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**PROGRAM
and
PROCEEDINGS
THE NEBRASKA ACADEMY
OF
SCIENCES**

1880-2013

including the

Nebraska Association of Teachers of Science

(NATS) Division

Nebraska Junior Academy of Sciences

(NJAS) Division

and

Affiliated Societies



133rd Anniversary Year

One Hundred-Twentythird Annual Meeting

April 19, 2013

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

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The 2013 Fall Conference of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, September 26 - September 28 (Thursday, Friday, and Saturday).

President: Mary Moser, Pawnee City High School, Pawnee City, NE

President-Elect: Katie Ramsey, Grand Island Public Schools, Grand Island, 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 /Nebraska Chapter, Nat'l Council Sections

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 17 - 19, 2013, Covenant Cedars Bible Camp, Hordville, 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 19 - 20, Joint Mtg w/ Ks, IA, MO, NE and SE South Dakota
NW Missouri State University, Maryville, MO

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 \$15.00 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 41 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* has moved to a digital format. 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. Manuscripts should be submitted via the online submission system at <http://digitalcommons.unl.edu/tnas/guidelines.html> using the Submit your paper or article link

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

PROGRAM

FRIDAY, APRIL 19, 2013

- 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
- 8:30 Biological and Medical Sciences, Session A, Olin 112
Biological and Medical Sciences, Session B, Smith Callen Conference Center
NE Chapter, Nat'l Council For Geographic Education, Olin 325
Junior Academy, Judges Check-In, Olin 219
Junior Academy, Senior High REGISTRATION, Olin Hall Lobby
- 8:40 Chemistry and Physics, Section A, Chemistry, Olin A
- 9:00 Chemistry and Physics, Section B, Physics, Planetarium
Collegiate Academy, Chemistry and Physics, Session A, Olin 324
Junior Academy, Senior High Competition, Olin 124, Olin 131
- 9:10 Aeronautics and Space Science, Poster Session, Olin 249
- 9:15 Anthropology, Olin 111
- 9:30 NWU Health and Sciences Graduate School Fair, Olin and Smith Curtiss Halls
- 10:30 Aeronautics and Space Science, Poster Session, Olin 249
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN B
Bob Feurer, North Bend High School, Making People Smarter Using "Habits of Mind"
- 12:00 LUNCH, PATIO ROOM, STORY STUDENT CENTER
(pay and carry tray through cafeteria line, or pay at NAS registration desk)
Aeronautics Group, Sunflower Room
- 1:00 p.m. 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
Collegiate Academy, Biology Session A, Olin B
Collegiate Academy, Biology Session B, Olin 249
Collegiate Academy, Chemistry and Physics, Session B, Olin 324
Junior Academy, Judges Check-In, Olin 219
Junior Academy, Junior High REGISTRATION, Olin Hall Lobby
Junior Academy, Senior High Competition, (Final), Olin 110
- 1:15 Anthropology, Olin 111
- 1:20 Teaching of Science and Math, Olin 224
- 1:25 Applied Science and Technology, Olin 325
- 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
- 5:45 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. VARIABILITY IN AGN ABSORPTION LINES BASED ON HUBBLE SPACE TELESCOPE/COS DATA. Ben Schmachtenberger* and Jack Gabel, Department of Physics, Creighton University, Omaha.
- 8:10 2. BALQSO KINETIC LUMINOSITY DETERMINATION WITH C III*. Daniel McGinnis* and Jack Gabel, Department of Physics, Creighton University, Omaha.
- 8:20 3. BREWSTER ANGLE MICROSCOPY AND CHARACTERIZATIONS OF LANGMUIR FILMS. Adrian Sanabria-Diaz* and Timothy Reece, Department of Physics and Physical Science, University of Nebraska at Kearney.
- 8:30 4. SORTING LIGHT'S TOTAL ANGULAR MOMENTUM FOR COMMUNICATION SYSTEMS. Nathan Scott Brady* and Liubov Kreminska, Department of Physics and Physical Science, University of Nebraska at Kearney; and Thein An Nguyen, Giovanni Milione, and Robert Alfano, Department of Physics, Institute for Ultrafast Spectroscopy and Lasers, City College of New York, NY.
- 8:40 5. THE PHOSPHORYLATION PATTERN OF RPA2, IN RESPONSE TO DOUBLE-STRAND BREAKS, DIFFERS DEPENDING ON THE LOCATION IN THE CELL AND THE PHASE OF THE CELL CYCLE. Kerry Brader* and Gloria Borgstahl, Eppley Institute, University of Nebraska Medical Center, Omaha.
- 8:50 6. THE DIOPHANTINE EQUATION $Ax^4 + By^4 = Cz^4$ IN QUADRATIC FIELDS. Melissa Emory, Department of Mathematics, University of Nebraska at Omaha.
- 9:00 7. THE SBML STANDARD TO SHARE COMPUTATIONAL MODELS OF BIOLOGICAL SYSTEMS. Bryan Kowal, Department of Mathematics, University of Nebraska at Omaha.
- 9:10 BREAK/POSTER PRESENTATIONS

- 9:30 8. HIGH SPEED ELECTRO-DISCHARGE DRILLING AND WIRE ELECTRODE-DISCHARGE MACHINING OF TITANIUM ALLOYS FOR AEROSPACE APPLICATIONS. K.P. Rajurkar, Department of Engineering, University of Nebraska–Lincoln.
- 9:40 9. ROUTING OVER THE INTERPLANETARY INTERNET. Joyeeta Mukherjee and Byrav Ramamurthy*, Department of Computer Science and Engineering, University of Nebraska–Lincoln.
- 9:50 10. WIRELESS INTEGRATED RELAY SYSTEM (WIRS). Shawn Schumacher, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 10:00 11. HUMAN REACTIONS TO FLUCTUATING NOISE CONDITIONS AS PRODUCED BY LOW-BOOM SUPERSONIC AIRCRAFT. Andrew Hathaway* and Lily Wang, Charles W. Durham School of Architectural Engineering and Construction, University of Nebraska–Lincoln.
- 10:10 12. NONINVASIVE, AMBULATORY, LONG-TERM , DEEP GASTROINTESTINAL BIOSENSOR AND IMPLANTER. Alfred Tsubaki* and Benjamin Terry, Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 10:20 13. RECONFIGURATION PLANNING OF MODULAR ROBOT UNDER UNCERTAINTY. Ayan Dutta*, Prithviraj Dasgupta, and José Baca, Department of Computer Science, University of Nebraska at Omaha; and Carl Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. DYNAMIC GAIT ADAPTION IN FIXED CONFIGURATION FOR MODULAR SELF-RECONFIGURABLE ROBOTS USING FUZZY LOGIC CONTROL. José Baca*, Raj Dasgupta, and Ayan Dutta, Department of Computer Science, University of Nebraska at Omaha; and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 11:00 15. EARLY STAGE DEVELOPMENT OF A MEDICAL DEVICE FOR NON-INVASIVE MEASUREMENT OF INTRACRANIAL PRESSURE. Jeff Hawks* and Tyler Ketchum, Department of Mechanical and Materials Engineering; and Max Twedt, Biological Systems Engineering, University of Nebraska–Lincoln.

- 11:10 16. COMPLIANT LAPAROSCOPIC SURGICAL GRASPER. Alan Goyzueta*, Linxia Gu, and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln; and Brittany Woodin, Department of Biomedical Engineering, University of Iowa, Iowa City, IA.
- 11:20 17. MODULAR JOYSTICK FOR VIRTUAL REALITY SURGICAL SIMULATION. Michael Head and Carl Nelson*, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln; and Ka-Chun Siu, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha.

