of Physics & Astronomy, University of Wyoming, Laramie, WY 82071; and Yaroslav Losovyj, Center for Advanced Microstructures and Devices, Louisiana State University, Baton Rouge, LA 70806; and I.N. Yakovkin, Institute of Physics, National Academy of Sciences of Ukraine, Prospect Nauki 46, Kiev 03028, Ukraine

High quality films of EuO and Gd doped EuO were successfully grown on p-type Si(100) via pulsed laser deposition (PLD). Although both EuO and Gd doped EuO (Eu_{0.96}Gd_{0.04}O or 4% of the rare earth content) share the same rock salt crystal structure, X-ray diffraction (XRD) results show that the addition of Gd considerably affects the texture growth direction. Photoemission spectroscopy (PES) reveals the presence of electron pockets providing evidence of a semi-metallic character. Changes in the surface properties are evident in combined photoemission and inverse photoemission studies as an apparent transition from an n-type to p-type surface, likely due to a surface reconstruction that would otherwise be a highly polar surface.

THE ELECTRONIC STRUCTURE OF A LOCAL CHARGE-TRANSFER-INDUCED SPIN TRANSITION MOLECULAR ADSORBATE

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The spin crossover phenomena has been identified in the $[\text{Fe}(\text{H}_2\text{B}(\text{pz})_2)\text{bpy}]$ where $\text{pz}=(1\text{-pyrazolyl})\text{borate}$ $[\text{Fe}(\text{H}_2\text{B}(\text{pz})_2)\text{bpy}]$, and but there is currently a lack of knowledge of the physical nature of this phenomena and the electronic structure of this organometallic compound has not been well characterized. We have investigated the interface electronic characteristics of molecular thin films of the metal-organic $[\text{Fe}(\text{H}_2\text{B}(\text{pz})_2)\text{bpy}]$ by ultraviolet photoelectron spectroscopy (UPS) and inverse photoemission (IPES). X-ray absorption spectroscopy (XAS) and Infrared spectroscopy (IR spectroscopy) were also used to study $[\text{Fe}(\text{H}_2\text{B}(\text{pz})_2)\text{bpy}]$. The IPES results coincide with XAS, and the model calculations. The molecular vibrational modes have been identified from a comparison of the IR spectroscopy with model calculations.

THE LOCAL STRUCTURE OF TRANSITION METAL DOPED SEMICONDUCTING BORON CARBIDES

Jing Liu, P. A. Dowben, A. K. Rajapitamahuni, and Andre Sokolov, Department of Physics and Astronomy, and Eric D. Shepherd and J. I. Brand, College of Engineering, University of Nebraska–Lincoln, NE 68588-0299; and Guangfu Luo and Wai-Ning Mei, Department of Physics, University of Nebraska at Omaha, NE 68182-0266; and Orhan Kizilkaya, Center for Advanced Microstructures and Devices, Louisiana State University, Baton Rouge, LA 70806; and Sudarshan Karki and Anthony N. Caruso, Department of Physics, University of Missouri-Kansas City, Kansas City, MO 64110

Transition metal (Mn, Fe, Co) doped boron carbides thin films produced by plasma-enhanced chemical vapor deposition of orthocarborane (*closo*-1,2- $\text{C}_2\text{B}_{10}\text{H}_{12}$) and metallocenes were investigated by performing K-edge extended X-ray absorption fine structure (EXAFS) and X-ray absorption near edge structure (XANES) measurements [1]. The Mn, Fe and Co transition metal atoms dope boron carbide pairwise on adjacent icosahedra. Each transition metal atom occupies one of the icosahedral boron or carbon apical site atomic site within the icosahedral cage on adjacent edge bonded icosahedral cages. Knowledge of the local structure provides the essential information for localized electronic structure calculations for a variety of the transition metal dopants in boron carbide. There is good agreement between the experiment and theoretical modeling of the local structure two adjoined carborane cages each with a Mn, Fe and Co metal atom (forming the pair wise doping). The local spin configurations of all the 3d transition metal doped boron carbides, Ti through to Cu, are compared using theoretical cluster or icosahedral chain calculations [2]. The results suggest that transition metal doping will not only permit fabrication of boron carbide homojunctions, as is now demonstrated, but also may result in materials suitable for spintronic applications, as suggested by other transition metal doped materials [3].

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ORDER-DISORDER TRANSITIONS FOR Au/Mo(112)

Keisuke Fukutani, Ning Wu, and Peter Dowben, University of Nebraska–Lincoln, NE 68588; and Yaroslav Losovyj and Natalia Lozova, Center for Advanced Microstructure and Devices, Louisiana State University, Baton Rouge, LA; and Ivan Yakovkin, Institute of Physics National Academy of Science of Ukraine, Prospect Nauki 46, Kiev 03028, Ukraine

Order-disorder overlayer phase transitions are observed at the surface of Au/Mo(112) for the nominal Au coverages of 1.66 and 1.75 monolayers. These transitions are characterized by the abrupt change in the surface Debye temperature. In the search for the detailed mechanism of this phase transition, we investigated the electron-phonon coupling (EPC), in the vicinity of the Fermi level, for the surface states of Au-covered Mo(112) surface from high-resolution angle resolved photoemission data taken parallel to the surface corrugation (i.e. $\langle 111 \rangle$). The changes of the widths of the surface weighted bands, induced by Au layers, are discussed in terms of electron-electron interactions, electron-impurity scattering and electron-phonon coupling. Gold overlayers suppress the mass enhancement of the Mo(112) surface band crossing the Fermi level at 0.54 \AA^{-1} . The data indicate that significant contributions from impurity and defect scattering must be considered in any serious analysis of the imaginary part of the self energy and that their interface effects can have a profound influence on the imaginary part of the self energy.

STRUCTURAL AND MAGNETIC PROPERTIES OF COBALT ATOMIC CLUSTERS ON (110) SURFACE OF TUNGSTEN

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We report results of the DFT based first principles calculations on the structural and magnetic properties of cobalt atomic clusters on (110) surface of tungsten. We found that for certain geometry these clusters can exhibit antiferromagnetic order. The result is unexpected, as in the bulk as well as in the thin films and free standing clusters Co always exhibits ferromagnetic structure. We compare results for Co with the ones for the analogous Fe atomic clusters. We found that Fe clusters deposited on (110) surface of tungsten tend to couple ferromagnetically similar to bcc Fe in considered geometries. In our calculations we analyzed different configurations of atomic islands, in particular $N=3, 4, 5, 6, 8, 12$, where N is the number of atoms in the cluster. We perform full structural and magnetic relaxation, and we show that depending on the geometry and number of cobalt atoms in the cluster, the system can be non-magnetic ($N=4, 6, 8$), ferromagnetic ($N=3, 5$) and antiferromagnetic or ferrimagnetic ($N=4, 12$). We present phenomenological model to explain these intriguing magnetic properties of Co atomic islands on (110) surface of tungsten.

THE TWIN PARADOX AS AN EXAMPLE OF NATIVE MATH PRESENTATION IN HTMLS

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Twin paradox has been a subject of some interest as evidenced by many articles on the subject. Yet finding an accessible and approachable solution on the internet is not without difficulty. Solutions that are found are often in archaic notations or abbreviated by assuming knowledge of specialized solutions so as to not belabor the informed reader or just give a descriptive “solution”. Heavy in math notation, an appropriate solution to the twin paradox would be graphically intensive and static on a traditional html document. With the advent of native mathml and svg in HTML5 these obstacles are overcome. I use the twin paradox as an example of how to create a complete, correct and publicly accessible write-up to a math intensive physics problem.

EARTH SCIENCES

ESTIMATING GREEN LAI IN MAIZE AND SOYBEAN FROM REMOTELY SENSED DATA

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Green leaf area index (gLAI) is an important biophysical variable used in various applications (e.g. agricultural yield prediction, climate modeling, and estimation of primary production). For these applications, there is a need for accurate estimates of gLAI across large spatial areas. This need can be fulfilled using remote sensing techniques. This study focuses on the application of several established vegetation indices (Simple Ratio, NDVI-like indices with spectral bands in the red, green and red edge regions, WDRVI, EVI, MTCI, and Chlorophyll Indices) for the estimation of gLAI in maize and soybeans from three fields involved in the Carbon Sequestration Project at UNL. The study area is located near Mead, NE and the data was collected from 2001-2008. One field is irrigated and continuous maize. The other two fields are on a maize/soybean rotation with one irrigated and the other rainfed. Reflectance data was collected using two Ocean Optics radiometers. Vegetation indices were calculated with reflectance data averaged to simulate bands of MODIS or MERIS satellite systems. NDVI-like indices and EVI are the most sensitive to gLAI at low gLAI, but became saturated at moderate gLAI ($>3 \text{ m}^2/\text{m}^2$). WDRVI and MTCI were equally sensitive to gLAI throughout the range in this study ($0\text{-}6.5 \text{ m}^2/\text{m}^2$). Simple Ratio and Chlorophyll Indices were the most sensitive at higher gLAI ($3\text{-}6.5 \text{ m}^2/\text{m}^2$). The vegetation indices with the lowest RMSE for each of these ranges are Red Edge NDVI ($0.754 \text{ m}^2/\text{m}^2$), MTCI ($0.660 \text{ m}^2/\text{m}^2$), and Red Edge Chlorophyll Index ($0.532 \text{ m}^2/\text{m}^2$).

REMOTE ESTIMATION OF CROP PRODUCTIVITY: FROM CLOSE RANGE TO SATELLITE OBSERVATIONS

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Crop productivity plays an important role in global carbon dioxide fixation through photosynthesis. An accurate and synoptic quantification of crop productivity is essential for regional and global studies of carbon budgets. We found that gross primary productivity (GPP) is closely related to the total crop chlorophyll (Chl) content. Thus, Chl content can be used as an accurate measure of GPP in crops. In this study, we applied a recently developed technique for the remote estimation of Chl estimation to assess GPP. The model relates GPP to a product of chlorophyll-related vegetation index and incoming photosynthetically active radiation. The vegetation indices used in this study were

calculated based on spectral data collected 6 meters above the top of the canopy as well as retrieved from Landsat imagery, over a period of eight years (2001 to 2008). The results show that this model is capable of accurately estimating widely variable GPP in maize and soybeans under both rainfed and irrigated conditions with the remotely sensed data collected at close range as well as satellite altitude.

THE APPLICATION OF DIATOM BIOSTRATIGRAPHY AND PALEOECOLOGY TO RESOLVE EARLY MIOCENE PALEOCLIMATE EVENTS

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The Early Miocene was a time of large global climate fluctuations making it ideal for paleoclimatic reconstructions and future climate analogues. The reconstruction of high-latitude climatic changes is critical for assessing global temperature and ice-volume changes during the Early Miocene. Stratigraphic drillcores from southern high-latitude sites that would reveal this history of Early Miocene paleoenvironmental changes are fairly limited. Low core recovery, poor microfossil preservation, and uncertainty in age models prevent a clear view of paleoceanographic changes in the Southern Ocean and linked climatic changes on the Antarctic continent for this time period. A history of glacial-interglacial cyclicity and dynamic-to-stable ice sheet behavior is evident from the ANDRILL Program's Southern McMurdo Sound Project (SMS) drillcore AND-2A, although diatom occurrence in the core is sparse and sporadic. In order to extend the reach of this proximal Antarctic record and correlate paleoenvironmental events from this Antarctic shelf site into the deep-sea, we investigated the diatom biostratigraphical and paleoecological history of several Southern Ocean sites spanning the time interval from 22.3 to 16.4 Ma. Early Miocene climatic and glacial fluctuations in the Southern Ocean are documented through a qualitative study of fossil marine diatoms recovered from Ocean Drilling Program (ODP) Legs 119 and 188. Specifically, we develop fossil diatom distributions in terms of abundance, preservation changes, and assemblage composition variation in Holes 744A & 744B on the southern Kerguelen Plateau (Leg 119) and Hole 1165B on the continental rise near Prydz Bay (Leg 188). Our study encompasses the stratigraphic interval from the highest occurrence of the diatom *Rocella gelida* (~22.3 Ma) up to the lowest occurrence of *Denticulopsis maccollumii* (~16.4 Ma). Building on previous work, this study provides new paleobiological records of paleoceanographic changes from the southern high-latitudes during the Early Miocene and helps constrain the nature of Early Miocene paleoclimatic and glacial events recognized from deep-sea (ODP) and Antarctic shelf (ANDRILL) sites.

LATE NEOGENE ANTARCTIC ICE SHEET HISTORY REVEALED BY ANDRILL PROGRAM DRILLHOLES IN THE WESTERN ROSS SEA, ANTARCTICA

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The ANtarctic geological DRILLing Program (ANDRILL), an international collaboration between scientists, drillers, engineers, educators, and technicians from Germany, Italy, New Zealand and the United States working together in the spirit of the 4th International Polar Year (IPY), successfully completed its two inaugural drilling campaigns in 2006 and 2007 (<http://www.andrill.org>). The primary

objectives of ANDRILL's McMurdo Ice Shelf Project (MIS) and Southern McMurdo Sound Project (SMS) were to recover and examine stratigraphic records of sedimentary rock from the Antarctic continental margin that document key steps in Antarctica's Cenozoic climatic and glacial history, and reveal events in the development of the Transantarctic Mountains and West Antarctic Rift System. The MIS Project successfully recovered a 1284.87 meter-long drillcore record of climate and glacial variability spanning the past ~14 million years from beneath the McMurdo Ice Shelf. The SMS Project successfully recovered a ~1138.34 meter-long drillcore record, including an expanded 600 m-thick sedimentary record of the middle Miocene Climatic Optimum. The drillsites were influenced by three elements of the Antarctic cryosphere system: East Antarctic Ice Sheet (EAIS), Ross Ice Sheet/West Antarctic Ice Sheet/Shelf, and Ross Embayment sea-ice. An excellent chronostratigraphic framework provides age control for the drillcores and the network of seismic lines in the western Ross Sea. The scientific results under development by the more than 100 scientists, students, technicians and educators involved with each project will be vital to SCAR's Antarctic Climate Evolution (ACE) program (www.ace.scar.org) whose objectives are to integrate geological and paleoclimatic data into climate and ice sheet models to constrain estimates of ice volume variability, and terrestrial and marine paleo-temperature. ANDRILL's key operational and technological achievements include the two deepest drillholes on the Antarctic continent, one of which was recovered beneath an 85 m-thick ice shelf in nearly 900 meters of water; high-quality rock core with recovery of more than 98%; and the first hydrofracture experiment and associated in-situ stress measurements in Antarctica. In addition, ANDRILL is engaging and training the next generation of Antarctic geoscientists and educators through exciting and collaborative international research and is taking polar science adventure into classrooms and homes through a stimulating education and outreach program (<http://andrill.org/education>). New cutting-edge technology, designed to improve core visualization and data management (e.g., Corelyzer, PSICAT; <http://www.apple.com/science/profiles/andrill/>), was developed and tested in collaboration with ANDRILL scientists, and will be used by other science programs to enhance rock core data capture, integration, and sharing. A well-developed chronostratigraphic framework allows for the comparison of events recognized in these drillcores with events identified in distal proxy records from deep-sea stable isotope studies, and in sea-level reconstructions based on continental shelf sequence stratigraphy. This dynamic response of Antarctic climate during times when CO₂ levels were only slightly higher than today, and greenhouse gas forcing was relatively modest, presents a serious challenge for numerical climate and ice sheet models that generally fail to produce the range of variability at levels of atmospheric CO₂ presumed to have existed in the Miocene and Pliocene. The ANDRILL Program is planning future drilling efforts from the Ross Ice Shelf at the Coulman High, in order to understand the history of West Antarctica under a warmer pre-glacial "Greenhouse" climate regime. Field activities in the 2010-11 field season advanced the environmental and seismic survey toward targeted drilling of these sequences in 2014. <http://andrill.org/projects/sms/team.html>, www.andrill.org/support/references/appendixc.html

“RATTLESTONES” FROM THE DAKOTA FORMATION OF NEBRASKA AND THEIR RELEVANCE TO IRON-OXIDE-CEMENTED CONCRETIONS IN UTAH’S NAVAJO SANDSTONE

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Crossbedded, fluvial sandstones of the Cretaceous Dakota Formation contain abundant intraformational clasts composed of heavy rinds of iron oxide that surround mud-rich cores. The cores contain enough void space that collisions can be heard when the clasts are shaken. Similar structures have been described from Pleistocene fluvial sands in the Netherlands and interpreted as the oxidized

remains of reworked siderite nodules (van der Burg, 1969, Palaeo-3). In thin-sections of rinds, silt particles within the iron oxide are commonly arranged in arcs and circles, indicating disruption of the sediment fabric by mineral growth. Mm-scale sphaerosiderites are abundant in the paleosols that developed in muddy floodplain facies of the Dakota Formation. We attribute the distinctive distribution of silt grains in the rattlestone rinds to sphaerosiderite growth in floodplain soils prior to the transportation, deposition, and oxidation of the intraclasts. The iron oxide rinds and iron-poor cores of the Dakota rattlestones are directly analogous to the Pleistocene Dutch rattlestones, and the iron-oxide-rich concretions in the Navajo Sandstone of south-central Utah. All three were generated by the oxidation of siderite precursors. During their formation, concretion interiors remained anaerobic until all siderite was dissolved and ferrous iron had migrated to the perimeter of the structure where it combined with oxygen.