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. NOVEL ASSISTIVE LOCOMOTOR TOOL FOR GAIT REHABILITATION IN THE ELDERLY. Eric Cutler* and Dan Blanke, Department of Health, Physical Education and Recreation, University of Nebraska at Omaha.
- 8:10 2. GAIT VARIABILITY HAS NO RELATION TO COGNITIVE PERFORMANCE ON THE PHONETIC FLUENCY TEST. Ryan Hasenkamp* and Sara Myers, Department of Health, Physical Education and Recreation, University of Nebraska at Omaha.
- 8:20 3. EFFECT OF TACTILE STIMULI ON LOCOMOTOR RHYTHM. Jung Hung Chien, Mukul Mukherjee, Sara Myers, Yawen Yu, Mu Qiao*, and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.
- 8:30 4. UNDERGRADUATE RESEARCH PIPELINE IN MATHEMATICS. Griffith Elder, Department of Mathematics, University of Nebraska at Omaha.
- 8:40 5. COLLEGE OF SAINT MARY ELEMENTARY SCIENCE OUTREACH PROGRAM. Kelly Lane*, Kathryn Dearing*, and Jeff Keyte, Department of Biology, College of Saint Mary, Omaha.
- 8:50 6. FOSTERING STUDENT AWARENESS ON GLOBAL CLIMATE CHANGE AND ENVIRONMENTAL STEWARDSHIP THROUGH CURRICULAR AND CO-CURRICULAR ACTIVITIES. Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha.

- 9:00 7. AUTONOMOUS RC CAR. Blake E. Ross*, Quinn Fogle*, and Bill Spurgeon, Business and Information Technology, Western Nebraska Community College, Scottsbluff.
- 9:10 BREAK/POSTER PRESENTATIONS
- 9:30 8. HIGH ALTITUDE BALLOON SOLAR PANEL VOLTAGE VARIATION. Josh Gebbie, Department of Math and Natural Science, Metropolitan Community College, Omaha.
- 9:40 9. MICROBENTHIC ALGAE DENSITIES IN THE DUPLIN WATERSHED. Gina Gilson* and John Schalles, Department of Biology, Creighton University, Omaha; and John O'Donnell, Department of Atmospheric Sciences, Creighton University, Omaha.
- 9:50 10. ESTIMATING UNCERTAINTY OF REFLECTANCE AND ERROR PROPAGATION IN VEGETATION INDICES. Tarlan Razzaghi*, Anatoly Gitelson, and Donald Rundquist, School of Natural Resources, University of Nebraska–Lincoln.
- 10:00 11. ESTIMATING SURFACE VISIBILITY ON THE U.S. EAST COAST: INCORPORATING THE AEROSOL VERTICAL PROFILE FROM GEOS-5. Amy Kessner* and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska Lincoln; and Robert Levy, Climate and Radiation Lab, NASA Goddard Space Flight Center, Greenbelt, MD; and Peter Colarco, Atmospheric Chemistry and Dynamics Lab, NASA Goddard Space Flight Center, Greenbelt, MD.
- 10:10 12. EFFECTS OF VOLCANIC EMISSIONS ON THE EARTH-ATMOSPHERE SYSTEM. Levi Boggs* and Cui Ge, Department of Earth and Atmospheric Science, University of Nebraska–Lincoln.
- 10:20 13. OBSERVING THE TRANSPORTATION OF DUST ON EARTH USING MISR. Carly Baumann* and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. ARGOS AND MICROGRAVITY FREE FLYER EVALUATION. Christian Laney*, Department of Electrical Engineering; and Jacob Reher, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 11:00 15. UNL LUNABOTICS TEAM: DESIGNING A ROBOT FOR THE NASA LUNABOTICS ROBOT COMPETITION. Kevin Kreis, Department of Mechanical Engineering; and Avery Quandt*, Department of Computer Engineering, University of Nebraska–Lincoln.

- 11:10 16. DESIGN, BUILD, FLY. Derek Stevens, Department of Mechanical Engineering; and Mirzoramshed Mirzokarimov*, Department of Electrical Engineering, University of Nebraska–Lincoln.
- 11:20 17. UNIVERSITY STUDENT LAUNCH INITIATIVE. Bryan Kubitschek, Department of Mechanical and Materials Engineering; and Mirzoramshed Mirzokarimov*, Department of Electrical Engineering, University of Nebraska–Lincoln.
- 11:30 18. EHD THIN FILM BOILING IN MICROGRAVITY ENVIRONMENTS. Mirzoramshed Mirzokarimov, Department of Electrical Engineering, University of Nebraska–Lincoln.

AERONAUTICS AND SPACE SCIENCE

Chairperson: Scott E. Tarry

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

POSTER SESSION

9:10 – 9:30 A.M. & 10:30 – 10:50 A.M.

Olin Hall Room 249

ANALYZE THIS – BUILDING BETTER CRITICAL THINKERS THROUGH PROBLEM ANALYSIS. Andrew Montgomery, STEM Education, University of Nebraska at Omaha.

IMPROVING NOCTURNAL FIRE PROPERTY RETRIEVAL WITH THE VISIBLE INFRARED IMAGING SPECTROMETER’S DAY-NIGHT-BAND. Thomas Polivka, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln.

COMBINING SATELLITE OBSERVATIONS OF FIRE ACTIVITY AND NUMERICAL WEATHER PREDICTION TO IMPROVE THE PREDICTION OF SMOKE EMISSIONS. David Peterson* and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln.

SEARCH FOR ASYMMETRIC INTERACTIONS BETWEEN CHIRAL MOLECULES AND SPIN-POLARIZED ELECTRONS. Joan Dreiling* and Timothy Gay, Department of Physics, University of Nebraska–Lincoln.

AUTOIGNITION IN AN UNSTRAINED METHANOL/AIR MIXING LAYER. Inkant Awasthi* and George Gogos, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.

ANALYSIS OF THE HST/COS SPECTRUM OF THE MASS OUTFLOW IN SEYFERT 1 GALAXY MRK 279. Zach Monti* and Jack Gabel, Department of Physics, Creighton University, Omaha, NE.

CHARACTERIZATION OF A 5.8KV SIC PIN DIODE FOR ELECTRIC SPACE PROPULSION APPLICATIONS. Alexandra Toftul*, Tanya Gachovska, and Jerry Hudgins, Department of Electrical Engineering, University of Nebraska–Lincoln.

WIRELESS POWER TRANSFER: DESIGN AND APPLICATION. Nicholas Goeser* and Caleb Berggren, Department of Mechanical Engineering, University of Nebraska–Lincoln.

FORCE SENSING OF GRASPING EVENTS FOR MINIATURE SURGICAL ROBOTS. Thomas Frederick, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.

UNDERSTANDING WALKING AND BREATHING COUPLING WHEN ABNORMAL BREATHING PATTERNS ARE PRESENT. Jennifer Yentes* and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

EXAMINING THE QUALITY OF MODIS REFLECTANCE PRODUCTS USING A FOUR-BAND SPECTRORADIOMETER. Anthony Nguy-Robertson*, Andy Suyker, Yi Peng, and Anatoly Gitelson, School of Natural Resources, University of Nebraska–Lincoln; and Toshihiro Sakamoto, Ecosystem Informatics Division, National Institute for Agro-Environmental Sciences, Tsukuba, Japan; and Timothy Arkebauer, Department of Agronomy and Horticulture, University of Nebraska–Lincoln.

INVESTIGATING LAND AND ATMOSPHERE CHARACTERISTICS DURING THE 2012 CENTRAL PLAINS DROUGHT USING MODIS AND TRMM PRODUCTS. Amy Kessner*, Jun Wang, and Ambrish Sharma, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln; and Laura Judd, Department of Earth and Atmospheric Sciences, University of Houston, TX.

ANTHROPOLOGY

Co-chairpersons: Matthew Douglass and Gwyneth Talley

Department of Anthropology

University of Nebraska–Lincoln

Olin Hall 111

9:15 a.m. WELCOME

- 9:35 1. A MARXIST APPROACH TO US HISTORICAL ARCHAEOLOGY: A REVIEW AND SUMMARY OF THE HISTORY AND APPLICATION OF MARXISM ON THE FIELD OF HISTORICAL ARCHAEOLOGY IN THE US. John Fitzpatrick III, Department of Anthropology, University of Nebraska–Lincoln.
- 9:55 2. JOHN COLLIER, ANTHROPOLOGY, AND THE INDIAN NEW DEAL. Terry Ahlstedt, Department of History, University of Nebraska–Lincoln.
- 10:15 3. COLONOWARE AND CULTURE: THE CHANGING INTERPRETATION OF 17TH CENTURY CERAMIC TRADITIONS IN THE SOUTH EASTERN UNITED STATES. Mike Chodoronek, Department of Anthropology, University of Nebraska–Lincoln.