AQUIFER MAPPING AND RECHARGE ESTIMATIONS IN GLACIATED AREAS OF EASTERN NEBRASKA

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Many of the significant aquifers of eastern Nebraska are located within paleo-valleys of ancient river systems that have been buried under thick sequences of glacial deposits. Mapping these aquifers has been problematic due to the discontinuous nature of the alluvial deposits. It is important to understand the distribution and water replenishment rates of these glaciated alluvial aquifers since they represent the most productive aquifers in eastern Nebraska. They are not only critical to Nebraska's economy; they also provide the primary source of drinking water to the two largest population centers of the state.

The goals of this research are twofold: 1) to map the significant aquifers of eastern Nebraska and 2) to estimate the recharge rates of these aquifers to better understand the water balance of the groundwater system. The first aspect of the project incorporates test hole logs from the University of Nebraska–Lincoln Conservation Survey Division, registered well logs from the Nebraska Department of Natural Resources database, and GIS mapping/3D visualization techniques to map the glaciated aquifers. The second aspect of the research involves developing accurate estimates of recharge across eastern Nebraska using vadose zone matric potential monitoring and lysimetry. Four areas for monitoring have been selected and three have been instrumented based on geologic characteristics and water well development pressures. The hydrogeologic datasets and maps will be integrated into the eastern Nebraska Water Resources Assessment (ENRWA) project and will complement geophysical mapping of aquifers in specific areas of the glaciated portions of eastern Nebraska.

PRELIMINARY EVIDENCE FOR MIOCENE TECTONISM IN NORTHWESTERN NEBRASKA

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Preliminary mapping of the Pine Ridge south of Chadron, Nebraska, provides insight into Miocene tectonism with possible connections to the southern Black Hills. Dominant east-west striking normal faults provide structural control of valleys and stream tributaries. The remaining fault population can be divided into three groups: normal faults with northwest strike, normal faults with northeast strike, and thrust faults with northwest strike. Faults are expressed in areas with sandstone and conglomerate

ledges high in the section. Tectonites found lower in the section and developed primarily in fine- to very fine sandy siltstones possibly indicate weakly developed axial plane cleavage of subtle folds. The deformed rocks are middle to late Miocene in age. South-vergent thrust faults with slip on the order of a few meters indicate a structurally elevated terrane to the north, possibly associated with the Black Hills. Post-tectonic erosion has removed most of this elevated terrane, leaving the Pine Ridge as a structurally-indicative outlier.

USE OF STREAM CHARACTERISTICS TO ASSESS STRUCTURAL CONTROL OF DRAINAGE ON TRIBUTARIES TO THE WHITE RIVER, NORTHWESTERN NEBRASKA, USA

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Stream drainage analysis has been shown to be a useful tool for recognition of geologic structures. However, most previous analyses have been conducted on large drainage systems with known structural controls. The White River drainage basin in northwestern Nebraska is small compared to drainages analyzed in other studies and it is unclear to what extent any streams within the basin are impacted by geological structures due to limited structural data. A matrix system has been developed to characterize streams and stream reaches in order to determine if they could be structurally controlled. Stream reaches are characterized by whether or not they coincide with mapped faults, mapped implied faults, lineaments, lithology changes, tributaries and man-made features. This matrix is being used as a tool to help focus locations for field investigation.

SPATIAL PATTERNS OF DROUGHT TRIGGERS AND INDICATORS

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Drought is a recurring phenomena with widespread economic, social, and environmental impacts. Unlike other disasters, a drought cannot be easily detected. In addition, droughts are widespread and develop slowly overtime making it difficult to detect its onset and monitor its severity and impacts. To monitor the spatial extent and magnitude of a drought, drought managers use indicators and triggers to identify the onset. Drought indicators are meteorological or hydrological variables or indices that quantify the level of drought. A drought trigger is a value of an indicator that initiates management and response actions. Despite their importance, drought indicators and triggers are not well understood and are often arbitrarily chosen. In fact, at a 2008 workshop convened by the National Integrated Drought Information System (NIDIS), stakeholders from across the country identified the need for a better understanding of drought triggers and indicators as a research priority. The purpose of this research is to identify spatial patterns of drought indicators and triggers. This was accomplished by identifying the types and numbers of indicators and triggers used in all currently available state drought plans. These were then organized in a database and analyzed using ArcGIS

software to identify the numbers of indicators and triggers used by each state as well as any spatial patterns. Results show that some patterns do exist and that the indicator or trigger used is not necessarily appropriate for the geographic location in which it is being used. Additionally, wide variability exists among the number of indicators and triggers used by each state. This information may help drought managers coordinate the use of critical indicators and triggers at the regional or basin level.

AN OVERVIEW OF WATERSHED MANAGEMENT AND BASIN-LEVEL DROUGHT PLANNING IN THE UNITED STATES

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Drought planning is implemented at multiple levels, but according to the Geological Society of America's conference report *Managing Drought: A Roadmap for Change in the United States* (2006), it is most soundly implemented at the scale of watersheds and hydrologic basins. However, addressing issues at the watershed and river basin levels presents a variety of challenges for environmental planners. Due to the trans-boundary nature of many watersheds and basins, a great number of stakeholders from multiple political jurisdictions and sectors are likely to be involved in the planning process. Drought is one of many issues that can impact watersheds and basins, further complicating planning at this level. The Colorado River Basin is an excellent example of a highly managed river system that is vulnerable to drought, climate change, and rapid changes in water demand, and it deserves further study. This paper examines literature pertinent to watershed management, basin-level drought planning, and water management issues in the Colorado River Basin. It is intended to provide an overview of the development of watershed- and basin-level drought planning in the U.S. while providing an example of drought management at the river basin level. The following conclusions can be drawn from this research: 1) the terms *watershed* and *basin* should not be used interchangeably, 2) watershed management has primarily focused on water quality planning and ecosystem management, and 3) drought planning is occurring, and it is recommended that it should be occurring, at the basin level.

TEACHING OF SCIENCE AND MATH

MV OR ONE-HALF MV SQUARED?

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Students frequently confuse momentum and kinetic energy. We shouldn't be surprised—scientists were confused for several hundred years. The historical development of these key concepts of physics will be sketched.

STUDENT-CENTERED VERSUS LECTURE-BASED TEACHING IN A GENERAL STUDIES BIOLOGY COURSE

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Current literature indicates that involving students in active learning and student-centered teaching results in increased learning by the students. I have altered the introductory non-science majors biology course from a lecture-based course a more student-centered classroom. Previously, I taught the course using entirely lecture based instruction for four semesters. In the fall 2010 semester, I began using the more interactive approach. Numerous techniques were instituted in the classroom, including study guides, animations, modeling, and group work. Exams for the fall 2010 semester were written using identical questions during at least one of the four previous semesters so direct comparisons could be made. Data is still being analyzed on the direct learning impacts. Student evaluations were also compared in the different learning environments to directly determine student perception of the classroom. Additionally, anecdotal evidence was collected based on questions asked during class, attendance, and engagement of the students in the classroom. Based on the data analyzed thus far, the active learning classroom resulted in students who were more interested in learning and engaged in the material. Additionally, the students took more responsibility for learning than they had in previous semesters of teaching the course. Preliminary evidence indicates that the academic performance of the students enrolled in the fall 2010 course was at least slightly better than those in previous offerings.

APPLIED ELECTROCHEMISTRY IN THE UNDERGRADUATE LABORATORY: ANODIZING ALUMINUM AND THE INTERCALATION OF VARIOUS DYES

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The anodizing process is a concrete example of applied electrochemistry that is easily accessible to undergraduates in a laboratory setting. Anodizing is used to create a durable, porous oxide matrix on the surface of aluminum metal. The newly formed matrix is highly susceptible to the addition of various substances, including dyes. Matrix thickness, dye type, and sealing techniques are all factors in the outcome of the anodized metal. Variations on the anodizing process and the use of multiple dye types and their effects on the aluminum will be discussed as well as applications in the undergraduate laboratory.

A LITERATURE-BASED, DISEASE-CENTERED MOLECULAR BIOLOGY COURSE

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Teaching students to understand and apply complex scientific concepts is a challenge. Molecular Biology is a particularly difficult course to teach because the ideas are particularly abstract and far

removed from the everyday world of human experience. Molecular biology textbooks tend to focus individually on cellular processes, molecular techniques, and diseases without integrating the knowledge so that students understand how molecular techniques lead to new discoveries about cellular processes and how knowledge of cellular processes can lead to molecular based treatments for common diseases. To allow students to better connect scientific discovery and molecular biology, I developed a Molecular Biology of the Cell course which is based on scientific literature and case studies of molecular diseases. In this course, students worked cooperatively in small groups to read and analyze scientific papers dealing with particular molecular processes and diseases. Students then applied their knowledge to case studies which focused on genetic disorders, drug discovery, and use of common molecular techniques. For example, students applied their knowledge of the ubiquitin-proteasome pathway to analyze the problem of Parkinson's disease and to design drugs for Alzheimer's disease. By the end of the semester, most students were comfortable designing theoretical experiments to screen potential drugs for the treatment of molecular diseases. Students self-reported increases in critical thinking, literature reading, and cooperative learning skills at the end of the class, and more than half the class liked the cooperative format better than a strict lecture format.

APPLIED SCIENCE AND TECHNOLOGY

SIMULATION OF AMERICAN RAKU FIRING, A REDUCTION ENVIRONMENT, IN A LABORATORY SETTING

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A Raku firing is the process of creating a reducing environment for the development of a ceramic glaze rather than using a traditional oxidizing environment in a kiln. Many times this reducing environment is created using an old metal barrel or trashcan upside-down on a patch of dirt or sand to limit the amount of oxygen allowed into the combustion chamber. The chamber is filled with combustible materials such as shredded paper, sawdust, straw, hay, dry leaves, shredded cloth or other flammable materials in order to "smoke" the pottery. The Raku firing technique was studied in the more controlled laboratory setting. The results of this closer study of the process will be reported.

AN EXPLORATION OF THE EFFECTS OF SELECTED MORDANTS ON COTTON FIBERS AND NATURAL DYE

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The art of natural dyeing has been known to cultures around the world for generations. Several factors are known to affect the results of a dye bath; most significant is the effect mordants have on the colors obtained during the dye process. The chemistry behind the effects of different mordants in color selectivity is exposed.

THE INTERACTION OF NATURAL DYES WITH SELECTED WOOL FIBERS

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Little information is provided for people wanting to dye fabrics like wool with natural dyes. Important information like what mordants work best for what colors, what concentration the mordants should be, or how long the materials should be exposed to the mordants have had limited systematic study. The results of a systematic study of several mordants with selected wool and wool blend fibers will be reported.

COLLEGIATE ACADEMY

**BIOLOGY
SESSION A**

EFFECTS OF NALTREXONE ON ANXIETY BEHAVIORS IN C57BL/J6 MICE

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Anxiety is a disorder that affects 40 million Americans. Anxiety is mediated by specific neuroreceptors in the brain, opioid receptors. Naltrexone is an opiate antagonist pharmaceutical approved for the treatment of alcoholism. C57BL/J6 mice were used to examine the effects of Naltrexone injections on anxiety behaviors. The effects of previous alcohol exposure were also observed using the animal model. Prior to the study half of the mice had exposure to alcohol during their youth and during adulthood the other half had exposure to alcohol during adulthood. The mice received interperitoneal injections of either saline or Naltrexone. Following injections anxiety behaviors were recorded using light/ dark boxes. As a result of being an opioid antagonist, Naltrexone may reduce anxiety behaviors in the mouse model. Previous exposure to alcohol may also play a role in the effects of Naltrexone on neuroreceptors and expression of anxiety behaviors.

OPTIMIZATION OF WESTERN BLOTTING TECHNIQUES FOR DETECTION OF PROTEIN MARKERS OF BOVINE LEUKEMIA VIRUS INFECTION

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Bovine Leukemia Virus (BLV) is a retrovirus that targets cattle and is closely related to the human T-cell leukemia virus. This study optimizes the procedure of western blotting to assess the effects of antiretroviral drug ribavirin and interferon on BLV proteins in FLK-BLV cells. Previous studies have shown that western blotting can be used as an effective technique in detecting protein markers of BLV cells. We were successful in finding many aspects of optimization for the procedure, but were still not able to detect the gp51 protein. The p24 capsid protein was shown in our western blots, but we were unable to suppress this protein by treatment with antiviral drugs. Although our experimental results were inconclusive, further research needs to be conducted to determine whether ribavirin and interferon are effective in suppressing the gp51 and p24 proteins of BLV. Supported by NIH grant number P20 RR016469.

TLR-3 EXPRESSION AND ACTIVATION OF TRANSCRIPTION FACTORS, NF κ B AND IRF3 IN HUMAN BRONCHIAL EPITHELIAL CELLS

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Pulmonary mucosal epithelial cells (16HBE) serve as the initial barrier to air-borne pathogens in the respiratory system. Results presented here address the overall hypothesis respiratory epithelial cells initiate innate, antiviral immune responses via Toll-like Receptor 3 (TLR3). Binding of TLR3 and its ligand, dsRNA, leads to a cascade of events resulting in the antiviral type I interferon (IFN) expression

in the cells. It is known that TLR3 can activate three unique pathways, leading to either Nuclear factor – kappa B (NFκB), Interferon response factor 3 (IRF3), or Activator protein 1 (AP-1) activation. Transcription factor, NFκB, works to regulate the expression of multiple genes and is initially located in the cytoplasm of cells. Upon stimulation of the cells by dsRNA or the synthetic ligand Poly I:C, NFκB is translocated to the nucleus. Western blotting and immunofluorescence, were used to detect the presence of NFκB translocation following activation of 16HBE cells with Poly I:C. An optimal stimulation time was determined experimentally for the synthetic ligand, Poly I:C by adding the ligand to various cell cultures at particular hourly increments of 0,1, 12, and 18 hours. Previous research indicated that, like NFκB, IRF3 was also located in the cytoplasm prior to stimulation of HEK293 cells. However, dsRNA treatment induced dimerization and nuclear translocation of IRF3. The purpose of the IRF3 translocation into the nucleus is to encourage binding to promoters containing interferon-stimulated response elements which initiate transcription of the target genes that code for antiviral molecules. Western blotting was also used to determine whether IRF3 was translocated to the nucleus following stimulation with Poly I:C in the epithelial cells of the respiratory tract. Preliminary western blot data does indicate an increase of IRF3 nuclear translocation in the stimulated cells than those cells not stimulated. Additional methods are also currently being developed for detection of NFκB and IRF3 in order to evaluate activation status of airway epithelial cells. Supported by NIH grant number P20 RR016469.

REGULATION OF PROTEIN MARKERS IN HUMAN BRONCHIAL SUB-MUCOSAL DENDRITIC CELLS

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Airborne pathogens may penetrate the human body by infecting bronchial epithelial cells. Once the epithelial cells are infected, they respond by producing antiviral chemical signals, such as type I interferons. We hypothesized that soluble antiviral mediators produced by respiratory epithelial cells serve to activate sub-mucosal defensive cells, called dendritic cells. Once stimulated, the dendritic cells may undergo morphological changes that allow them to serve as antigen presenting cells, which can then be used to stimulate T-cells and B-cells. These cells, in turn, begin the specific immune response to combat and eventually kill the unwanted pathogen. Experiments described here were performed to evaluate the utility of the human dendritic-like cell line, KG-1, for *in vitro* studies of interactions between pulmonary mucosal cells and the underlying dendritic cells. Activated dendritic cells exhibit increased surface expression of specific protein markers HLA-DR, CD83, and CD11c. Immunofluorescence and flow cytometry were used along with phorbol esters to analyze the expression of these specific proteins on KG-1 cells before and after stimulation. Preliminary results showed up-regulation of HLA-DR and CD11c, but showed little CD83 up-regulation. These results may indicate that CD83 expression on the surface of KG-1 cells is subject to tight regulation or that this subset of the cell population is undergoing apoptosis because of the absence of co-stimulatory signals *in vitro*. Supported by NIH grant #P20 RR016469.

BIOCHEMICAL EXTRACTION OF THE QUORUM SENSING MOLECULE IN *MYCOBACTERIUM SMEGMATIS* THAT DISPLAYS INCREASED PIGMENTATION IN *STREPTOMYCES COELICOLOR*

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This study investigates quorum sensing (QS) in *Mycobacterium smegmatis*. Quorum sensing is the regulation of gene expression in response to changes in population density. It has been demonstrated that many bacteria communicate within and across species through quorum sensing. *M. smegmatis* may also possess this system. Ethyl acetate and methanol were used to extract the QS molecule from *M. smegmatis* culture supernatants. Biological activity of the QS molecule was tested on lawns of *Streptomyces coelicolor* and observed for increased pigmentation. Preliminary results indicate that *M. smegmatis* does possess a QS molecule that displays increased pigmentation in *S. coelicolor*. It has been shown that the QS systems of other bacteria are involved in pathogenesis. This study may provide future insights into the virulence of pathogenic strains such as *M. tuberculosis* and *M. leprae*. Supported by NIH grant number P20 RR016469.

STEPWISE CLONING AND EVALUATION OF FRAGMENTS OF THE HUMAN N-CADHERIN PROMOTER

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N-cadherin is a transmembrane cell-adhesion protein normally expressed in cells such as fibroblasts and neurons and following the epithelial-to-mesenchymal transition during development. Regulation of N-cadherin transcription has implications for both cancer and kidney integrity. Most human cancers arise in epithelial tissue that does not normally express N-cadherin, though expression of N-cadherin has been correlated with development of a motile cancer phenotype. Kidney cells normally express N-cadherin and in rats downregulation of N-cadherin expression has been correlated with loss of kidney integrity. Previous studies in our lab using N-cadherin promoter reporter constructs have indicated that sequences between -462bp and -1975bp are involved in activation and repression of N-cadherin expression. Fragments spanning this region were cloned into luciferase reporter constructs and transiently transfected into human embryonic palatal mesenchyme cells (HEPM). Luciferase results suggest that a 225bp fragment spanning -1280bp to -1055bp is sufficient for reproducing the repression of luciferase expression produced by a fragment spanning the whole region. Additionally, a 333bp sequence spanning -1518bp to -1851bp appears to include an enhancer element as that fragment is capable of a significant increase in luciferase expression. A transcriptional element sequence search (TESS) suggests these sequences include consensus binding sites for transcription factors Wt-1, EGR-2 or EGR-4 in the 225bp fragment and for PEA3 binding to the 333bp fragment. We are currently using Western analysis to determine if any of these proteins are expressed in HEPM cells. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

ENHANCING THE UNMETHYLATED PRODUCT IN METHYLATION SPECIFIC PCR OF THE HUMAN N-CADHERIN GENE

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N-cadherin, a cadherin protein associated with mobile tissues, has many adverse implications in cancer metastasis, often promoting the spread of a malignant cancer. In some cancers, however, the N-cadherin gene has been methylated and therefore inactivated, which prevents the expression of the N-cadherin protein. This inactivation can effectively prevent the spread of certain types of cancers. The goal of this study is to confirm that the N-cadherin gene is methylated in BT-20 cells, a line of benign human breast cancer cells. Using Methylation Specific PCR (MSP), we intend to determine definitively the methylation status of the N-cadherin gene in BT-20 cells.

TRANSLATION OF BASIC STORZ CMAC INTUBATION USAGE VIDEO INTO FARSI FOR AFGHAN MEDICAL PERSONNEL

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Afghanistan has one of the world's worst healthcare systems. This is due to lack of medical education and medical personnel. Healthcare is especially problematic in rural areas where 80% of Afghani people live. The STORZ CMAC video intubation system is a portable emergency care unit that can eliminate complications from airway management. Translating a basic STORZ CMAC video into Farsi was done as part of the effort to help Afghanistan's emergency healthcare system, which largely affects the nation's rural populations. The translated video will be posted in an online database which can be accessed from anywhere in the world in an effort to help Afghani healthcare.

THE USE OF *SALMONELLA TYPHIMURIUM* InvB/InvC AS A POSSIBLE DRUG DELIVERY SYSTEM

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Salmonella typhimurium is a foodborne Gram negative bacterium with the capability to internalize into mammalian cells. Numerous proteins play a role in the internalization of this pathogen and include the invasive proteins InvB and InvC. *S. typhimurium* utilizes a type III secretion system in which the bacterial virulence proteins are injected directly into host cells. InvB is a chaperone within this system and binds to secretion proteins before leaving the bacterial cell. The pathogenic secretion proteins must be unfolded before entering the host cell. InvC assists in the unfolding of proteins prior to release from the InvB chaperone, resulting in uptake of the bacterial protein by the host cell. Exploitation of the invasive properties of InvB and InvC could serve as the foundation for a more efficient mode of medication delivery. Initial research in the cloning of InvB and InvC genes into plasmids for over-expression of the protein has been achieved. Purification of the proteins will allow for further study as to the value of these individual proteins as a means of drug delivery in mammalian cells. This research was funded by the Nebraska INBRE Grant Number: P20 RR016469.

CLONING, OVER-EXPRESSION, AND PURIFICATION OF NUS-FREE InlB FROM *LISTERIA MONOCYTOGENES* AS A POSSIBLE DRUG DELIVERY VEHICLE

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Listeria monocytogenes is a foodborne pathogen known to internalize into mammalian cells. Surface proteins known as Internalin A (InlA) and Internalin B (InlB) appear to play a fundamental role in inducing this process, while excreted proteins such as Internalin C (InlC) may enhance the mechanism. The focus of this research is to ascertain the potential value of InlB as a drug delivery vehicle. This specific protein is required for induced internalization into epithelial tissues and HeLa cells *in vitro*. Internalization is stimulated by tyrosine phosphorylation and leads to cytoskeletal rearrangements in the host cell culminating in internalization of the entire organism. Previous work by this lab has led to successful isolation of over-expressed InlB but only when NUS-tagged in pET-44. However, in all likelihood NUS modification alters the protein to yield a non-native confirmation. Here the InlB gene was inserted into pET-46, and over-expressed without the NUS tag. The over-expressed protein was isolated with a His-tag column (Qiagen) prior to Western Blot analysis. Initial experiments to determine InlB's ability to induce internalization in HeLa cells includes fluorescent tagging and detection by microscopy and spectrofluorometry. This research was funded by the Nebraska INBRE Grant Number: P20 RR016469.

DEVELOPMENT OF THE ARABIDOPSIS G-PROTEIN SIGNALING NETWORK DATABASE

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The heterotrimeric G-protein complex plays a central role in major signal transduction networks in both animals and plants. It's involved in the regulation of a wide variety of gene functions. Many diseases are caused from the malfunction of G-protein signaling genes. A number of proteins are involved in the G-protein signaling network. G-protein coupled receptors (GPCRs) detect signals at the cell surface. A G-protein complex consists of alpha, beta, and gamma subunits, which interact with a GPCR. This interaction causes a signal to be transferred to the downstream effectors within the cell. In animals 102-103 of GPCRs, 23 G-alpha, 6 G-beta, and 12 G-gamma subunits are known. The network complexity increases with multiple effectors. Identifying all the components, and understanding the protein interactions, could eventually result in the development of treatments or cures for many diseases. In contrast to the animal system, the G-protein signaling network in plants is much simpler. In the model plant *Arabidopsis thaliana* only one G-alpha, one G-beta, and two G-gamma subunits are known, and only 22 GPCR candidates have been identified. For our study, we chose to use *Arabidopsis* due to its relative simplicity. We are also interested in elucidating how plants and animals have different modes of evolution in G-protein signaling.

A high-throughput interaction screening was done using 24 of the bait proteins against 9 cDNA libraries prepared from a variety of *Arabidopsis* tissues with varying conditions. The bait proteins included G-proteins and other proteins that were confirmed to interact with G-proteins. Over 1000 interactions were found from these *Arabidopsis* proteins.

Sifting through the substantial amount of interaction data can be difficult. Finding the critical interactions, looking up additional information, and visualizing the interactions can be time-consuming. To facilitate the analysis of such a complex network of information, we have developed the G-protein signaling network database. It creates a more manageable approach by organizing, supplying, and enhancing the analysis of the protein interaction data. Search functions, external links, and visualization tools assist in the discovery of key proteins and their interactions. Records from The Arabidopsis Information Resource (TAIR) are also incorporated for comparison. The elasticity of the database also supports influxes of additional data to be analyzed, without over-complicating appearance or analysis. This research was funded by the Nebraska INBRE Grant Number: P20 RR016469.

THE EFFECT OF PLASMID SIZE ON TRANSFORMATION EFFICIENCY

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Many bacterial cells harbor plasmid DNA which code for typically non-essential proteins including those that may result in resistance to antibiotics. Plasmids can be obtained by other competent bacterial cells often resulting in the rapid spread of antibiotic resistance. The size of the plasmid may play a critical role in the efficiency of transformation from one organism to another. In order to determine the influence of plasmid size on its ability to be obtained by competent cells, three plasmids of varying size, each containing an ampicillin resistance marker, were transformed into chemically competent *E. coli* cells under controlled conditions. The transformed cells were grown on ampicillin plates allowing the number of transformants to be compared on a plasmid to plasmid basis. These results are not meant to mimic natural transfer by F⁺/F⁻-conjugation pili but instead provide insight to uptake of plasmid from local environments by natural competence. This research was funded by the Nebraska INBRE Grant Number: P20 RR016469.

EFFECT OF INCLINE ON THE LOCOMOTOR COSTS OF CARRYING AN ENLARGED CLAW IN FIDDLER CRABS (*UCA PUGILATOR*)

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Sexual selection often results in males exhibiting exaggerated traits (e.g. bright colors, elaborate appendages) to attract potential mates. These traits, however, can impose costs, such as an increase in energy expenditure and a decrease in locomotor performance, which could decrease foraging efficiency and increase an individual's vulnerability to predators. We examined the locomotor costs of the enlarged claw in fiddler crabs (*Uca pugilator*) during movement on different inclines. Speed and endurance were measured for clawed males, males with the claw removed, and females. We found that claw removal significantly increased endurance on tested inclines. Though claw removal had no significant effect on horizontal speeds, removal of the major claw significantly increased uphill speeds of male fiddler crabs in non-horizontal inclines. Generally, as incline increased, the difference in performance between the enlarged claw and clawless crabs increased. Fiddler crabs are found naturally on uneven terrain; this study indicates that an assessment of movement on level surfaces alone may not be ecologically relevant to detect actual costs of sexually-selected structures.

SCREENING FOR ANTIBACTERIAL ENDOPHYTIC FUNGI WITH LIVING TISSUE COLLECTED IN WYOMING AND WESTERN NEBRASKA

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There is a common quest for finding naturally derived antibiotics and chemotherapeutic agents that have low toxicity and are environmentally friendly. This search is driven by the antibiotic resistance of bacteria such as *Mycobacterium*, *Staphylococcus epidermidis*, and *Streptococcus*. (Li et al, 2005). Several studies have focused on endophytic fungi that can be found in grasses and woody plants in temperate regions. (Guo, 2000 & Li et al, 2005 & Lin, 2007). The endophyte samples for this study were collected in western Nebraska and Wyoming. The bacteria tested were *Staphylococcus epidermidis*, *Escherichia coli*, *Candida albicans*, *Mycobacterium*, *Pseudomonas aerogenosa*, and *Bacillus subtilis*. Primary bioassay was performed with 58 different endophyte samples. Culture *Bricker71725S* showed the strongest inhibition across six different bacteria and was tested for secondary bioassay. Methanol and ethyl acetate were used for isolation. Further chemical analysis is needed on *Bricker71725S*. Supported by NIH grant number P20 RR016469.

COLLECTION OF *CANNABIS SATIVA* IN LANCASTER COUNTY AND MEASUREMENT OF THC BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

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The purpose of this study is to find and compare concentrations of THC in *Cannabis Sativa* populations that grow around Lancaster County. The goal was to compare levels to those found in illegal marijuana as well as look at differing percentages among plants in the same populations. The study was done by collecting multiple samples of plants and using HPLC to measure THC levels against standards. The results showed low levels of THC, ranging from 1.89% to 0.84%. This is much lower than the average of 9.6% found in marijuana sold for drug use. Also, four populations were found to have statistically different levels of THC at 95% confidence, and four populations had no statistical difference between plants in the same population at 95% confidence. Supported by NIH grant number P20 RR016469.