- 10:35 4. CREOLE COTTAGES AND GARDEN ESTATES: SPACE AND PURPOSE IN EARLY NEW ORLEANS. Nora Greiman, Department of Anthropology, University of Nebraska–Lincoln
- 10:55 5. QUALITY CONTROL FOR IN-FIELD PHOTOGRAPHY: DIGITAL CURATION AND NON-COLLECTIONS OF ARTIFACTS. Erin Carr, Department of Anthropology, University of Nebraska–Lincoln.
- 11:15 6. ASSESSING LITHICS THROUGH COLOR METRICS. Erin Carr and Kasey Mathiesen, Department of Anthropology, University of Nebraska–Lincoln.
- 11:35 7. REFITTING OF STONE ARTIFACTS USING COLORIMETRIC ANALYSIS. Kasey Mathiesen, Department of Anthropology, University of Nebraska–Lincoln.
- 11:55 8. THE RESTORER OF THE REPUBLIC: AN ANALYSIS OF AUGUSTUS’S SOCIAL, MORAL, AND POLITICAL REFORMS WITH REGARDS TO THE ROMAN FAMILY. Holly Staggs, Department of Anthropology, University of Nebraska–Lincoln.
- 12:15 LUNCH
- 1:15 FACULTY TALK- DR. EMILY HAMMERL
- 1:30 9. A COMPARISON BETWEEN MID-EIGHTEENTH CENTURY RURAL AND URBAN CHESAPEAKE ELITE CONSUMPTION PATTERNS OF WILD FAUNA. Gaby Lapera, Department of Anthropology, University of Nebraska–Lincoln.
- 1:55 10. CORTEX RATIO AS A MEASURE OF ARTIFACT TRANSPORT IN THE OGALALA NATIONAL GRASSLANDS. Nora Greiman and Bailey Lathrop, Department of Anthropology, University of Nebraska–Lincoln.
- 2:15 11. GENERATING INFERENCES ABOUT MOBILITY AND ECONOMIZATION IN THE OGLALA NATIONAL GRASSLANDS FROM MODELS OF LITHIC USE LIFE AND EXPERIMENTAL CORE REDUCTION. Kyle Sass and Justin King, Department of Anthropology, University of Nebraska–Lincoln.
- 2:35 12. METRIC AND NON-METRIC INDICATORS OF SEX IN THE POSTCRANIA OF ADULT SKELETONS USING BINARY LOGISTIC REGRESSION. Audrey Jaksich and Dan Osborne, Department of Anthropology, University of Nebraska–Lincoln.
- 2:55 13. GIVING OR SELLING?: EXAMINING ORGAN EXCHANGE IN THE GLOBAL ORGAN TRADE. John J. Wagoner, Department of Anthropology, University of Nebraska–Lincoln.

- 3:15 14. WOMEN WARRIORS: AN INTRODUCTORY TO THE NEW MOROCCAN CULTURAL EQUESTRIANS. Gwyneth Talley, Department of Anthropology, University of Nebraska–Lincoln.
- 3:35 15. WHAT DO YOU GET FROM HER STORY?- DISCOURSE ANALYSIS OF AN INTIMATE PARTNER VIOLENCE VICTIM’S POST IN A PUBLIC ONLINE DISCUSSION FORUM. Shuhong Luo, College of Education, University of Nebraska–Lincoln.
- 3:55 16. THE EFFECTS OF TRANSRACIAL ADOPTION ON FAMILY DIVERSITY. Kristine Sudbeck, Department of Anthropology, University of Nebraska–Lincoln.
- 4:15 FACULTY TALK -- DR. MATTHEW DOUGLASS
- 4:30 FACULTY TALK - DR. LUANN WANDSNIDER

APPLIED SCIENCE AND TECHNOLOGY

Chairperson: Mary Ettel
Wayne State College, Wayne
Olin Hall 325

- 1:25 OPENING REMARKS
- 1:30 1. INVESTIGATING THE PHYSICO-CHEMICAL PROPERTIES OF NAFION® MEMBRANE TO IMPROVE ITS EFFICIENCY IN DIRECT METHANOL FUEL CELL (DMFC). Evan Canning* and Darius Agoumba, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 1:45 2. CHARACTERIZATION OF ANODIZED ALUMINUM PLATES FOR APPLICATIONS IN THIN LAYER CHROMATOGRAPHY. Alexis Sieh*, Mary Ettel, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 2:00 3. SPECTROSCOPIC STUDIES OF PLANAR CHIRAL CHROMIUM COMPLEXES. Seth Dallman* and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.

BIOLOGICAL AND MEDICAL SCIENCES

Chairperson: Annemarie Shibata
Department of Biology, Creighton University

SESSION A

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

- 8:30 1. STRUCTURAL CHARACTERIZATION OF A MAMMALIAN RIBOSWITCH IN THE SPERMINE BIOSYNTHETIC PATHWAY. Zachariah Holmes*, K. Del Vecchio, M. McDevitt, Department of Chemistry; and J. Monahan, G. Soukup, Department of Biomedical Sciences; and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.
- 8:42 2. EXAMINATION OF THE STRUCTURE AND FUNCTION OF A MAMMALIAN RIBOSWITCH IN ORDER TO DESIGN ANTI-CANCER DRUGS. Katherine M. Bauer* and Juliane Soukup, Department of Chemistry, Creighton University, Omaha.
- 8:54 3. INTRON DEGENERATION IN THE LICHEN FUNGI TELOSCHISTES. Derek Kleier* 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.
- 9:06 4. THE ROLE OF SEPTIN CDC3 IN CELL WALL INTEGRITY IN *CANDIDA ALBICANS*. Tanner Johnson* and Jill R. Blankenship, Department of Biology, University of Nebraska at Omaha.
- 9:18 5. FUNGAL DIVERSITY OF A COTTONWOOD ROOT SYSTEM. Jeff A. Shaw* and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney; and Mary J. Harner, Department of Biology, University of Nebraska at Kearney and Crane Trust, Wood River.
- 9:30 BREAK
- 9:45 6. CHARACTERIZATION OF AN ENVIRONMENTAL PHAGE LYSOGEN OF *MYCOBACTERIUM SMEGMATIS*. Apryl Benedict* and Lara Madison, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 9:57 7. SEPTIN ASSOCIATING PROTEINS IN *CANDIDA ALBICANS*. Elizabeth H. Hutfless* and Jill R. Blankenship, Department of Biology, University of Nebraska at Omaha.