A STUDY OF ILLICIT DRUG CONTAMINATION FROM SITES UPSTREAM AND DOWNSTREAM OF WASTE WATER TREATMENT PLANTS OF LINCOLN, ASHLAND AND SEWARD, NEBRASKA

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The purpose of this research project was to test for the illicit drugs THC and its metabolite, MDMA (ecstasy) and methamphetamine (meth) upstream and downstream of waste water treatment plants in Lincoln, Ashland and Seward, Nebraska. These locations were strategically chosen due to the bodies of water that receive the treated water from these sites and the watersheds that are affected. These waste water treatment plants (WWTPs) in Lincoln and Ashland have significant influence in a major water supply; emptying into the Platte River. Seward WWTP ultimately affects the water supplies in Kansas from the merging of various streams. This research project identified the presence of illicit drugs in the water at these three locations. Caffeine and the metabolite of caffeine, 1,7-dimethylxanthine, were human waste indicators. High amounts of caffeine and the metabolite were identified in the samples. The greatest amount of illicit drug detected was methamphetamine. Highest levels were detected downstream of the Lincoln WWTP, and various levels were detected at the Seward and Ashland WWTPs.

CHARACTERIZATION OF ANTIBIOTIC RESISTANT BACTERIA FROM THE PLATTE RIVER

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Water is the foundation of life. Water quality is the chemical, physical and biological characteristics of water and, being the basis of life, is important to everyone. A variety of disciplines including chemistry, biology, toxicology, and microbiology can be researched when investigating water quality. College of Saint Mary is taking an active role in water quality research and students have begun researching different topics all related to this central theme. My project is laying the groundwork for the microbiology portion of this endeavor. Toxicology is also being studied.

The biological and chemical composition of water is influenced not only by natural means but also by human activities. Since Nebraska is a rural state, a large portion of our surface water quality is based upon pollutants we dump into our rivers as a result of agricultural processes. Farming communities frequently use antibiotics to help stave off disease and infection due to large amounts of over-crowding and poor sanitation. This overuse and misuse of antibiotics is allowing naturally occurring antibiotic-resistant bacteria to become even more prevalent. The U.S. Center for Disease Control and Prevention considers antibiotic resistance to be one of its top concerns and healthcare providers in Nebraska are required to report any infectious cases of antibiotic-resistant organisms. This study is in the initial stages of searching for any correlations between those organisms and different sources of environmental containments in our water supply.

Initially, water samples were collected from the Platte River. Microorganisms isolated from these samples have been subjected to various microbiological techniques to identify common structural, metabolic and genetic characteristics. Kirby-Bauer antibiotic testing has been done to identify isolates that are resistant to more than one antibiotic. Noteworthy organisms will be studied further.

EFFECT OF DISSOLVED LEAD ON PLANT GROWTH

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The World Herald had an article on January 10, 2011 addressing the concern about an estimated 14,500 residences requiring cleanup as a result of lead soil contamination. This study addresses the vegetation that could be grown for consumption in these areas. The purpose of my research is to study the mobility and accumulation of lead in plants grown in soil artificially contaminated with concentrated lead. Growth inhibition and production of vegetation will be evaluated in radish, lettuce, and pea plants. A comparative analysis of heavy metal accumulation from different sections of the plant; roots, leaves, stems, and vegetation will be provided. Lead effects on plant pH, plant biomass accumulation, and phenology changes will also be noted.

A STUDY OF FLASH BEHAVIOR IN THE EASTERN COTTONTAIL RABBIT

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Tail-flagging occurs in a wide variety of species. It is seen in deer, antelope, and the cottontail rabbit. Tail-flagging normally occurs due to a predator's presence, and is a communication tool between predator and prey. No study has ever been done on the cottontail rabbit's tail-flagging behavior. By saying it is flash behavior; we can say that the rabbit will drop its tail when stopped. In this study I look at the underlying causes of the rabbit's tail-flagging behavior by simple observations. Looking at the rabbit's tail after being threatened gave me a good understanding that it is not flash behavior. The rabbit's flag could either be just a mechanical component to its body, or a pursuit invitation signal.

TAXONOMIC IDENTIFICATION OF MEDICINALLY IMPORTANT ENDOPHYTIC ORGANISMS USING PCR AND BIOINFORMATIC TECHNIQUES

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As part of a larger bioprospecting program aimed at identifying medicinally important organisms; my research focuses on the taxonomic identification of fungal endophytes isolated from native plant species collected in eastern Wyoming in July, 2009. I am currently streamlining the DNA extraction and polymerase chain reaction (PCR) protocols for our lab. Our system utilizes PCR amplification of the internal transcribe spacer (ITS) region of the fungal endophyte's ribosomal DNA followed by sequencing of the PCR product. The DNA sequence is then submitted to the BLAST (Basic Local Alignment SearchTool) database at the National Center for Biotechnology Information (NCBI/GenBank) to obtain a putative taxonomic identification of the endophytic organism. Supported by NIH grant number P20 RR016469.

A DESCRIPTIVE STUDY TO DETERMINE WHICH BAT SPECIES BREEDING IN LANCASTER COUNTY, *MYOTIS SEPTENTRIONALIS*, *LASIONYCTERIS NOCTIVAGANS*, *EPTESICUS FUSCUS*, *LASIURUS BOREALIS*, *LASIURUS CINEREUS*, AND *NYCTICEIUS HUMERALIS*, EMIT A PRESENCE OVER NEBRASKA WESLEYAN UNIVERSITY'S CAMPUS

Hollie Cotten, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

This descriptive study was done in order to gain a better understanding as to which bat species breeding in Lancaster County, NE are present on Nebraska Wesleyan's campus. Echolocation recordings were taken using an ultrasound detector connected to a hand-held recorder after sunset. The recordings were then analyzed using SonoBat 2.9.5, a bat call analysis program. It has been determined that at least two, *Lasionycteris noctivagans* and *Eptesicus fuscus*, of the six bat species breeding in Lancaster county emit a presence over Nebraska Wesleyan University's campus.

TAIL-FLAGGING AS A PURSUIT DETERRENT SIGNAL IN COTTONTAIL RABBITS

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Sylvilagus flridanus or Cottontail rabbits use their white tail as a signal to predators when they are near. But little is known about exactly what message the flag is conveying to the predator and several hypotheses can be debated. This study was used to determine if the flagging of the tail conveyed as a pursuit deterrent signal to the predator. Three groups of cottontail rabbits approached from 0, 20, and 40-degree angles were observed and tail-flagging behavior was recorded. A Fisher's Exact Test determined a significant difference between 0 and 40 degree angles. The results of the cotton tail rabbits being directly approached by the predator (0 degree) flagging more often does suggest that tail flagging in cottontail rabbits is a pursuit deterrent signal intended for the predator.

THE REGULATION OF ARO80P IN *CANDIDA ALBICANS* AROMATIC AMINO ACID METABOLISM

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The fungus *Candida albicans* is an opportunistic pathogen and common symbiotic resident of the human microbiota. The *C. albicans* transcription factor Aro80 contributes to regulation of genes responsible for aromatic amino acid metabolism. In the absence of a strong nitrogen source, *C. albicans* can utilize the aromatic amino acids phenylalanine, tryptophan, and tyrosine as a nitrogen source. The output of this metabolic pathway produces the aromatic alcohols phenylethanol, tryptophol, and tyrosol. These alcohols, particularly tyrosol, have been shown to have consequences for *C. albicans* morphology. Tyrosol induces germ tube formation and hyphal growth when present in high concentrations in the media. This filamentous growth is positively correlated with pathogenicity, thus understanding this aspect of the yeast-to-hyphae transition is important in developing treatments for candidiasis. This study of the aromatic acid metabolic pathway has centered on the function of Aro80p using an *aro80/aro80* knockout strain of *C. albicans*.

COLLECTION AND ISOLATION OF FUNGAL ENDOPHYTES FROM CO-LOCATED TERRESTRIAL AND EPIPHYTIC ECUADORIAN BROMELIADS

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Endophytes, fungal and bacterial microbes living inside all vascular plant tissues, are highly diverse throughout plant populations. Recently tapped knowledge of endophytes has led to the discovery that many possess biological properties, some of particular interest to the medical community for the production of pharmaceutical compounds. Endophytes are known to be host specific, directing the search for unique endophytes to areas with high biodiversity. As part of a larger analysis, this project explored the diverse communities of fungal endophytes within co-located terrestrial and epiphytic plants from the tropical family Bromeliaceae collected near the Yanayacu Biological Center for Creative Studies in Napo Province of northeastern Ecuador. The identity of fungal endophytic isolates was determined by gene-specific PCR. Continuation of the project was conducted to analyze potential medicinal properties of the isolated endophytes. Of 35 bromeliad leaf samples from Ecuador, 464 subcultures were isolated, 400 of which came from co-locations. The 400 co-location subcultures resulted in 136 morphologically distinct pure fungal endophyte cultures from both terrestrial and epiphytic bromeliads. The isolated pure cultures were used to examine the causation of endophyte locality within tropical bromeliads, potentially having an affect on the conservation status of members of the bromeliad family. Supported by NIH grant number P20 RR016469.

COLLEGIATE ACADEMY
BIOLOGY
SESSION B

EFFECTS OF ISOLATION ON STRESS AND BEHAVIOR IN THE GUPPY, *POECILIA RETICULATE*

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Guppies (*Poecilia reticulata*) are social creatures that live in shoals of varying densities, from 2-50 individuals. Guppies noticeably react when separated from their social network. Here, I test the effects, over a given time interval, when individual guppies within a shoal are isolated. The barriers used to isolate the guppies included physical isolation techniques as well as a combination of both physical and visual isolation techniques. I found, overall, there was a significant increase in the total number of laps swam by an isolated fish when the combination of both physical and visual isolation occurred compared to just physical isolation. However, over five minute intervals for a twenty five minute period, no evidence was found demonstrating the number of laps swam during each individual interval would either increase or decrease consistently among individuals. These results suggest visual stimulation of the shoal plays a significant role in the guppies' response during isolation.

IDENTIFICATION AND CHARACTERIZATION OF CELLULAR GENES EXPRESSED DURING EARLY PHASES OF REACTIVATION FROM LATENCY

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Bovine herpesvirus 1 (BHV-1) is an alpha-herpesvirinae subfamily member that establishes latency in the sensory neurons of cattle. The sensory neurons of the trigeminal ganglia are the primary site for latency, but persistent or latent infections can also occur in the tonsils and lymph nodes. Once latency has been established reactivation can occur at any time, usually following natural or corticosteroid induced stress, resulting in shedding of the virus. Though mechanisms that regulate reactivation are unknown, we do know that synthetic corticosteroids like dexamethasone (DEX), once introduced into latently infected cattle, consistently initiates reactivation from latency. Three hours after DEX treatment, via microarray analysis, six cellular transcription factors were up-regulated more than ten-fold, suggesting they may influence viral gene expression. Upon further analysis of these six transcription factors it was discovered that all six activate viral transcription, stimulating productive infection at least five-fold in comparison to the control. From our results we determined that all six transcription factors can stimulate productive infection and can potentially regulate viral gene expression.

***FRANCISELLA TULARENSIS* LIVE VIRUS STRAIN INFECTS ALVEOLAR EPITHELIAL CELLS AND INDUCES APOPTOSIS**

Emily Prinz, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

Francisella tularensis is a gram-negative bacterium that is the causative agent of tularemia, a disease that can be fatal in humans. The attenuated live vaccine strain (LVS) of this bacterium is avirulent in many but causes fatal tularemia-like diseases in mice. Evidence suggests that *F. tularensis* directly interacts with epithelial and endothelial cells of the airway, cells that play a central role in the innate immune response. Acquiring knowledge on how this bacterium affects these cell types is critical for a better understanding of tularemia pathogenesis. Studies were performed to determine the interactions of *F. tularensis* LVS with mouse alveolar epithelial cells. Using an *in vitro* cell culture

model, we have preliminary results demonstrating that *F. tularensis* LVS can infect, replicate, and induce apoptosis in mouse alveolar epithelial cells. Additional experiments indicate that although both cell types alert the immune system of this pathogen, their cytokine signaling profile differed. Additional studies will be required to determine how a respiratory form of *Francisella* subverts the immune system and enters the bloodstream, possibly causing fatal diseases.

CREATING A STICKY VIRUS: PCR MUTAGENESIS TO CONFIRM COXSACKIEVIRUS B3 BINDING SITES

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Coxsackieviruses are small, nonenveloped positive stranded RNA enteroviruses. Group B coxsackieviruses are known to bind to and infect cells via the coxsackievirus and adenovirus receptor (CAR). Certain strains of coxsackievirus B3 (CVB3), CVB3/RD and CVB3/RDVa, possess altered binding patterns. Sequence analysis of CVB3/RD, CVB3/RDVa, and CVB3/28 viruses revealed high levels of homology at the amino acid level for the genomes, despite observations that both CVB3/RD and CVB3/RDVa bind decay accelerating factor (DAF) in contrast to CVB3/28 which does not bind DAF. It is hypothesized that a single nucleotide change causing a glutamic acid to glutamine amino acid change at the residue 234 in the viral protein 3 in CVB3/RD and CVB3/RDVa enables these strains to bind DAF. A second focus of this study was the ability of some coxsackievirus strains to bind ligands in addition to CAR and DAF. Observations of CVB3/RDVa strain binding led to this focus. It is of interest to determine what differences in the amino acid sequences of these viruses promote or inhibit ligand-binding. It is hypothesized that the nucleotide mutations leading to amino acid changes: VP1-Q130K, VP1-T128I, and VP1-P126H allow CVB3/RDVa to bind ligands. The main contributing amino acid mutation among the three in CVB3/RDVa is believed to be the VP1-Q130K, since lysine possesses a positive charge. PCR mutagenesis was used to construct CVB3/28 cDNA genomes with the required mutations. The mutated cDNA genome will be incorporated into the CVB3/28 virus which will be infected into cells and assays will be conducted to determine if DAF-binding and ligand-binding occur.

OPTIMIZATION OF METHODS TO DETECT ACTIVATION OF TLR-3 AND EPITHELIAL BARRIER FUNCTION IN HUMAN BRONCHIAL EPITHELIAL CELLS.

David Synhorst and Therese McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln NE 68504

Epithelial cells of the respiratory tract serve as barriers from the external environment and as potential targets for infection with respiratory pathogens. Epithelial cells possess Toll-like receptor 3 (TLR-3) which serves as an innate detection system for airborne viruses. Experiments performed in our lab were designed to test the overall hypothesis that engagement of TLR-3 with its ligand, dsRNA, upon respiratory virus infection results in a cascade of events that ultimately promotes activation and maturation of submucosal dendritic cells. Before studying the activation of dendrites that lie beneath the epithelial layer, it was necessary to establish a realistic epithelial layer *in vitro*. The Transwell system was used in order to simulate the independent layers that exist in lung tissue. The top well was seeded with human bronchial epithelial cells and allowed to grow to confluence. Trans-epithelial Resistance measurements were monitored in the hope that a layer of cells with tight junctions that mimicked the outermost layer in the lungs would be produced. In order to verify that a tight, selectively permeable junction was formed, immunofluorescence was used on the adherence protein, "Zona Adherence Protein-1. The resistance measurements along with the evidence from the ZO-1 staining suggest that a realistic *in vitro* model of epithelial tissue was successfully created. Future experiments will use this model to study the activation of dendritic cells placed in the lower well of the transwell system. This experiment was supported by NIH grant number P20 RR016469.

UPREGULATION OF PATTERN RECOGNITION RECEPTORS ON A MACROPHAGE RAW264.7 CELL LINE IN RESPONSE TO STIMULATION AND INFLUENZA INFECTION

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T cells play an important role in the adaptive immune response to Influenza A infection; however, little is known how signals delivered by the innate immune response impacts the development of T cell immunity to influenza. Pattern recognition receptors (PRRs) are expressed by innate cells, such as macrophages, and alert the immune response to invading pathogens. PRRs Toll-like Receptor 3 (TLR3), TLR7 and retinoic acid inducible gene I, (RIG-I) are important in detecting viral RNA such as influenza viral RNA. Macrophages are cells of the innate immune response that reside in the lung and are the first line of defense against invading pathogens. To study the effects of influenza virus on macrophage populations, we used a cell line RAW 264.7 and influenza infection *in vitro*. Treatment of RAW cells with PRR agonists such as Poly IC (TLR3) or Loxoribine (TLR7) showed upregulation of TLR3 and TLR7, respectively, indicating that RAW macrophage cells express these PRRs. In addition, Poly IC also increases expression of RIG-I, an intracellular PRR that recognizes viral RNA. *In vitro* infection of RAW cells with highly pathogenic influenza virus PR8 demonstrated that TLR3 and RIG-I are upregulated higher than TLR7. Further studies will determine which cytokines or chemokines are upregulated following influenza infection. These data will be important when developing vaccine strategies that target T cell immunity to influenza. Supported by NIH grant number P20 RR016469.

DETERMINING GENES RESPONSIBLE FOR QUORUM SENSING IN *MYCOBACTERIUM SMEGMATIS* USING *STREPTOMYCES COELICOLOR*

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Quorum sensing (QS) is an enzyme regulatory mechanism that relies on a high cell density to be effective. Our research goal is to determine if *Mycobacterium smegmatis*, a nonpathogenic form of *Mycobacterium*, has a QS system. If proven to have a QS system, we will then determine if it plays a role in pathogenesis, specifically in *Mycobacterium tuberculosis*. *Streptomyces* is the model species used. Both *Streptomyces* and *Mycobacterium* are gram positive bacteria, easily grown, have a high G-C content and appear to, when interacting with *Streptomyces coelicolor* (M145), participate in QS. Aerial hyphae and purple pigmentation indicates QS between the two organisms. *Streptomyces* participates in QS when interacting with *Mycobacterium* because purple pigmentation and aerial hyphae are produced. Production of aerial hyphae and purple pigmentation is most likely due to the interaction between *Streptomyces* and chemical signals released by *Mycobacterium*. Preliminary results in our laboratory indicate that is potentially true. An over expression gene library of *Mycobacterium smegmatis* was produced and screened to determine which genes are responsible for QS. *Mycobacterium smegmatis* colonies that do not produce aerial hyphae or produce an abundance of aerial hyphae will be tested further by sequencing the colony's genome and comparing it to *Mycobacterium smegmatis* wild type. Transposon mutagenesis of *Mycobacterium smegmatis* was preformed. Selectable mutants grown were verified, using PCR, to contain the kanamycin resistance gene (selectable marker) and that the phage integrated *M. smegmatis* genome at random. *M. smegmatis* mutant genome would be sequenced if the colony was shown not to participate in QS and would then be compared to the *M. smegmatis* wild type

genome. The comparison would be used to determine the gene responsible for producing QS molecules. If concluding that *M. smegmatis* does have a viable QS system, it is hoped that this model could be used to determine if QS plays a role in pathogenesis in *M. tuberculosis*. If QS does play a role in pathogenesis in *M. tuberculosis*, then inhibiting QS from occurring between cells could play a vital role in the treatment and prevention of *M. tuberculosis*. Supported by NIH grant number P20 RR016469.

FILM AND TRANSLATION OF STORZ CMAC VIDEO INTUBATION SYSTEM MAINTENANCE VIDEO FOR AFGHAN MEDICAL PERSONNEL

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In 2004, Afghanistan ranked 173 out of 178 in the United Nations Human Development Index, which measures standard living conditions. (WHO, 2006) One of the main problems is the healthcare system. It has the third highest infant mortality rate in the country, mainly due to the lack of properly trained personnel and equipment. (CIA, 2010) The purpose of this project was to provide a video for proper maintenance the Storz CMAC intubation system. The video is translated to Dari and Pashto, native languages of Afghanistan, and will be used in an online database that will allow free access by medical personnel. This projects hopes that there will be many more videos made and translated into different languages to provide free access for physicians in underdeveloped nations around the world.

COLLECTION, ISOLATION, AND IDENTIFICATION OF FUNGAL ECUADORIAN BROMELIAD ENDOPHYTES

Amy C. Gerdes, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

Endophytes, fungal and bacterial microbes living inside all vascular plant tissues, are highly diverse throughout plant populations that span the planet. This project is part of a larger study at Nebraska Wesleyan University and explores the diverse communities of endophytes between epiphytic and terrestrial species of Bromeliaceae of the Napo province in northeastern Ecuador. Thirty-five co-located specimens collected from the Yanayacu Biological Center for Creative Studies during a two-week period in June 2010 were analyzed for both species diversity and richness of fungal endophytes. Four hundred subcultures were isolated from the 35 specimens. Of these 400 subcultures, 136 were found to be morphologically distinct. Continuation of the study will involve participation from future Wesleyan students and will assess the potential medicinal properties of isolated endophytes. Supported by NIH grant number P20 RR016469.

COSOLVENT STABILIZATION OF ALCOHOL DEHYDROGENASE

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The enzyme alcohol dehydrogenase is characteristically unstable in dilute solutions. In an attempt to stabilize this enzyme by “crowding” it with other molecules, the stabilizing effects of three cosolvents (trehalose, glycerol, and bovine serum albumin) on alcohol dehydrogenase subjected to thermal destabilization were examined. All three cosolvents exhibit stabilization of the enzyme; furthermore they show increased stabilization effects with increased concentration.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS
SESSION A

DEVELOPMENT OF TRICARBOXYLATED ARENES AS FLUORESCENT CHEMOSENSORS FOR DIVALENT AND TRIVALENT CATIONS

Audrey T. Gallagher and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

Dicarboxylated derivatives of 1,3-bis(meta-aminophenylethynyl)benzene were recently shown to serve as effective fluorescent chemosensors for the selective detection of Zn(II), Pb(II) and Cd(II) analytes in an aqueous environment. Analyte binding was shown to cause a bathochromic shift in arene fluorescence, and such sensors were proposed to operate via conformational restriction mechanisms. The goal of this study was to develop next-generation sensors based on tricarboxylated derivatives of 1,3,5-tris(meta-aminophenylethynyl)benzene. Members of this next-generation sensor family are predicted to display fluorescence output at lower energy than the first generation sensors due to their relatively expanded pi systems, while the tricarboxylated nature of these sensors enables both divalent and trivalent metal cation analytes to be targeted. Sonogashira coupling of 1,3,5-tribromobenzene with three equivalents of meta-ethynylaniline produced the triamino intermediate product in 83% yield. This triaminoarene was condensed with three equivalents of each of three cyclic anhydrides (succinic anhydride, glutaric anhydride and diglycolic anhydride) in dichloromethane solvent to produce three different tricarboxylated sensors in yields ranging from 61-86%. Condensation reaction progress was monitored by HPLC analysis, and each product was characterized by ¹H NMR, MALDI-TOF mass spectrometry and UV-Visible absorbance spectroscopy. High-throughput fluorescence binding assays were used to screen this family of tricarboxylated arenes against a range of both divalent and trivalent cations. Details of the synthesis, characterization and fluorescence binding assays will be presented.

DETECHIP: THE USE OF DIGITAL PHOTO ANALYSIS FOR A SENSING ARRAY

Jeff Hawken, Marcus Lyon, Mark Wilson, Andrea Holmes, and Sharmin Sikich, Department of Chemistry, Doane College, Crete, NE 68333

DETECHIP (Detection Chip) is an array test for use in both the lab and field that enables the rapid detection of abused narcotics and other analytes. The term DETECHIP combines the idea of small molecule detection with the goal of miniaturized use on a chip similar to DNA microarray technology. DETECHIP is able to detect a variety of substances, utilizing an array of eight sensing molecules. In moving towards automation of reading codes, digital photo analysis using RGB values has been employed with excellent agreement with visual analysis. Computer measurement of RGB values is more objective and has the potential to eliminate errors caused by differences in human vision and subjective interpretation. Supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources and by the NSF CHE-0747949.

ANALYSIS OF METHANOL IN BIODIESEL BY NEAR INFRARED SPECTROSCOPY

B. A. Bialas, and A. D. Gift, Department of Chemistry, University of Nebraska at Omaha, NE 68182

Biodiesel is typically produced by reacting methanol and triglycerides to form fatty acid methyl esters (biodiesel) and glycerol. After the processing of the biodiesel, the final product will contain trace amounts of impurities. It is important to determine the methanol concentration in biodiesel because

there are specifications limiting the maximum amount it can contain in order to be sold commercially. The ability of near-infrared spectroscopy (NIR) to determine the concentration of methanol in biodiesel was investigated. Samples of biodiesel were obtained from a local producer. These samples were used to create calibration samples. Standards of 0.0%, 0.01%, 0.1% and 0.5% methanol were prepared. These samples were analyzed using both NIR and gas chromatography. The NIR spectra of the standards were imported into a multivariate software program. A partial least squares calibration model was developed for the NIR spectral region between 5050 cm^{-1} and 4800 cm^{-1} . This calibration model was used to predict the concentration of methanol in biodiesel produced from a variety of different used vegetable oils. The results of the NIR model were validated by comparing to the gas chromatography results.

DIAZONIUM SALTS IN MULTI-STEP ONE-POT CLICK REACTIONS: SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL EVALUATION

Jacqueline E. Reilly and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

Sharpless-Meldal ‘click’ reactions have been shown to be effective components of multi-step one-pot click transformations. In order to avoid the potential dangers of isolating small organic azide molecules, synthetically efficient reactant precursors capable of rapidly forming organic azides are desirable for click reaction molecules. The goal of this study was to evaluate whether commercially available ‘fast’ dye diazonium salts could be used as efficient organic azide precursors in one-pot multistep click transformations. We specifically analyzed two-step and three-step click transformations involving aromatic diazonium salts reacting with terminal alkyne and trimethylsilyl-protected alkyne reagents. Each two-step reaction involved the in-situ formation of organic azides by reaction of a diazonium salt with sodium azide, followed by copper-catalyzed Huisgen 1,3-dipolar cycloaddition in aqueous solution. Each three-step reaction additionally involved the promotion of a base-catalyzed trimethylsilylalkyne deprotection by potassium carbonate. Products were confirmed using ^1H NMR, UV-Visible absorbance and IR spectroscopy and MALDI-TOF mass spectrometry. Subsequently, purified compounds were tested for their antimicrobial activity against both fungus and bacteria using a minimum inhibitory concentration assay.

***IN VIVO* SKIN FLUORESCENCE MEASUREMENTS TO DETERMINE EFFECTS OF SUN EXPOSURE**

Cassie Reicks, Jordan Groathouse, Mitch Trauernicht, Sharmin Sikich, Mark Wilson, and Andrea Holmes, Department of Chemistry, Doane College, Crete, NE 68333

Elastin and collagen are the two components in human skin that contribute to the skin’s auto-fluorescence. Sun exposure and aging can result in changes of fluorescence intensity. *In vivo* fluorescence measurements of solar and non-solar exposed skin were evaluated in 15 human volunteers from different age groups using a custom made fiber optic probe attachment for our Shimadzu spectrofluorometer. Our studies demonstrate that fluorescence intensity of solar exposed skin is lower than in non-solar exposed skin. This indicates that sun exposure of skin could result in loss of fluorescence and therefore leaving the skin looking dull and lackluster. A novel, highly fluorescent compound named ‘Wild Plum’ was prepared to camouflage this loss of fluorescence. Our studies show this loss of fluorescence can be restored when this compound was formulated into lotions and creams and applied to solar exposed skin.

Supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources and by the NSF CHE-0747949.

DETERMINATION OF VARIOUS ENERGY DRINK COMPONENTS USING REVERSE PHASE CHROMATOGRAPHY

Bobbi A. Stromer and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney, NE 68849

Due to the increased popularity of energy drinks among college students, a method to separate and quantify caffeine, riboflavin (vitamin B2), niacinamide (vitamin B3) and pyridoxine (vitamin B6) in energy drinks was developed for use in undergraduate analytical laboratories. In this method, the vitamins and caffeine were separated by high performance liquid chromatography (HPLC) using a 4.6 x 250 mm Spherisorb Amino 5- μ m column using a methanol-buffer mobile phase and with dual UV-vis detection. A series of calibration curves were constructed to quantify the amounts of the individual compounds.

DEVELOPMENT OF A COLLEGE LABORATORY EXPERIMENT BASED ON pH DEPENDENCE OF PARTITION COEFFICIENTS FOR COMMON NSAIDS

Adam Mosel, Department of Chemistry, Nebraska Wesleyan University, Lincoln, NE 68504

The measurement of partition coefficients for common NSAID's at varying pH's serves as a comparison to biological drug absorbance across cell membranes in different biological environments and consequently for drug distribution throughout different regions of the body. By changing pH, the drug will deviate from neutrality thereby changing the hydrophobicity, polarity, hydrogen bonding, and other characteristics of the drug molecule and its function. Therefore, partition coefficients at varying pH's can serve as a simple and effective model of the complexity of drug interaction in a biological system and serve as an important biochemical learning model for college undergraduates. Naproxen, Ketoprofen, and Acetaminophen are being considered as possible NSAID's suitable for college laboratory use.

FLUORESCENCE LIFETIME IMAGING FOR THE ASSESSMENT OF CELLULAR METABOLISM IN MULTICELLULAR TUMOR SPHEROIDS

Jorge Vergen and Michael G. Nichols, Department of Physics, Creighton University, Omaha, NE 68178

Intrinsic fluorescence of reduced Nicotinamide Adenine Dinucleotide (NADH) within a cell can be used to characterize its metabolic state. Previous studies have used fluorescence lifetime imaging (FLIM) to show that the average NADH fluorescence lifetime in living tissue varies as a result of metabolic state and disease progression. We demonstrate an innovative method using FLIM to image EMT6 tumor spheroids which show a similar metabolic profile to the cell types used in previous studies. By analyzing experimental data taken from cross-section images of tumor spheroids, we have been able to identify and characterize free and bound NADH sub-populations within the cell. Our analysis further indicates that it is possible to quantify variations of average NADH concentrations with metabolic state as well as the localization of various free and bound NADH sub-populations within the cell. Methods for determining the identity of various NADH-enzyme binding partners will also be discussed

This work was supported by: P20 RR016469 from the INBRE Program of the National Center for Research Resources and by NIH R15-GM085776.