- 10:09 8. INVESTIGATION OF THE ROLE OF SEPTINS IN *CANDIDA ALBICANS*. Mitchell Chlopek* and Jill R. Blankenship, Department of Biology, University of Nebraska at Omaha.
- 10:21 9. CARBON DIOXIDE RECEPTOR GENES IN THREE SPECIES OF *SIMULIUM*. Emily N. Hendricks*, Charles Brockhouse, and the Simulium Genomics consortium, department of Biology, Creighton University, Omaha.
- 10:43 10. EVOLUTIONARY DEVELOPMENT OF pH TOLERANCE TO FLUCTUATING ENVIRONMENT IN EXPERIMENTAL *ESCHERICHIA COLI* LINEAGES. Lee G. Weiner*, Vinay Panchal, Lee W. Noel, and Nicholas J. Revers, College of Arts and Sciences, Creighton University, Omaha.
- 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. EXPERIMENTAL INOCULATION OF NESTLING HOUSE SPARROWS (*PASSER DOMESTICUS*) WITH BUGGY CREEK VIRUS. Ellecia Rainwater* and Carol Fassbinder-Orth, Department of Biology, Creighton University, Omaha.
- 8:42 2. AVIAN ADAPTIVE IMMUNE RESPONSES TO BUGGY CREEK VIRUS (*TOGAVIRIDAE: ALPHAVIRUS*) AND ITS ARTHROPOD VECTOR, THE SWALLOW BUG (*OECIACUS VICARIUS*). Virginia Barak*, Charles Brown and Carol Fassbinder-Orth, Department of Biology, Creighton University, Omaha.
- 8:54 3. ANALYSIS OF CORTICOSTERONE LEVELS BETWEEN MALE AND FEMALE RED-WINGED BLACKBIRD NESTLINGS. Michele Stretch* and L.M. Reichart, Department of Biological Sciences, University of Nebraska at Kearney.
- 9:06 4. EFFECTS OF CORTICOSTERONE ON THE MATERNAL BEHAVIOR OF THE PRAIRIE SKINK, *PLESTIODON SEPTENTRIONALIS*. Alexander J. Anton* and James D. Fawcett, Department of Biology, University of Nebraska at Omaha; and Tracy Langkilde and Sean Graham, Department of Biology, Pennsylvania State University, PA.
- 9:18 5. POLLINATION PROCESSES AND RATES IN *NUPHAR*. Diane Cooley* and Mackenzie Taylor, Department of Biology, Creighton University, Omaha.
- 9:30 BREAK

- 9:45 6. NEUTRAL LIPID ACCUMULATION IN *CHLAMYDOMONAS* AND ALGAL ISOLATES COLLECTED IN THE MIDWEST. Amanda Kobayashi*, Byeong-ryool “BJ” Jeong, Allison Fees, Sean Awakuni, Amanda Bittar, and Karin van Dijk, Department of Biology, Creighton University, Omaha; and Heriberto Cerutti, School of Biological Sciences, University of Nebraska–Lincoln.
- 9:57 7. THE HrpG PROTEIN OF *PSEUDOMONAS SYRINGAE* IS A TYPE III CHAPERONE POTENTIALLY INVOLVED IN REGULATING THE TYPE III SECRETION SYSTEM. Meghan Smith*, Andrew Karpisek, Hayley Geisterfer, Andrew Markham, and Karin van Dijk, Department of Biology, Creighton University, Omaha.
- 10:09 8. THE SEARCH FOR THE *PSEUDOMONAS SYRINGAE* EFFECTOR PROTEINS INVOLVED IN CAUSING EPIGENETIC CHANGES AND DISEASE IN THE HOST PLANT *ARABIDOPSIS THALIANA*. Gloria Larson*, Michael Visenio, and Hayley Geisterfer, Department of Biology, Creighton University, Omaha; and James Alfano, Department of Plant Pathology, University of Nebraska–Lincoln; and Karin van Dijk, Department of Biology, Creighton University, Omaha.
- 10:21 9. EFFECT OF ZINC AND NITROGEN DEPRIVATION ON LIPID ACCUMULATION IN *CHLAMYDOMONAS*. Kelsie M. Musil*, K.C. Brungardt, and P. Twigg, Department of Biology, University of Nebraska at Kearney.
- 11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCE

SESSION C

Session Chairperson: Julie Shaffer, University of Nebraska Kearney
Olin 112

- 1:00 1. COMPUTATIONAL SELF-ASSEMBLY OF PHOSPHOLIPID BILAYERS. Matthew Armbruster*, William Marquart, and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 1:12 2. CONFORMATIONAL DYNAMICS OF THE SYRIAN HAMSTER PRION PROTEIN DURING INTERACTION WITH A MODEL LIPID BILAYER. Saad Malik* and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 1:24 3. COARSE GRAIN MOLECULAR DYNAMICS ANALYSIS OF THE INTERACTION BETWEEN AB ALZHEIMER’S PROTOFILAMENTS AND A LIPID BILAYER. Nathan Horst*, Amtt Armbruster, Brendy Aoki and Patricia Soto, Department of Physics, Creighton University, Omaha.

- 1:36 4. CHARACTERIZATION OF THE PUTATIVE DNAK-SUPPRESSOR PROTEIN IN THE LYME DISEASE SPIROCHETE *BORRELIA BURGDORFERI*. Tia Hadley* and T. J. Bourret, Department of Biology, University of Nebraska at Kearney.
- 1:48 5. STUDYING THE MECHANISM CAUSING ABNORMAL GROWTH OF *T. GONDII* IN COPS7B OVEREXPRESSING U-2 OS HOST CELLS. Steven V. Ready*, Sydney Zach, Matthew Christenson, Andrew Trease, and Paul H. Davis, Department of Biology, University of Nebraska at Omaha.
- 2:00 BREAK
- 2:12 6. EFFECTS OF *TOXOPLASMA GONDII* GROWTH IN U-2 OS HOST CELLS THAT OVEREXPRESS THE GENE CYP17. Sarah Lehn*, Matthew Christenson, Andrew Trease, Sydney Zach and Paul Davis, Department of Biology, University of Nebraska at Omaha.
- 2:24 7. CHARACTERIZING A POTENTIAL STAGE SPECIFIC TRANSCRIPTION FACTOR IN *TOXOPLASMA GONDII*. Matthew K. Christenson* and Paul H. Davis, Department of Biology, University of Nebraska at Omaha.
- 2:36 8. A COMPARISON OF RIVER OTTER LATRINE SITES ALONG THE SOUTH LOUP RIVER AND THE PLATTE RIVER IN NEBRASKA. Kelsey Seifert* and Joseph T. Springer, Department of Biology, University of Nebraska at Kearney.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

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

- 1:00 1. ANALYSIS OF A NOVEL COMBINATION OF ANTI-RETROVIRAL NANOPARTICLES FOR HIV PROPHYLAXIS. Krista LaBruzzo* and Annemarie Shibata, Department of Biology; and Abhijit Date and Christopher Destache, School of Pharmacy and Health Professions, Creighton University Omaha; and Emily McMullen, University of Iowa Carver College of Medicine, Iowa City, IA.
- 1:12 2. CHARACTERIZATION OF THE SITE OF NORA VIRUS REPLICATION IN *DROSOPHILA MELANOGASTER*. Justin L. Buchanan*, Brad L. Ericson, Darby J. Carlson, and Kimberly. A. Carlson, Department of Biology, University of Nebraska at Kearney.

- 1:24 3. A COMPARISON OF NATURALLY OCCURING VIRULENT AND AVIRULENT COXSACKIEVIRUS B3 5' UNTRANSLATED REGION SECONDARY STRUCTURE. Jerome Prusa* and William Tapprich, Department of Biology University of Nebraska at Omaha.
- 1:36 4. OTOTOXIC ANTIBIOTIC-INDUCED CHANGES IN COCHLEAR METABOLISM GENERATE CELL-DAMAGING FREE RADICALS. K. G. Ward* and M.G. Nichols, Department of Physics; and H. Jensen-Smith Department of Biomedical Sciences, Creighton University, Omaha.
- 1:48 5. SPATIALLY RESOLVED PROFILING OF MULTICELL SPHEROIDS BY NADH FLUORESCENCE LIFETIME IMAGING MICROSCOPY. L.V. Zholudeva*, Department of Chemistry, and M.G. Nichols, Department of Physics, Creighton University, Omaha.
- 2:00 BREAK
- 2:12 6. HABITAT OCCUPANCY OF RED-TAILED HAWKS IN AGRICULTURAL LANDSCAPES. Kaitlyn Darveau* and T.L. Freeman, Department of Biology, College of Natural and Social Sciences, University of Nebraska at Kearney.
- 2:24 7. EXPRESSION OF AVIAN TIMP2 IN *PICHTIA PASTORIS*. Emma R. Hoppe*, S. Cho, and M.V. Reedy, Department of Biology, Creighton University, Omaha; and P.R. Brauer, Department of Biomedical Sciences, Creighton University School of Medicine, Omaha.
- 2:36 8. NON-MUSCLE MYOSIN II MAINTAINS NEURAL PROGENITORS AND SUPPRESSES NEURONAL DIFFERENTIATION. Curtis Perriotte-Olson*, Allison Dougherty, Minhan Ka, Deeba Baig, and Woo-Yang Kim, Developmental Neuroscience Department, University of Nebraska Medical Center, Omaha.

CHEMISTRY AND PHYSICS

Chairperson:

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

SECTION A, CHEMISTRY

Olin LH-A

8:40 a.m. WELCOME

8:45 1. USE OF ENTRAPMENT TO PREPARE COLUMNS CONTAINING ALPHA1-ACID GLYCOPROTEIN FOR RAPID STUDIES OF DRUG-PROTEIN BINDING BY HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY. Cong (Penny) Bi*, Rong Li, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

9:05 2. METAL DECORATED CERIUM OXIDE CATALYSTS: SYNTHESIS AND APPLICATION TO BIOPOLYMER HYDROLYSIS. Zane C. Gernhart*, Y. Zhou, N.J. Lawrence, J.J. Burke, K.O. Sonnenfeld, and C.L. Cheung, Department of Chemistry, University of Nebraska–Lincoln.

9:25 3. DEVELOPMENT OF AN ON-LINE FORMAT FOR STUDYING DRUG-PROTEIN BINDING BY HIGH-PERFORMANCE IMMUNOAFFINITY CHROMATOGRAPHY. Ryan Matsuda*, Donald Jobe, Jared Beyersdorf, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

9:45 BREAK

9:55 4. USE OF PHILISA RAPID THERMOCYCLER IN UNDERGRADUATE BIOCHEMISTRY LABORATORIES. Erika N. Crawford*, R.B. Lomneth, and J.L. Kreiling, University of Nebraska at Omaha.

10:15 5. EVALUATION OF MODIFIED MONOLITH COLUMNS USING HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY. Zhao Li*, Shannon Lum, Robert Hougas, Theresa Greving, Steven M. Gross, Erika Pfaunmiller, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

10:35 6. STABILIZATION OF INTERNAL CHARGED TRANSFER BY INTRAMOLECULAR H-BOND IN N-ARYL-1,8-APHTHALIMIDES. Junqi Wang* and Haishi Cao, Department of Chemistry, University of Nebraska at Kearney.

10:55 BREAK

11:00 MAIBEN LECTURE

- 1:00 p.m. WELCOME
- 1:05 7. INTER AND INTRAMOLECULAR REACTION OF CARBANIONS WITH PEROXIDES: AN UMPOLED APPROACH TO CYCLIC ETHERS. Benjamin Puffer, Rachel Willand-Charnley*, and Patrick H. Dussault,* Department of Chemistry, University of Nebraska–Lincoln.
- 1:25 8. ANALYSIS OF FREE FRACTIONS FOR CHIRAL DRUGS USING AFFINITY MICROCOLUMNS AND MULTI-DIMENSIONAL HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY. Xiwei Zheng*, Michelle J. Yoo, David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 1:45 9. NOVEL SMILES PHOTOREARRANGEMENT AND INTRAMOLECULAR OXIDATIVE PHOTODISPLACEMENT OF HYDROGEN BY AN AMINE. Qiao Song* and Gene G. Wubbels, Department of Chemistry, University of Nebraska at Kearney.
- 2:05 BUSINESS MEETING / BREAK
- 2:15 10. HOMOLOGY MODELING AND DOCKING STUDIES OF CXCR7/LIGAND COMPLEXES. Jacques V. Anthony*, Benadette Ngamelue, and Haizhen A. Zhong, Department of Chemistry, University of Nebraska at Omaha.
- 2:35 11. PROTEIN ENTRAPMENT IN SILICA SUPPORTS FOR STUDYING INTERACTIONS OF PROTEINS WITH SMALL MOLECULES BY HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. John Vargas Badilla*, Abby Jackson, Jeanethe A. Anguizola, and David S. Hage, Department of Chemistry, University of Nebraska– Lincoln.
- 2:55 12. SIMPLE METHOD FOR THE ENANTIOSELECTIVE SYNTHESIS OF BETA HYDROXY THIOESTER DERIVITIVES OF N-ACETYL CYSTEAMINE. Andrew S. Olson* and Patrick H. Dussault, University of Nebraska–Lincoln.
- 3:15 CLOSING COMMENTS

CHEMISTRY AND PHYSICS

Chairperson: Renat Sabirianov
Department of Physics
University of Nebraska at Omaha

SECTION B, PHYSICS

Planetarium

- 9:00 a.m. WELCOME
- 9:10 1. CONSTRAINTS ON UNIVERSAL EXTRA DIMENSIONS THEORY FROM DARK MATTER DIRECT DETECTION. Christopher S. Lefky, College of Arts and Sciences, Creighton University, Omaha.
- 9:30 2. LARGE MAGNETORESISTANCE OF MNBI/BI/MNBI SPIN VALVE. N. N. Al-Aqtash* and R. F. Sabirianov, Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln and Department of Physics and Astronomy University of Nebraska at Omaha; and K. Tarawneh, Department of Science and Humanities, Princess Sumaya University for Technology (PSUT) Amman, Jordan.
- 9:50 3. MAGNETO-RESISTANCE IN THIN FILM BORON CARBIDES. Elena Echeverria, Department of Physics, University of Nebraska–Lincoln.
- 10:10 4. THE POSSIBILITY OF CAUSAL PARADOX WITH THE ALCUBIERRE DRIVE. Adam N. Davis, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 10:30 5. TWO PHOTON FLUORESCENCE CORRELATION SPECTROSCOPY OF PROTEINS IN GLUCOSE SOLUTIONS. Eric Hauger*, N.S. Holman, M. G. Nichols, D. L. Sidebottom, and E. J. Haas, Department of Physics, Creighton University, Omaha.
- 10:50 6. A CHARACTERIZATION OF CROSSTALK IN THE PSI46V2 PIXEL READ OUT CHIP. Cameron Bravo* and Aaron Dominguez, University of Nebraska–Lincoln.
- 11:10 7. LESS THAN PERFECT C_{2v} SYMMETRY: LOSS OF MIRROR PLANE SYMMETRY IN ANGLE-RESOLVED PHOTOEMISSION. Thomas T. Scott, Department of Physics and Astronomy, University of Nebraska–Lincoln.
- 11:30 8. MARTENSITIC TRANSITION IN SHAPE MEMORY NIMNIN ALLOYS. R. Sabirianov*, N. Al-Aqtash, University of Nebraska at Omaha; and A. Sokolov, University of Nebraska–Lincoln.

NEBRASKA CHAPTER, NATIONAL COUNCIL
FOR GEOGRAPHIC EDUCATION

Chairperson: J. Clark Archer
University of Nebraska–Lincoln
Olin 325

- 8:30 a.m. 1. ESTIMATING RANGELAND BIOMASS WITH LANDSAT IMAGERY. Christine A. Nycz, Department of Geography and GIScience, University of Nebraska–Lincoln.
- 8:50 2. RADAR INTERFEROMETRY OF LAND CHANGES DUE TO RECENT EARTHQUAKES IN NEBRASKA AND SOUTH DAKOTA. Nathan Pindell* and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 9:10 3. PLEISTOCENE HORSES FROM SIX MILE BUCKLE, CHAVEZ COUNTY, NM. Benjamin S. Brechtel, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 9:30 4. COMPARING MEASURES OF THE DEMOGRAPHIC IMPACT OF MIGRATION. Glen Humphress, Department of Geography and GIScience, University of Nebraska–Lincoln.
- 9:50 5. HISTORICAL GIS FOR SPATIAL ANALYSIS: CIVIL WAR WASHINGTON EXPERIENCE. Rob Shepard, Department of Geography and GIScience, University of Nebraska–Lincoln.
- 10:10 6. GEOGRAPHY EDUCATION: PAST, PRESENT, AND FUTURE. Kristin Sorensen, Department of Geography and GIScience, University of Nebraska–Lincoln.
- 10:30 7. A POLITICAL-GEOGRAPHICAL PERSPECTIVE ON THE 2012 U.S. PRESIDENTIAL ELECTION. J. Clark Archer, Department of Geography and GIScience, University of Nebraska–Lincoln.