STARLIGHT SIMULATIONS FOR DETECTING AND ANALYZING ULTRA PERIPHERAL COLLISIONS AT RHIC

Gleb Bataikin, Department of Physics, Creighton University, Omaha, NE 68178

RHIC is a particle accelerator that collides heavy ions at relativistic speeds. The STAR detector at RHIC investigates the interactions resulting from these collisions. We focus on studying Ultra Peripheral Collisions (UPCs), events involving two colliding ions that barely miss each other. STARlight is a program written in C++ designed to simulate these UPCs. Based on the simulations, we can determine whether the STAR detector is capable of detecting certain types of events. Furthermore, simulations allow us to determine the efficiency of our detectors by using simulated data, detected and reconstructed by a simulated detector. The reconstructed events can be compared to the original data. Finally, simulations provide a means to check our assumptions and methods used for real data analysis. This talk will focus on the ways in which STARlight simulations are useful in high energy physics and more specifically their use in analyzing UPC events at RHIC.

THREE DIMENSIONAL IMAGING USING A CD-ROM DRIVE FRINGE PROJECTION INTERFEROMETER

Stephen Cannon, Department of Physics, Hastings College, Hastings, NE 68902

One of the applications of interferometry is topographic imaging of surfaces. A fringe projection interferometer was constructed using the optics found within a common CD-ROM drive. A ball was mapped by taking four phase-shifted digital photographs of interference fringes projected onto its surface. The intensity of each pixel was compared between the four images and a phase-shifting algorithm was used to determine the separation from specific points on the ball to the camera lens. This allowed a profile of the ball to be reconstructed and represented graphically in MATLAB.

PARTICLE IDENTIFICATION OF KAONS IN ULTRA-PERIPHERAL HEAVY ION COLLISIONS

Mark P. Ridder, Department of Physics, Creighton University, Omaha, NE 68178

In Au-Au ultra-peripheral collisions at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven, NY, many particle interactions are observed. Most of these interactions result in the production of pions due to their relatively low mass. Conversely, larger massed particles such as kaons are not as frequently observed. To observe these, accurate particle identification is necessary in order to separate the few kaons from the many pions. This study will demonstrate techniques for separating kaons from pions. This study will then discuss some implications and expectations for the resultant data.

AERODYNAMICS OF A GOLF BALL: HOW DIMPLE DESIGN ALTERS DRAG AND LIFT

Kendall Murphy, Department of Physics, Hastings College, Hastings, NE 68902

New technological developments have made golf balls fly farther and straighter than ever before. Varying the design of the dimples on a ball is one way to achieve such improvements in flight. An experiment was conducted to demonstrate the effect that dimples have on reducing the drag and increasing the lift on a golf ball. Experiments were conducted using a wind tunnel to observe how the dimples reduce the drag coefficient of the ball, and coupled with a variable speed motor to simulate rotation, how the dimples modify lift on the ball.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS
SESSION B

PREPARATION AND ANTIMICROBIAL ACTIVITY OF 1,2,3-TRIAZOLE AND TRIAZOLIUM SALTS: STRUCTURE ACTIVITY RELATIONSHIP OF BENZYL GROUP IDENTITY

Andrew C. Klick and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

Due to the threat of bacteria and fungi evolving into drug-resistant strains, there is an ongoing need for the development of new small molecule therapeutics to combat such organisms. Both imidazole and 1,2,4-triazole rings are commonly utilized as components of antimicrobial small molecules. Despite the ability to efficiently prepare 1,2,3-triazole molecules via the recently developed Sharpless-Meldal Click reaction, significantly fewer examples of antimicrobial small molecules incorporating such 1,2,3-triazole rings have been reported. The goal of this study was to prepare a family of benzylated 1,4-disubstituted-1,2,3-triazole compounds, along with the corresponding triazolium salts, and complete a structure-activity relationship profile for the antimicrobial properties of this series of small molecules. The target compounds were prepared via one-pot tandem Click transformations, converting a series of benzyl bromide reactants (including 3-trifluoromethyl-, 4-trifluoromethyl-, 3-trifluoromethoxy- and 4-trifluoromethoxy-) into 1-benzylated-1,2,3-triazoles via substitution with sodium azide followed by Cu(I)-catalyzed Huisgen 1,3-dipolar cycloaddition with terminal alkyne co-reactant under aqueous reaction conditions. Product yields for this tandem reaction ranged from 30-93%. Derivatives were then converted to 3-benzylated and 3-alkylated triazolium salts, and the resulting family of compounds was tested for antifungal and antibacterial activity by performing minimum inhibitory concentration assays against *c. albicans*, *c. parapsilosis*, *c. tropicalis*, *c. krusei*, *s. epidermis* and *e. coli*. Details of the synthesis, characterization and antimicrobial assays will be presented.

NOVEL CIRCULAR DICHROISM SPECTROSCOPY TECHNIQUE FOR THE STUDY OF SECONDARY STRUCTURE OF PROTEINS ADSORBED TO SOLID SURFACES

Crystal Vander Zanden, Mark Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Bone mineralization is controlled by a group of proteins that function by adsorbing to the surface of hydroxyapatite crystals and modifying their growth. The adsorbed structures of these proteins are key to understanding this process. Circular dichroism (CD) is used to determine secondary structure of proteins in solution, but is difficult to apply to proteins adsorbed to solid surfaces because scattering of light by the solid particles creates large amounts of noise and signal distortion. A novel gel-suspension CD method was developed in which peptides were adsorbed to a solid surface and the adsorbed complex was suspended in sol-gel. This method greatly increases S/N and makes CD a viable option for studying adsorbed proteins. The protein osteocalcin was adsorbed to hydroxyapatite and secondary structure changes were observed in the presence and absence of free calcium ion. Characterization and validation of sol-gel as a non-interfering environment was also performed.

PREPARATION AND ANTIMICROBIAL ACTIVITY OF 1,2,3-TRIAZOLE AND TRIAZOLIUM SALTS: STRUCTURE ACTIVITY RELATIONSHIP OF TRIAZOLE COUNT

Rachel N. Fickes and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

A series of benzylated 1,2,3-triazole compounds were efficiently prepared via multi-step one-pot Sharpless-Meldal Click transformations. Benzyl bromide, α,α' -dibromo-*m*-xylene, α,α' -dibromo-*p*-xylene and 1,3,5-tris(bromomethyl)benzene were each reacted with sodium azide and terminal alkyne co-reactants to give a family of compounds with one, two or three 1,2,3-triazole units sharing the 1-benzyltriazole substructure. Target compounds were prepared from commercially available reactants in 65-82% yields via this approach. Because azole rings such as imidazole and 1,2,4-triazole are commonly found in antimicrobial small molecules, this family of compounds was targeted to determine whether the 1,2,3-triazole ring afforded similar biological activity and allow a rational examination of whether increasing the number of 1,2,3-triazole rings would impact such activity. Each derivative was also converted into 3-substituted-1,2,3-triazolium salts via benzylation or alkylation to examine how the cationic nature of such salts would impact antimicrobial activity. Minimum inhibitory concentration assays were performed against fungi *c. albicans*, *c. parapsilosis*, *c. tropicalis*, *c. krusei*, and bacteria *s. epidermis* and *e. coli*. in 96-well microtiter plates. Preliminary results indicate that increasing the quantity of 1,2,3-triazolium units led to the strongest antifungal and antibacterial activities, with the most active derivatives showing activity at less than 8 micromolar concentration. Details of the synthesis, characterization and antimicrobial studies for this family of compounds will be presented.

USE OF CHROMATOGRAPHY TO CHARACTERIZE A SUBSTRATE BINDING CONSTANT FOR A HIS-TAG IMMOBILIZED ENZYME

Benjamin White, A.M. Moser, and F.A. Kovacs, Department of Chemistry, University of Nebraska at Kearney, NE 68849

The analytical chromatographic method of frontal analysis has been used successfully to measure binding constant for ligands to proteins. The typical method of protein immobilization for these studies is via a covalent linkage of the protein to a silica resin. In this work we have demonstrated that an enzyme-substrate binding constant can be measured using a Histidine tag to immobilize the protein which can be done in much less time. We have expressed the enzyme ascorbate peroxidase (APX) from switch grass with a His-tag and immobilized it on a Ni-NTA linked agarose resin. We then measured the binding of the enzyme with the substrate, ascorbate. Although no binding constants have been measured previously for switch grass APX, our measured value ($K_d = 11.4 \pm 2.41$) for switch grass APX corresponds well to those for APX from the literature ($K_d = 11.6 \pm 0.4$).

CONTRAST PHASE MICROSCOPY AND DIGITAL HOLOGRAPHY

Robert Thomen, Creighton University, Omaha, NE 68178

Accurate measurements of the optical properties of living cells are essential for both therapeutic and diagnostic applications of biomedical optics. The cellular index of refraction is also of critical importance in cellular biomechanics measurements. In the optical stretcher, a dual-beam optical trap, small variations in the index of refraction can lead to substantial errors in the assessment of single-cell elasticity. To determine the cell-to-cell variation of the index of refraction, we have integrated a conventional transmitted light microscope into a Mach-Zehnder interferometer to obtain high-resolution interferograms of individual cells. Quantitative phase images are obtained by performing a Hilbert transform and using Goldstein's algorithm to unwrap the wrapped phase image. These phase images can then be used to calculate the cellular index. By employing several laser sources, the cellular index of refraction can be measured as function of wavelength. Results indicate that the refractive index can, in fact, vary significantly from cell-to-cell.

ABSOLUTE DETECTION EFFICIENCY OF A MICROCHANNEL PLATE DETECTOR

John E. Tiller, Garek A. Bebee, and D. R. Sieglaff, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln, NE 68504

A dual microchannel plate particle detector is being used to count the number of positive ions formed within an electron beam apparatus that is designed to measure absolute partial ionization cross sections in electron/molecule collisions. The absolute detection efficiency of the detector, among other things, must be determined in order to place cross section measurements upon an absolute footing. To determine the absolute detection efficiency, a beam of Ar^+ ions must be formed within an adjacent ion beam machine, admitted into the electron beam apparatus through a gate valve, and steered to strike the detector. The beam must then be electrostatically steered into a Faraday cup where the ion current can be measured using an electrometer. By rapidly switching the beam between the detector and the Faraday cup, fluctuations in the beam current can be averaged. Progress toward measurement of the absolute detection efficiency of the detector is reported.

MEASURING THE NONERGODICITY IN GLASSES BY ENSEMBLE-AVERAGED PHOTON CORRELATION SPECTROSCOPY

Eric D. Svingen and David L. Sidebottom, College of Arts and Sciences, Creighton University, Omaha NE 68178

Although dynamic light scattering is used to monitor the dynamics of glass-forming liquids above the glass transition temperature, in the glass phase the absence of ergodicity results in a partial arrest of these dynamics and traditional time-averaged measures fail to monitor the remaining dynamics. Instead, scattering data must be processed in an ensemble-averaged manner by integrating the scattering from multiple regions by slowly translating the sample. We report studies of glass-forming $2\text{Ca}(\text{NO}_3)_2 \cdot 3\text{KNO}_3$ (CKN) obtained below the glass transition temperature using a motorized translation system. Our findings will be used to assess the temperature dependence of the so-called nonergodic level that is predicted by certain mode-coupling theories to exhibit "cusp" near the mode coupling critical temperature.

RHO MESON PRODUCTION IN ULTRA-PERIPHERAL COLLISIONS AT THE RELATIVISTIC HEAVY ION COLLIDER

Jamison Duckworth and Janet Seger, College of Arts and Sciences, Creighton University, Omaha, NE 68102

Rho mesons are fundamental particles that have been observed in Ultra Peripheral Collisions (UPC's) of relativistic heavy ions. Research is done on Long Island, New York, at Brookhaven National Laboratory at the Relativistic Heavy Ion Collider (RHIC) which smashes beams of ions together at speeds near the speed of light. One type of collision is where two ions miss entirely but an electromagnetic interaction is still produced between the beams, this is called an Ultra Peripheral Collision. STAR, a Solenoidal Tracker At RHIC, has measured the rho photo production cross-sections in UPC's at various energies before. These cross sections serve as a "standard candle" with which to compare the cross sections of more exotic particles. This presentation will discuss how the analysis is done to determine how many rho mesons are produced in UPC's at RHIC.

CONSTRUCTION OF A PHOTOVOLTAIC ENERGY SYSTEM TO DETERMINE MAXIMUM EFFICIENCY

Jake Doyle, Department of Physics, Hastings College, Hastings, NE 68902

There has been much interest over the last 50 years in using energy from the sun to create photovoltaic energy. To investigate the properties of this energy, an experiment was conducted by creating a simple photovoltaic system consisting of a solar panel, charge controller, battery, and inverter. The system was designed to collect, store, and convert energy from the sun into alternating current electricity in the most efficient manner possible. Using data collected from a testing panel, the system is constructed to perform most efficiently based on surrounding temperature, orientation angle, and weather conditions. The effects of sunlight concentration are also investigated using the solar test panel. The results of the experiment provide information on designing photovoltaic systems to optimize overall performance.

DEVELOPMENT OF A FREQUENCY-DOMAIN PHASE-SENSITIVE FLUORIMETER TO QUANTIFY THE OXYGEN CONSUMPTION OF LIVING CELLS

Kristina Ward, Lonza Ramsey, and Michael G. Nichols, Department of Physics, Creighton University, Omaha, NE 68178

Fluorescence intensity has historically been used to measure the concentration of NADH of in living cells and tissues. Fluorescence lifetime imaging has shown that changes in metabolism results in significant shifts in the lifetimes and concentration of bound and free forms of NADH. To compare the metabolic state as revealed by two-photon imaging of NADH fluorescence with other measures of cellular metabolism, we have developed a non-invasive phase-fluorimetric technique to quantify the oxygen consumption of adherent cells. This optical method can be used in conjunction with NADH imaging techniques to provide a more complete assessment of cellular energetics. To test this instrument, We have used mitochondrial uncouplers and inhibitors with varying substrate and oxygen concentrations to adjust the metabolic state. We learned that as the glucose concentration is increased, the cell's metabolic rate increases, as expected. We also varied the temperature at which our experiments we taking place, and found that cells at room temperature had significantly lower consumption rates than those at 37 °C. We also tracked cell density, but found that this had a minimal effect on oxygen consumption rates. This work was supported by P20 RR016469 from the INBRE Program of the National Center for Research Resources, and by NIH R15-GM085776.

SEARCH FOR OXYGEN IN CALLISTO'S ATMOSPHERE

Mitchell J. Hain and N. J. Cunningham, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and J. R. Spencer, Planetary Science Directorate, Southwest Research Institute, Boulder, CO 80302-5142; and J. C. Green and C. S. Froning, Center for Astrophysics and Space Astronomy, University of Colorado, Boulder, CO 80309-0389

The aim of our study is to establish or constrain the presence of an O₂ atmosphere on Jupiter's moon Callisto. O₂ is the most plausible dominant atmospheric component supplying the observed ionospheric electrons. Photodissociation of O₂ should produce a measurable atomic oxygen component, which can be observed through far-ultraviolet spectroscopy. Past spectrographic observations with the Hubble Space Telescope have only produced upper limits on atomic oxygen. Using spectra of Callisto from Hubble's new, more sensitive Cosmic Origins Spectrograph, we seek to quantify the column density of atomic oxygen. We face a particular challenge in separating Callisto's emissions from the spectral signature of oxygen in the terrestrial geocorona, due to Callisto's significant angular diameter and the slitless design of the point-source-optimized spectrograph. We report our measurements of atomic oxygen flux and column density, and discuss the resulting constraints on Callisto's O₂ atmosphere.