TEACHING OF SCIENCE AND MATH

Chairperson: Julia Polak

Exeter-Milligan Public Schools, Exeter

Olin 224

1:20 p.m. WELCOME

- 1:30 1. PHAGE HUNTING WITH HHMI'S SEA-PHAGE PROGRAM. Wendy Jamison* and James Bahensky, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 1:45 2. DEVELOPMENT OF A RESEARCH BASED ORGANIC LABORATORY SEQUENCE. Logan Fischer* and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 2:00 3. A COLLEGIATE LABORATORY EXERCISE FOR GENOTYPING A HUMAN SINGLE NUCLEOTIDE POLYMORPHISM. James E. Fernando*, B. A. Carlson, T. S. LeBard, M. R. McCarthy, F. Umali, F. F. Rose, Jr., Department of Biology, Union College, Lincoln.
- 2:15 4. MOLECULES TO CELLS: A FIRST-YEAR LEARNING COMMUNITY COMBINING GENERAL CHEMISTRY 1 AND CELL BIOLOGY. Tessa Durham Brooks, Kate Marley*, and Erin Wilson*, Department of Biology and Chemistry, Doane College, Crete.
- 2:30 5. LEARNING THE TENANTS OF HUMAN BIOMECHANICS THROUGH RESEARCH ON THE HUMAN GAIT. Lara L Madison, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 2:45 BREAK
- 3:00 6. COMPUTER SIMULATION OF SLEEP APNEA AND CONGESTIVE HEART FAILURE. Emily Pfeifer*, Elizabeth Warner*, and Josef Kren, Bryan College of Health Sciences, Lincoln.
- 3:15 7. PATHOPHYSIOLOGY OF FATTY LIVER, COMPUTER SIMULATION, AND MODELING. Melissa Sukhram, Rachel James*, Amy Morton, and Josef Kren, Bryan College of Health Sciences, Lincoln.

- 3:30 8. COMPUTER SIMULATION OF ACUTE RENAL FAILURE. Allyse Edwards, Kurt Kuhl, and Sarah Wadas*, and Josef Kren, Bryan College of Health Sciences, Lincoln.
- 3:45 9. PATHOLOGY OF STRESS: PREDICTIONS AND SIMULATIONS. Emilea Harrahill*, and Lacey Huber, and Josef Kren, Bryan College of Health Sciences, Lincoln.
- 4:00 10. UNDERSTANDING PHARMACOKINETICS THROUGH STELLA MODELS. Lan Le*, Miles Hadley, Nicole Schlautman, and Josef Kren, Bryan College of Health Sciences, Lincoln.

COLLEGIATE ACADEMY

BIOLOGY

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

SESSION A

Olin LH-B

- 8:00 a.m 1. RNAi OF SPERMATHECAE GENES IN *DROSOPHILA MELANOGASTER*: FUNCTIONAL EFFECTS ON SPERM STORAGE. Jami Pritschau*, Department of Biology, Nebraska Wesleyan University, Lincoln; and L. Harshman and B. Stork, School of Biological Sciences, University of Nebraska–Lincoln.
- 8:12 2. DETERMINATION OF INTRA-SPECIES COMMUNICATION (QUORUM SENSING) WITHIN *MYCOBACTERIUM SMEGMATIS* USING *STREPTOMYCES COELICOLOR*. John P. Kersenbrock* and A. L. McKinney, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:24 3. AN INVESTIGATION INTO THE CHANGES IN PROTEIN GLYCOSYLATION AND ANTIGENICITY DUE TO MUTATIONS IN THE *A064R* GENE OF THE *PARAMECIUM BURSARIA* CHLORELLA VIRUS. Emily K. Dierks* and G. A. Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:36 4. CARBON FIBER REINFORCED POLYETHERETHERKETONE (CF-PEEK)—NEXT GENERATION IN ORTHOPEDIC INTERNAL FIXATION MATERIALS. Jordan Kershner*, Department of Biology, Nebraska Wesleyan University, Lincoln; and David L. Samani, Bryan Medical Center West, Lincoln.
- 8:48 5. EARLY LEARNING EXPERIENCE AND RESVERATROL SUPPLEMENTS EFFECT IL-6 AND NEUROTROPHIC FACTOR GENE EXPRESSION. Ben Siems, Department of Psychology, Nebraska Wesleyan University, Lincoln.

- 9:00 6. THE EFFECT OF MOISTURE, RELATIVE HUMIDITY, AND GROWTH STAGE ON *FUSARIUM* SPP. IN AIR AND GRAIN SAMPLES OF SORGHUM. Joshua R. Aldridge*, Department of Biology, Nebraska Wesleyan University, Lincoln; and D. L. Funnell-Harris, Grain, Forage, and Bioenergy Research Unit (GFBRU), United States Department of Agriculture-Agricultural Research Service (USDA-ARS), and Department of Plant Pathology, University of Nebraska– Lincoln.
- 9:12 7. EFFECTIVENESS OF BAYER INSECTICIDE EAR TAGS ON THE CONTROL OF FACE, HORN, AND STABLE FLIES AND THE IMPACT OF FLY REDUCTION ON WEIGHT GAIN IN CATTLE. Tiffany N. Hoaglund*, Department of Biology, Nebraska Wesleyan University, Lincoln; and David Boxler and Rick Funston, West Central Research and Extension Center, University of Nebraska–Lincoln, North Platte.
- 9:24 BREAK
- 9:36 8. THE ROLE OF NF- κ B SIGNALING IN MAMMARY EPITHELIAL CELL DIFFERENTIATION. Alex M. Crouse*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Dulce Maroni and Mayumi Naramura, Eppley Institute for Research in Cancer and Allied Diseases, University of Nebraska Medical Center, Omaha.
- 9:48 9. ANALYSIS OF THE STRUCTURE, CONSERVED REGIONS, AND EVOLUTIONARY HISTORY OF ULBP3 PROTEIN. Christianne M. Kroeker*, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 10:00 10. BIG BLUESTEM ECOTYPIC DIFFERENCES IN LEAF NITROGEN CONTENT AS A POSSIBLE MECHANISM FOR INCREASED PERFORMANCE OF CENTRAL KS ECOTYPE IN RECIPROCAL GARDENS PLANTED ACROSS THE GREAT PLAINS. Amber Jensen*, Department of Biology, Nebraska Wesleyan University, Lincoln; Loretta Johnson, Kansas State University, Manhattan, KS; Sara Baer, Southern Illinois University, Carbondale, IL; and Brian Maricle, Fort Hays State University, Hays, KS.
- 10:12 11. IDENTIFICATION OF A PUTATIVE NUCLEAR LOCALIZATION SEQUENCE IN HUMAN MCM10. Jacob Wragge, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 10:24 12. COLLECTION OF METABOLIC FINGERPRINTS FROM ROOTS OF *ARABIDOPSIS THALIANA* DURING A GRAVITY STIMULUS USING PROTON NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. Autumn M. Longo*, Mark V. Wilson, and Tessa L. Durham Brooks, Departments of Biology and Chemistry, Doane College, Crete.

- 10:36 13. HARVESTING AND PURIFYING BONE MINERALIZATION-REGULATING PROTEINS FROM UMR-106 RAT SARCOMA CELL LINE. Jordan Pieper*, Jacob Kringle*, Kate Marley, and Erin Wilson, Doane College, Crete.
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN LH-B
- 12:00 LUNCH
- 1:00 14. *LISTERIA MONOCYTOGENES* INLA AS POSSIBLE DRUG DELIVERY SYSTEMS. Nathan Broeker*, D. Christensen, and S. Percy, Department of Life Sciences; and G. Zardeneta, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 1:12 15. ISOLATION OF INLB FROM *LISTERIA MONOCYTOGENES* AND ITS USE AS A DRUG DELIVERY AGENT. Trent Ahlers*, D. Christensen, and S. Percy, Department of Life Sciences; and G. Zardeneta, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 1:24 16. ACTIVITY AND FREQUENCY OF THE ITPA P32T VARIANT AMONG COLORECTAL PATIENTS. Carrie Brown*, Department of Life Sciences Wayne State College, Wayne; and C. Grabrow, Y. Pavlov and G. Borgstahl, Eppley Institute for Research in Cancer, University of Nebraska Medical Center, Omaha.
- 1:36 17. OPTIMIZING MOMP, VIA MUTAGENESIS, FOR USE AS A *CHLAMYDIA TRACHOMATIS* VACCINE. Nicole McKenna*, D. Christensen, and S. Percy, Department of Life Sciences; and G. Zardeneta, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.
- 1:48 18. THE EFFECTS OF COTTON NEMATODE ON SOYBEAN AND CORN AND THE EFFECTS OF COVER CROPS IN SUPPRESSING SOY BEAN CYST NEMATODE NUMBERS. Erica R Dickmeyer* and G. Dappen, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:00 19. EFFECT OF THE OVIPOSITOR ON LOCOMOTION AND PREDATOR AVOIDANCE IN HOUSE CRICKETS (*ACHETA DOMESTICA*). Stephanie Densberger, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:12 20. OBSERVATION OF COTTONTAIL RABBIT (*SYLVILAGUS FLORIDANUS*) TAIL BEHAVIOR IN NON-PREDATOR ENVIRONMENTS. Lauren Wight, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:24 BREAK

- 2:36 21. EFFECTS OF PRENATAL EXPOSURE TO CHLORPYRIFOS AND ATRAZINE ON ACETYLCHOLINESTERASE LEVELS IN SPRAGUE-DAWLEY RATS. Allison Kern, Department of Biology, Hastings College, Hastings.
- 2:48 22. EFFECTS OF LOW LEVEL INTERMEDIATE EXPOSURE TO ATRAZINE AND CHLORPYRIFOS IN SPRAGUE-DAWLEY RATS. Kevin D. Wright, Department of Biology, Hastings College, Hastings.
- 3:00 23. THE DEVELOPMENT OF THE SENTINEL ORGANISM *RANA PIPIENS*. Matthew K. Christenson*, Andrew J. Trease, Steven V. Ready, Lindsey A. Knight, Alan S. Kolok, and Paul H. Davis, Department of Biology, University of Nebraska at Omaha.
- 3:12 24. VIRUSES AND STRESS RESPONSE OF *APHIS GLYCINES*. Daniel Cloonan*, Laramy Enders, and Nicholas Miller, University of Nebraska–Lincoln.
- 3:24 25. GENETIC BASIS OF FLOWER COLOR POLYMORPHISM IN *IOCHROMA CALYCINUM*. Rachel A. Coburn and Randi Griffin, School of Biological Sciences, University of Nebraska–Lincoln; and Stacey D. Smith, School of Biological Sciences, University of Nebraska–Lincoln; and Department of Human Evolutionary Biology, Harvard, Boston, MA
- 3:36 26. ANALYSIS OF MANNITOL CRYSTALS ON POTASSIUM LEVELS OF RED BLOOD CELLS UTILIZING HEART/LUNG PUMP. Laura McQuiston, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:48 27. LINKING OF GENOMIC CONTIGS OF THE CHLOROVIRUSES IL-3A AND Br0604L USING PCR-DNA SEQUENCING. Tyler A. North* and Garry A. Duncan, 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. INVESTIGATION OF METHYLATION STATUS OF CADHERIN GENES IN CANCER CELL LINES FROM PROSTATE, OVARIAN AND BREAST CANCERS. Kelsey Stark*, Maire Rose Donnelly, and Kate Marley, Department of Biology, Doane College, Crete.

- 1:12 2. EVALUATION OF N-CADHERIN PROTEIN EXPRESSION AFTER TREATMENT OF BT-20 HUMAN BREAST CANCER CELLS WITH METHYLATION INHIBITORS. Maire Rose Donnelly*, N. Lukens, S. Pracht, K. Stark, and Kate Marley, Department of Biology, Doane College, Crete.
- 1:24 3. STUDYING THE IMPACT OF EPIGALLOCATECHIN-3-GALLATE, A COMPONENT OF GREEN TEA, ON BREAST CANCER STEM CELLS. Zachary J. Wordekemper* and Kate Marley, Department of Biology, Doane College, Crete.
- 1:36 4. THE EFFECT OF TEMPERATURE ON MINIMUM INHIBITORY CONCENTRATIONS OF ANTIBIOTIC RESISTANT BACTERIA. Ischel Gonzalez-Kelso*, B.S. Mauck, P.M. Higley, Department of Biology, College of Saint Mary, Omaha.
- 1:48 5. EFFECT OF OXYGEN ON ANTIBIOTIC RESISTANCE IN BACTERIA ISOLATED FROM THE PLATTE RIVER. Megan Gunderson*, B.S. Mauck, and P.M. Higley, Department of Biology, College of Saint Mary, Omaha.
- 2:00 6. COMPARISON OF ANTIBIOTIC RESISTANT BACTERIA FROM URBAN AND RURAL WATER SOURCES. Ana Laura Ortiz-Morales*, B.S. Mauck, P.M. Higley, Department of Biology, College of Saint Mary, Omaha.
- 2:12 7. HEAVY METAL RESISTANCE IN BACTERIAL ISOLATES FROM URBAN AND RURAL WATER SOURCES. Melina Baeza Villa*, B.S. Mauck, and P.M. Higley, Department of Biology, College of Saint Mary, Omaha.
- 2:24 BREAK
- 2:36 8. AN EVALUATION OF VARIOUS LYOPHILIZATION STABILIZERS AND CYCLES USING A MONOVALENT BOVINE VIRUS VACCINE. Jason S. Brooks*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Wanda Isaacson and Andrew T. Scobey, Formulations, Pfizer-Zoetis, Lincoln.
- 2:48 9. ARE RUNNERS SUPPORTED OR SABOTAGED BY THE MODERN RUNNING SHOE? James M. Bahensky*, Ryan D. Ackerman, Coleman J. Ahrens, Brittany C. Chacon, Ben F. Ruckhaus, Karly M. Watson, Crista R. Wolf, and Lara L. Madison, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 3:00 10. ARM REHABILITATION DESIGN FOR CEREBRAL PALSY. Mary Hernandez, College of Engineering, University of Nebraska–Lincoln.

- 3:12 11. MODELING CIRCADIAN BLOOD HORMONE FLUCTUATIONS IN *GRYLLUS FIRMUS*: IDENTIFICATION AND DEVELOPMENT OF MODEL PARAMETERS. Matthew Shuman, Department of Biology, University of Nebraska–Lincoln.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

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

SESSION A

Session Chairperson, David Treichel
Olin 324

- 9:00 a.m. 1. KEPLER MISSION TRANSIT SEARCHES IN THE COLLEGE PHYSICS ADVANCED LAB. Platte Gruber* and Nathaniel J. Cunningham, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln.
- 9:12 2. Φ MESON PHOTOPRODUCTION IN AU-AU ULTRAPERIPHERAL COLLISIONS AT RHIC. Barak R. Gruber* and J. Seger (for the STAR collaboration), Department of Physics, Creighton University, Omaha.
- 9:24 3. THE DESIGN AND TESTING OF A ROBOTIC HAND TO DETERMINE ITS QUALIFICATION AS AN ADEQUATE PROSTHETIC DEVICE. Jordan Borrell, Department of Physics, Hastings College, Hastings.
- 9:36. 4. DETERMINATION OF PIEZOELECTRIC CHARACTERISTICS OF PZT CERAMICS USING LASER INTERFEROMETRY. Jacob Braunberger, Department of Physics, Hastings College, Hastings.
- 9:48 5. INTERFACING EPICS WITH THE LABVIEW CONTROL OF THE BARREL CALORIMETER AT STAR. Charles Costello*, Ryan Gnabasik, Jiro Fujita, Department of Physics, Creighton University, Omaha.
- 10:00 . 6. PHOTOPRODUCTION OF ELECTRON-POSITRON PAIRS IN ULTRAPERIPHERAL COLLISIONS AT RHIC. Jarrod K. Bang* and J. Seger (for the STAR Collaboration), Department of Physics, Creighton University, Omaha.
- 10:12 7. MEASURING BILLIARD BALL DYNAMICS USING A HIGH-SPEED CAMERA. Anthony Kramer, Department of Physics, Hastings College, Hastings.
- 10:24 8. INVESTIGATING ORBITAL TRAJECTORY AND LUMINOSITY OF A PROMISING COMET. Laura VanEpps, Department of Physics, Hastings College, Hastings.