THE RELATIVISTIC HEAVY ION COLLIDER AND ULTRA PERIPHERAL COLLISIONS

Jhenieve Enriquez, Department of Physics, Creighton University, Omaha, NE 68178

The Relativistic Heavy Ion Collider, RHIC, located at Brookhaven National Laboratory, collides heavy ions that have been stripped of their orbiting electrons. Primarily, gold is used. RHIC accelerates these ions through two beam lines and collides them head on at almost the speed of light. There are three different types of collisions that can occur: head on, grazing, and ultra peripheral. Creighton studies ultra peripheral collisions closely with STAR, the Solenoid Tracker at RHIC. An ultra peripheral collision occurs when the ions completely miss another but still pass closely enough to create an interaction between electric fields. We will discuss the analytical techniques used to reconstruct the vector mesons produced in these interactions with a particular emphasis on the J/ψ meson.

COLLEGIATE ACADEMY CHEMISTRY AND PHYSICS SESSION C

UNIVERSAL PATTERNS OF CLUSTER GROWTH IN AQUEOUS SUGARS OBSERVED BY DYNAMIC LIGHT SCATTERING

Tri D. Tran and Dave Sidebottom, College of Arts and Sciences, Creighton University, Omaha, NE 68178

Dynamic light scattering was performed on aqueous sugar solutions to monitor the growth of sugar clusters as a function of sugar concentration and temperature. Three sugars (glucose, maltose and sucrose) were investigated. Analysis of the hydrodynamic radius of the diffusing clusters suggests a two-stage process of cluster growth. At low volume fractions of sugar, a cluster phase consisting of nearly monodisperse clusters forms; with a mean cluster mass that increases in proportion to the volume fraction. A second stage of growth develops when clusters reach a size where they begin to overlap. In this later stage, cluster-cluster aggregation occurs and the cluster size grows in a common, but temperature dependent, power law fashion in advance of a percolation threshold near 83 wt% sugar.

THEORY, EXPERIMENTATION, AND ANALYSIS OF THE DOMINO EFFECT

Chris Webber, Department of Physics, Hastings College, Hastings, NE 68901

The domino effect is surprisingly more complex than it initially seems. It proposes that there is a certain propagation velocity that exists for any array of falling dominoes that is dependent on the height, thickness, and spacing of the dominoes. Collision theory, conservation laws, and the influence of friction all play a role in this effect; however, collision theory is the most important feature of this problem. Using a high-speed camera, data was taken and analyzed to confirm or deny previous theories. Recordings of the sound of the collisions were also made and sound analysis software was utilized to test the accuracy of the collision theory.

HARDWARE CONTROL SYSTEMS FOR THE STAR EXPERIMENT USING EPICS

Jordan Kellerstrass, Department of Physics, Creighton University, Omaha, NE 68178-0114

The Experimental Physics and Industrial Control System (EPICS) has been implemented for controlling and monitoring the STAR (Solenoidal Tracker at RHIC) experiment at Brookhaven National Laboratory. The system provides a common interface to all hardware subsystems. It regulates and measures approximately 30,000 parameters, such as temperatures and voltages. Much of the software has been produced by Creighton University students. A summary of the project and recent upgrades will be presented.

RHO PRODUCTION IN ULTRA PERIPHERAL PROTON-PROTON COLLISIONS AT RHIC

Jarrod K. Bang and J. Seger, Department of Physics, Creighton University, Omaha, NE 68178

At RHIC (Relativistic Heavy Ion Collider) two atomic nuclei are stripped of their surrounding electrons and accelerated to near the speed of light. Creighton is a member of the STAR (Solenoidal Tracker At RHIC) collaboration that studies UPC's (Ultra Peripheral Collisions) through the STAR detector. UPC's occur when two nuclei miss but pass each other at a very short distance yet still interact with one another electromagnetically. While the nuclei continue along the beam line particles are produced from the interaction. The production of rho mesons in UPC's of Au-Au interactions has been previously observed by the STAR collaboration. This talk will describe the process of looking for evidence of rho production in proton-proton UPC interactions. I will discuss techniques for identifying UPC's and describe how these techniques might be applied specifically to proton-proton data. I will discuss how rho mesons are expected to be identified in the data.

A COMPARISON OF TIME- AND STRAIN-DEPENDENT OPTICAL STRETCHING METHODS

Anya Burkart and Michael G. Nichols, Department of Physics, Creighton University, Omaha, NE 68178

The optical stretcher is a dual-beam trap used to study the biomechanical properties of single cells. Our studies have accurately determined the Young's modulus for single cells by measuring cellular deformation with respect to an applied incrementally-varying optical strain. We now are developing the ability to study the visco-elastic properties of cells, by applying a single increase in optical strain and measuring the deformation with respect to time. Most optical stretcher labs operate time-dependent procedures; however, strain-dependent methods may present some advantages and should be compared.

This research is funded by grant number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH).

DETECHIP 1.2: AN IMPROVED MOLECULAR SENSING ARRAY

Marcus M. Lyon, S. Sikich, J. Groathouse, M.V. Wilson, and A. E. Holmes, Department of Chemistry, Doane College, Crete, NE 68333-2401

DETECHIP 1.2 is a novel, highly selective, and sensitive molecular sensor that changes color and fluorescence in the presence of small molecules or analytes. This technology is a two buffer system which utilizes an array of eight sensing molecules that are dispensed in a 96-well plate. Color and fluorescent changes in the presence of analytes are recorded as a 32 digit binary code that is able to discriminate many substances without false negatives or positives. The current application is dedicated to testing narcotics and other drugs of abuse such as cocaine, tetrahydrocannabinol (THC) from marijuana, methamphetamine, and flunitrazepam. Shown to be a contactless, portable, and inexpensive optical detection system, DETECHIP 1.2 can detect many substances and can therefore be used where a high degree of preliminary diagnostics is needed. Besides narcotics, DETECHIP 1.2 is able to detect and discriminate OTC medications, TNT, pesticides, and narcotics laced with cutting agents. DETECHIP 1.2 offers possibilities for a simple, sensitive, selective, and affordable alternative to costly immunoassays.

AN INVESTIGATION OF THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AND SODIUM SULFATE AEROSOLS USING INFRARED SPECTROSCOPY

Yohei Kohno and Joshua P. Darr, Department of Chemistry, University of Nebraska at Omaha, Omaha, NE 68182

Sodium chloride and sodium sulfate aerosols have each been generated from an aqueous solution using an atomizer. Using a flow cell apparatus, infrared spectra of each of the aerosols have been acquired as a function of relative humidity in order to examine their hygroscopic properties. The resulting deliquescence and efflorescence relative humidities are in good accord with previous measurements acquired using different experimental techniques. Preliminary results of the hygroscopic properties of mixed sodium chloride and sodium sulfate aerosols containing varying relative abundances of each compound are also presented.

SYNTHESIS OF PENICILLIN DERIVATIVES AND THE USE OF PLANT EXTRACTS IN THE FIGHT AGAINST ANTIBIOTIC RESISTANCE

Kassandra Connell and David Peitz, Department of Physical Science and Mathematics; and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne, NE 68787

The mechanism of β -lactam antibiotic resistance is studied using ampicillin resistant bacteria. One known mechanism of resistance is the inactivation of penicillin, ampicillin and other β -lactam's by lactamase via hydrolysis of the amide bond. A series of plant extracts and synthetic derivatives of penicillin are studied to determine if the effects of sulbactam (a known inhibitor of antibiotic resistance) can be increased or duplicated. In this study, antibiotic resistant bacteria (*E. coli*), ampicillin, sulbactam, plant extracts, and phenolic derivatives of ampicillin are screened for possible inhibition of antibiotic resistance by monitoring the growth of bacteria under various combinations of treatment dilutions. Growth inhibition due to any combination of these components will be presented. This research was partially supported by the Nebraska INBRE grant # P20 RR16469.

SYNTHESIS AND CHARACTERIZATION OF ETHYNYLARENE COMPOUNDS AS SELECTIVE FLUORESCENT CHEMOSENSORS FOR DIVALENT ZINC, CADMIUM AND LEAD

Douglas E. Deever and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

Zinc is known to regulate transcription proteins and is involved in both immunological regulation and pancreatic insulin secretion. Because zinc cannot be detected directly through spectroscopic means, fluorescent chemosensors have been developed in order to study zinc in biological systems. Commercially available Zn(II) sensors largely generally rely on an internal charge transfer mechanism upon the binding of analyte to register a change in fluorescent intensity. One next generation approach to fluorescent chemosensor design incorporates freely rotating π -systems that rigidify upon binding analytes. Termed a conformational restriction mechanism, such an approach has the advantage that analyte detection can be varied independently of sensor identity. The goal of this study was to develop new Zn(II) fluorescent chemosensors operating via conformational restriction mechanisms under biologically relevant conditions. Utilizing triaryldiyne compounds with diamino substitution allowed for quick and simple creation of a library of sensor derivatives, including *ortho*, *meta* and *para* isomers with two succinic, glutaric, or diglycolic anhydride-derived chelating units. NMR, MALDI-TOF MS, and HPLC analysis was used to characterize and determine the purity of products, and high throughput fluorescent binding assays were used to screen this family of sensors against a wide range of divalent cations. In buffered aqueous solution the *meta* isomer was shown to detect Zn(II) as well as Cd(II) and Pb(II) but not Ca(II), Sr(II), Co(II), Cu(II), Mg(II) or Hg(II). The detection signal of this sensor involves a shift in fluorescence from 350 nm to 393 nm upon analyte binding. The *para* isomer sensor also selectively binds Zn(II), Cd(II) and Pb(II), forming a fluorescent precipitate detectable by eye using a hand-held UV lamp.

IMMUNOEXTRACTION OF NICOTINE FROM SERUM SAMPLES USING MAGNABIND® BEADS TO CREATE A STANDARD CURVE FOR NICOTINE QUANTIFICATION

Taylor L. Carlson and Annette C. Moser, University of Nebraska at Kearney, NE 68849

When measuring clinical serum samples, it is desirable to create a standard curve from 'blank' plasma samples. Unfortunately, small amounts of some compounds are naturally present in serum and prohibit the creation of a standard curve. One solution to this problem is to use immunoaffinity extraction coupled with magnetic bead technology to remove the undesired components from the serum prior to creating the standard solutions. Nicotine is a common compound found in human plasma even in nonsmokers. In this project, nicotine was stripped from human plasma using MagnaBind® magnetic beads coupled with an anti-nicotine antibody. Removal of the nicotine was verified by HPLC with UV-vis detection. Future work with this project will involve calculating the binding capacity, optimizing extraction conditions, and determining the number of times the Magnabind® beads can be regenerated.

INFLUENCE OF POLYMERIC EXCIPIENTS ON CARBAMAZEPINE HYDRATE FORMATION KINETICS IN AQUEOUS SLURRIES

Amanda L. Riesberg and A.D. Gift, Department of Chemistry, University of Nebraska at Omaha, Omaha, NE 68102-0109

Active pharmaceutical ingredient (API) can undergo an anhydrate-to-hydrate transformation during different stages of processing and this transformation may result in an unwanted crystal form of the API in the final drug product. The transformation of the anhydrate crystal to the hydrate crystal can affect various properties of the API including solubility, bioavailability, and stability and thus change the efficacy of the drug. The ability to inhibit this transformation is important to maintain control of the solid state form of the API during processing. The influence of various polymeric excipients was investigated to determine the inhibition on the model API, carbamazepine (CBZ), in aqueous slurries. A mass of 1.0 gram of CBZ was combined with 50 mL of aqueous solution containing a polymer. This solution was continuously stirred and the anhydrate-to-hydrate phase transformation of CBZ was monitored using in-line Raman spectroscopy. The collected spectra were used to create kinetic profiles of the transformations. The results showed that hydroxypropyl methylcellulose had inhibitory effects on the CBZ transformation. Additionally, the degree of substitution of the cellulose polymer and the chain length of the cellulose polymer showed varying inhibitory effects. Microscopic images of the hydrate crystals were also collected to determine changes in morphology of the CBZ hydrate after transformation.

THE SYNTHESIS OF WILD PLUM

Mitchell Trauernicht, Jordan Groathouse, and Andrea Holmes, Department of Chemistry, Doane College, Crete, NE 68333

A novel, highly fluorescent compound named 'Wild Plum' was prepared to camouflage skin imperfections. The synthesis of Wild Plum presented technical challenges. Several organic reaction conditions were explored to determine the most efficient method for this synthesis. The initial yields for Wild Plum ranged from 15 to 50%. This presentation will report how different experimental conditions can affect the yield of Wild Plum.

Supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources and by the NSF CHE-0747949.

THE USE OF ATR FT-IR AND TLC TO QUANTITATE AND IDENTIFY ORGANIC COMPOUNDS

Zach Sudbeck and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

Novel and complicated synthesis in an undergraduate organic chemistry class can be difficult to manage with large number of students, especially when the reactions do not give high yields or are difficult to purify in the time constraints of typical lab. GC/MS with an auto-sampler is an effective method to separate and identify substances but is costly, breakage is easy, and it is difficult to train 60 students in its use and in data retrieval. Attenuated Total Reflectance (ATR) FT-IR allows for sample to be directly analyzed without much sample preparation. The ATR adaptors are virtually maintenance free, rugged, and can stand up to typical, novice student use without breakage. However, acquiring an IR spectrum of a mixture generally leads to little useful information, so purification is needed. Here we will show an effective means of using FT-IR with low yielding reactions and mixtures. An ATR adapter can be used in combination with Thin Layer Chromatography (TLC) to separate and show qualitative functional group transformations to aid in identification. Difficulties associated with quantitation using FT-IR and TLC will be discussed. Traditional and non-traditional undergraduate organic lab reactions, such as converting phenols to ethers and esters, and alkenes to alcohols, will be evaluated for their effectiveness in using FT-IR with TLC.

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Special Recognition goes to Nebraska Wesleyan University for hosting our Annual Meeting and all the time and effort that entails.

The following individuals and organizations have contributed \$100 or more during the last year to help the Academy in promoting research and teaching of science and technology in high schools, community colleges, colleges, and universities throughout Nebraska.

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FRIEND OF SCIENCE AWARD TO ELIZABETH MULKERRIN



Elizabeth Mulkerrin, Director of Education at Omaha's Henry Doorly Zoo, began her career in secondary science education as a biology teacher in 1994.

Elizabeth received her B.S. in biology with an endorsement in secondary science from the University of Nebraska–Lincoln in 1994. She received her M.S. in school administration from University of Nebraska at Omaha in 1997 and is currently a doctoral candidate. Elizabeth is the recipient of the Nebraska Science Teachers Association Catalyst award, has written a chapter featured in the 2007 National Science Teacher Association Exemplary Informal Science Programs Monogram; and most recently was a featured keynote speaker at the Sino-U.S. science education forum in Shanghai, China.

Ms. Mulkerrin is responsible for establishing, promoting and maintaining formal and informal educational programs, developing educational graphics, managing over 500 volunteers, managing long distance learning programs, coordinating workshops for non-profit professionals, developing curriculum, and facilitating professional development workshops for educators.

Ms. Mulkerrin serves on several boards and advisory committees including Association of Zoos and Aquariums Conservation Education Committee, Metropolitan Science and Engineering Fair Board, National Informal Science Education Position Statement Committee, Glenwood Schools Curriculum Coordinating Council, and National Science Teacher Association Board of Directors. Elizabeth is strongly committed to science education and its future in today's society.

FRIEND OF SCIENCE AWARD TO WILLIAM WEHRBEIN



Bill Wehrbein majored in physics and mathematics at Nebraska Wesleyan University and studied planetary atmospheres at the University of Colorado-Boulder where he received a PhD in Astro-Geophysics. After a research appointment at the University of Washington he returned to Nebraska Wesleyan in 1981 where he served as physics department chair and faculty president before retiring in 2008. His primary teaching responsibility was the introductory physics course, which was transformed from the traditional lecture and lab to the highly interactive “hands-on” Workshop Physics format. In addition Wehrbein was active in general education revision at NWU and helped implement the Liberal Arts (freshman) Seminar program.

Wehrbein was president of the Nebraska Section of the American Association of Physics Teachers and served as section representative at national meetings. He has written as well as reviewed articles for the Association’s publications, *The Physics Teacher* and *The American Journal of Physics*. Wehrbein has served as secretary of the Nebraska Academy of Sciences, Inc. since 2002.

While at Wesleyan Wehrbein has been involved in several science enrichment workshops for high school students and teachers in rural areas sponsored by the NSF and the HHMI. He is currently physics coordinator for the Wesleyan Honors Academy, which provides him opportunities to work with teachers in some of Nebraska’s smaller high schools.

For many years Wehrbein has served as a judge at Kahoia Elementary and Lincoln city-wide science fairs, the Nebraska Science Olympiad, and occasionally the Junior Academy competition. He provides a “bulbs, batteries, and generator” experience for fourth graders visiting NWU from inner-city Omaha schools.

Although officially retired, Wehrbein maintains an office at NWU, serves on several college task forces, stays active in the life of the physics department, and even occasionally teaches a course.

Index

A

Aldrich 10, 65
Alfano 9, 61
Ali 11, 12, 68, 69, 74
Allen 19, 95
An 15, 85
Anthony 3, 40
Arkebauer 17, 88
Arp 7, 53
Atkin 22, 105
Augustin 21, 100
Austerberry 1, 31
Awasthi 1, 33

B

Babchuk 7, 54
Baker 8, 56
Balmat 4, 18, 40, 41, 91
Bang 27, 119
Barcomb 10, 63
Barent 20, 96
Bartles 4, 42
Bartz 10, 66
Bastola 12, 74
Batakin 25, 113
Bathke 18, 92, 93
Bearnese 22, 105
Bebee 26, 116
Beck 2, 34
Behney 5, 22, 44, 103
Belashchenko 15, 85
Bennett 3, 40
Bergman 18, 92, 93
Bernadt 18, 92
Bernhagen 20, 24, 99, 109
Bessick 5, 44
Bialas 24, 110
Bichsel 10, 67
Biondo 5, 44
Bishop 12, 75
Bishu 3, 38
Bjelkevig 15, 85
Blecha 14, 80
Boedeker 20, 24, 99, 109
Bohaty 17, 89
Bokashanga 12, 74
Boken 4, 41
Bosch 12, 71
Boutwell 10, 65
Brand 16, 86

Brauer 11, 70
Brewer 13, 76
Bricker 21, 23, 102, 106
Brockhouse 12, 75
Brown 23, 108
Bruce 8, 55
Bruckman 15, 84
Bruening 2, 36
Brust 8, 56
Bryant 20, 98
Buchmann 3, 8, 19, 39, 59, 94
Budak 7, 52
Buenafe 6, 50
Bunker 22, 105
Burk 8, 56
Burkart 27, 119
Burnett 14, 79

C

Cafer 6, 48
Canfield 23, 108
Cannon 25, 113
Cao 14, 80
Carey 3, 37
Carlson 12, 28, 73, 74, 121
Carmenaty 5, 45
Carper 3, 38
Caruso 16, 86
Cassada 13, 79
Cerutti 10, 63
Chan 11, 67
Chang 5, 46
Chen 4, 41
Cheung 2, 13, 34, 76
Cho 12, 75
Choe 13, 14, 78, 79
Christensen
 21, 28, 99, 100, 101, 120
Chu 4, 42
Chung 13, 78
Cirillo 23, 108
Condon 23, 108
Connell 28, 120
Cordes 12, 73
Cotten 22, 104
Cunningham 27, 118
Cutler 2, 36

D

Darr 28, 120
Dasgupta 4, 43
Davis 9, 16, 62, 88
Day 11, 67
Dean 5, 45
Deever 28, 121
Deffenbacher 11, 67
Del Vecchio 9, 60
Dempsey 11, 69
Denniston 8, 56
Destache 12, 73
Doan 10, 66
Doudin 16, 86
Dowben 15, 16, 85, 86, 87
Doyle 27, 117
Duckworth 26, 117
Duda 1, 15, 30, 31, 84
Dupper 14, 81
Durand 8, 11, 59, 69
Dwyer 3, 40

E

Egentowich 2, 33
Elbaum 3, 40
Elbert 10, 64
Elder 20, 97
Enders 15, 16, 83, 87
Engebretsen 21, 100
Enriquez 27, 118
Ericson 12, 73
Ettel 19, 94, 95
Evans 8, 58

F

Farmer 17, 89
Ferraro 20, 96
Fickes 26, 115
Fierstein 4, 42
Fletcher 24, 26, 28, 110, 111, 114,
 115, 121
Florindo 17, 89
Flowerday 7, 51
Freidline 14, 81
Friesth 10, 66
Froning 27, 118
Fukutani 16, 87
Fuller 22, 104

G

Gabel 1, 32
Gaddam 15, 85
Galano 11, 69
Gallagher 24, 110
Garcia 20, 96
Garrett 1, 30
Gates 17, 91
Gaulter 10, 67
Gaya 9, 63
Ge 3, 38
Gebregiworgis 13, 77
Gehring 3, 39
Geis 13, 78
Gerald 21, 101
Gerdes 24, 109
Ghosh 22, 105
Gift 24, 28, 110, 122
Gilkey 4, 42
Gitelson 17, 88
Goede 12, 73
Gogos 1, 2, 33, 36
Goodman 2, 34
Grandgenett 5, 45
Green 27, 118
Groathouse 24, 28, 111, 120, 122
Gu 1, 2, 32, 36
Guillaume 16, 86
Guy 11, 69

H

Hage 13, 14, 76, 79, 80, 81, 82
Hahn 21, 101
Hain 27, 118
Hake 12, 71
Hall 12, 74
Han 15, 85
Hansen 10, 67
Harbison 13, 77
Hardy 8, 59
Harner 8, 58
Harney 19, 94
Harrison 10, 11, 64, 69
Hart 3, 39
Harwood 17, 89
Hawken 24, 110
Hayes 18, 92, 93
Hebets 8, 57
Hicks 10, 65
Higley 22, 103
Hinrichs 17, 90
Hippen 21, 99
Hitchcock 7, 54
Hoelsing 29
Holly 11, 68

Holmes 24, 28, 110, 111, 120, 122
Horst 5, 46
Hossain 4, 42
Hou 14, 80
Hubbard 9, 61
Huben 3, 5, 37, 47
Hunt 3, 37

I

Isaacson 20

J

Jackson 13, 76
Jacobberger 2, 34
James 2, 5, 11, 34, 46, 70
Jamil 11, 69
Jamison 19, 94
Jarecki 9, 61
Jeong 9, 15, 61, 85
Jerrells 12, 72
Jones 6, 21, 22, 51, 100, 105
Jordan 10, 20, 66, 96
Joseph 14, 81

K

Kalal 13, 79
Kamerkar 9, 62
Karki 16, 86
Karpisek 9, 61
Karr 2, 5, 34, 44, 45
Kavan 9, 61
Kebaara 22, 105
Kegey 11, 69
Kelber 15, 85
Kellerstrass 27, 119
Kelley 4, 42
Kettler 17, 90
Keyte 5, 44
Kilbride 8, 56
Kim 10, 63
Kirchner 9, 63
Kizilkaya 16, 86
Klick 26, 114
Klinkebiel 11, 67
Knutson 18, 93
Kohnno 28, 120
Kokrda 23, 106
Kong 15, 85
Konvalina 11, 68
Konz 8, 55
Kovacs 26, 115
Kreminska 2, 34, 35
Kuhlenengel 24, 109
Kuska 20, 96

L

Lachel 11, 67
Lai 14, 82
Lansu 8, 55
Lawrence 13, 76
Lee 15, 85
Leite 4, 18, 40, 41, 91, 92
Létard 16, 86
Levell 4, 41
Levy 17, 89
Li 20, 24, 99, 109
Limato 1, 32
Liu 15, 16, 85, 86
Loope 17, 90
Losovyj 15, 16, 85, 87
Lozova 16, 87
Lukashev 16, 87
Lukens 20, 99
Luo 16, 86
Lush 6, 49
Lutzoni 9, 63
Lyon 24, 28, 110, 120

M

Machal 12, 72
Maddox 11, 23, 70, 108
Maika 19, 95
Marley 20, 98, 99
Marquez 5, 46
Martin 4, 41
Masek 17, 88
Matsuda 14, 80
Matthews 5, 45
Mauck 2, 22, 33, 103
McCormick 5, 47
McDevitt 9, 60, 61
McGinn 14, 20, 23, 82, 96, 97, 107
McKinney 20, 23, 98, 108
McMullen 12, 73
Medvar 1, 32
Mei 13, 16, 76, 86
Miadlikowska 9, 63
Milikovic 20, 24, 99, 109
Miller 10, 65
Monahan 9, 60
Moriyama 21, 100
Mosel 25, 112
Moser 25, 26, 28, 112, 115, 121
Muhleisen 11, 70
Murphy 25, 113
Myers 3, 37

N

Naik 4, 5, 42, 45
Naish 17, 89
Nawandar 10, 63
Neilson 2, 36
Nelson 4, 21, 42, 43, 102
Newsome 22, 103
Nguyen 9, 60
Nguy-Robertson 17, 88
Niazi 20, 24, 99, 109
Nichols
 15, 25, 27, 84, 112, 117, 119
Nickerson 22, 105
Nielsen 8, 11, 56, 69
Nigro 4, 41
Nothwehr 18, 92

O

O'Connor 17, 91
O'Donnell 3, 40
Opere 11, 69
O'Reilly 6, 49

P

Papastavros 13, 79
Pattison 10, 65
Pauley 11, 68
Pawloski 22, 104
Pearcy 21, 100
Peitz 28, 120, 123
Peng 17, 88
Pfaunmiller 14, 82
Pham 12, 73
Pierce 12, 71
Platz 8, 55
Porta 2, 35
Potane 10, 65
Powell 17, 89
Powers 13, 77
Prinz 23, 106
Prososki 12, 73

R

Rack 17, 89
Rajapitamahuni 16, 86
Rajurkar 2, 33
Ramaekers 4, 43
Ramsey 27, 117
Reedy 4, 11, 40, 70
Rees 23, 107
Reichter 19, 95
Reicks 24, 111
Reilly 24, 111

Restau 20, 96
Rice 8, 57
Richter-Egger 5, 45
Ridder 25, 113
Riesberg 28, 122
Robine 18, 92
Romary 4, 41
Rundquist 4, 5, 17, 41, 44, 88

S

Sabbah 14, 80
Sabirianov 16, 87
Santana 15, 85
Sapignoli 7, 54
Schalles 3, 39, 40
Schmidt 20, 98
Schnell 15, 83
Schrack 9, 60
Schultz 20, 98
Score 3, 11, 39, 70
Seberg 10, 63
Seger 26, 27, 117, 119
Sell 7, 52
Shaffer 9, 59
Shaw 8, 58
Shepherd 16, 86
Shibata 12, 71, 72, 73
Shoiab 12, 72
Shurts 23, 108
Shuster 5, 45
Sidebottom 26, 27, 116, 118
Sieglaff 26, 116
Sikich 24, 28, 110, 111, 120
Simon 8, 9, 58, 63
Singh 13, 77
Siu 4, 43
Skov 6, 50
Smith 1, 32
Snow 13, 79
Sokolov 16, 86
Soo 13, 76
Soto 10, 66
Soukup 9, 12, 60, 61, 71
Specht 20, 96
Spencer 27, 118
Spurgeon 1, 30
Steele 11, 67
Steinert 2, 36
Stergiou 3, 5, 37, 48
Stewart 10, 63
Stromer 2, 25, 35, 112

Strydom 9, 59
Stubbendieck 8, 57
Sudbeck 28, 123
Suh 4, 43
Sullivan 9, 62
Summerson 4, 42
Sutton 21, 102
Suyker 17, 88
Svingen 26, 116
Svoboda 18, 92
Swain 2, 33
Swanson 10, 63, 64
Synhorst 23, 107

T

Takacs 13, 79
Talley 7, 53
Tang 15, 18, 85, 93
Tapprich 5, 9, 47, 62
Tarry 1
Tefft 5, 47
Thacker 13, 78
Thapa 12, 74
Thiesen 21, 101
Thomen 26, 116
Tiller 26, 116
Tong 14, 81
Topp 5, 45
Torpin 1, 31
Toyama 13, 79
Tran 21, 27, 102, 118
Trauernicht 24, 28, 111, 122
Tucker 4, 41
Tuma 8, 59

U

Urbach 23, 108

V

Vander Zanden 26, 114
van Dijk 9, 61
Van Waes 11, 70
Vennerstrom 14, 80
Vergen 15, 25, 84, 112
Verma 17, 88
Vinton 8, 57
Vogel 23, 108
Volpe 4, 41
von Behren 10, 65
Vuran 3, 40

W

Waddle 12, 75
Wall 18, 92
Wandsnider 6, 50
Wang 3, 13, 15, 39, 76, 85
Wanninayake 15, 84
Ward 27, 117
Warnke 11, 68
Watts 4, 42
Webber 27, 119
Weber 17, 90
Weedon 8, 59
Wehrbein 19, 94
Weidman 4, 42
Wells-Kingsbury 13, 76
White 26, 115
Whitson 10, 64, 65
Wichers 11, 67
Williams 20, 98
Wilson 24, 26, 28, 110, 111, 114, 120
Woldemariam 15, 83
Woo 12, 75
Woolman 14, 82
Worley 13, 77
Wortman 5, 47
Wright 3, 39
Wu 13, 15, 16, 76, 85, 86, 87

X

Xiao 15, 85
Xuan 13, 76

Y

Yakovkin 15, 16, 85, 87
Yang 14, 80
Yentes 5, 48
Young 4, 18, 40, 92
Yule 1, 32

Z

Zaitouna 14, 82
Zardeneta 21, 100
Zera 8, 57
Zha 14, 82
Zhang 3, 13, 15, 16, 38, 77, 85, 86
Zhong 14, 80, 82
Zhou 15, 85