- 10:36 9. ASSESSING CELLULAR METABOLISM BY NADH FLIM AND INTENSITY-BASED MEASUREMENTS OF MONOLAYER AND MULTICELL TUMOR SPHEROIDS. M. J. Lehnerz*, D. E. Desa, and M. G. Nichols, Department of Physics; and L. V. Zholudeva, Department of Chemistry, Creighton University, Omaha.

11:00 MAIBEN LECTURE (Olin B)

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

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

SESSION B

Session Chairperson, Nathanael Fackler
Olin 324

- 1:00 p.m. 10. THE USE OF PVSS TO MONITOR THE ALICE EMCAL SUB-DETECTOR AS PART OF THE LHC CONTROLS SYSTEM. Brendan O'Connor, Department of Physics, Creighton University, Omaha.
- 1:12 11. DESIGN AND CONSTRUCTION OF A SPATIALLY-RESOLVED OXIMETER FOR METABOLIC PROFILING OF MULTICELL TUMOR SPHEROIDS. Christian T. Meyer* and Mike G. Nichols, Department of Physics, Creighton University, Omaha.
- 1:24 12. IDENTIFICATION AND ANALYSIS OF THE PRODUCTS REMOVED FROM HUMAN FEET BY AN ELECTROLYSIS FOOTBATH. Cara Flemmer*, Dan Story and Charles Freidline, Division of Science and Mathematics, Union College, Lincoln.
- 1:40 13. IDENTIFICATION AND ANALYSIS OF THE PRODUCTS REMOVED FROM HUMAN FEET BY AN ELECTROLYSIS FOOTBATH WITH THOUGHTS ABOUT POSSIBLE MECHANISM OF ACTION. Dan Story*, Cara Flemmer, and Charles Freidline, Division of Science & Mathematics, Union College, Lincoln.
- 1:56 14. VALIDATION OF A DOUBLE-DIFFUSION GEL-BASED METHOD FOR *IN VITRO* DETERMINATION OF FUNCTION IN MINERALIZATION-REGULATING PROTEINS FROM TISSUE EXTRACTS. A.J. Spanel*, Aaron Haag*, Mark Wilson and Erin Wilson, Department of Chemistry, Doane College, Crete.
- 2:12 15. THE MINERALIZATION-REGULATING PROTEIN OSTEOPONTIN EXHIBITS NO ADOPTION OF ORDERED SECONDARY STRUCTURE UPON ADSORPTION TO HYDROXYAPATITE MINERAL SURFACE. Cason Christensen*, Vincent Krejci, Mark Wilson and Erin Wilson, Department of Chemistry, Doane College, Crete.

- 2:24 BREAK
- 2:34 16. DEVELOPMENT OF METHODS TO DETECT ATRAZINE IN WATER AND SOIL SAMPLES. Corey Willicott* and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney.
- 2:46 17. HETEROGENEOUS CATALYSIS: THE HORIUTI-POLANYI MECHANISM AND ALKENE HYDROGENATION. Nhu Le*, Anne Mirich*, Wendy Foster, Jaclyn Greimann, Trisha Hoette, Shanna Wankum, Ann Cabri, Claire Reichenbacher, Erika Schwanke, and Bruce Mattson, Creighton University, Omaha.
- 3:02 18. CHEMOSENSING PROPERTIES OF NBD TRIAZOLE COMPOUNDS Nicholas D. Franz* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 3:14 19. DETECTION OF FORMALDEHYDE IN SHAMPOO AND LOTION PRODUCTS MARKETING FOR USE ON INFANTS AND YOUNG CHILDREN BY FLUORESCENCE SPECTROSCOPY. Desiree Erikson*, Mark Wilson and Erin Wilson, Department of Chemistry, Doane College, Crete.
- 3:26 20. DETERMINING THE STRUCTURE AND DYNAMICS OF MINERAL BINDING PEPTIDES FROM OSTEOPONTIN BY SOLID-STATE NUCLEAR MAGNETIC RESONANCE. Megan Uehling*, Mark Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete.
- 3:38 21. MINERAL BINDING PROTEINS ASSUME HELICAL STRUCTURES IN CROWDED ENVIRONMENTS. Vincent Krejci*, Cason Christensen, Mark Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete.

JUNIOR ACADEMY OF SCIENCES

Chairperson: Aurietha Hoelsing, NJAS President, Omaha

8:30 – 9:00 a.m.	Senior High Registration & Set Up Displays	Olin Hall Lobby
9:00 – 12:00	Senior High Competition (preliminary)	Olin 124, Olin 131
9:00 – 10:00	Judging of Posters, Q&A	Olin 124, Olin 131
9:00 – 10:00	Meet and Greet	2nd Floor Biology Lounge
10:00 – 10:30	Visitors view posters, talk w/ students	Olin 124, Olin 13
10:30 – 11:30	Judging, no visitors	Olin 124, Olin 131
11:30 – 12:00	Visitors view posters, talk w/ students	
11:00 – 12:00	Maiben Lecture	Olin LH B
12:00 – 1:00 p.m.	Lunch Break, Story Student Center	
1:00 – 1:30	Junior High Registration & Set Up Displays	Olin Hall Lobby
1:00 – 4:30	Senior High Competition (Final)	Olin 110
	Visitors may observe presentations	
	Space is limited, schedule will be posted	
1:30 – 4:30	Junior High Competition	Olin 124, Olin 131
1:30 – 2:30	Judging of Posters, Q&A	Olin 124, Olin 131
2:30 – 3:00	Visitors can view posters and talk with students	
3:00 – 4:00	Judging, no visitors	Olin 124, Olin 131
4:00 – 4:30	Meet and Greet Wrap-up with Visitors	2nd Floor Biology Lounge
2:00 – 3:30	NJAS Directors' Meeting	Olin 219

5:45

AWARDS AND SCHOLARSHIPS RECEPTION AND PRESENTATIONS

General Awards

Special Awards

Top Ten Awards – Juniors

Top Ten Awards – Seniors

Top Five Awards – Seniors

High School Scholarships

Collegiate Scholarships

Friend of Science Award

NAS Special Awards

First United Methodist Church

2723 N 50th Street, Lincoln, NE

PROCEEDINGS

AERONAUTICS AND SPACE SCIENCE

SESSION A

VARIABILITY IN AGN ABSORPTION LINES BASED ON HUBBLE SPACE TELESCOPE/COS DATA

Ben Schmachtenberger and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

We present preliminary results of our project to study mass outflows from a sample of active galactic nuclei (AGN). Our project is based on analysis of ultraviolet spectra obtained with the Cosmic Origins Spectrograph (COS) aboard NASA's *Hubble Space Telescope*. Our study will explore the variability in the observed intrinsic absorption lines that are the signature of AGN outflows. We present an initial report of the variations in absorption strength and discuss implications for the physical nature of the outflows.

BALQSO KINETIC LUMINOSITY DETERMINATION WITH C III* MEASUREMENTS

Daniel McGinnis and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

Mass outflows in active galactic nuclei (AGN) are hypothesized to represent a feedback mechanism by which black hole growth and galaxy formation are linked. In order to assess this claim, a lower limit on the kinetic luminosity of these outflows must be determined. These limits can be constrained by combining computerized photoionization models with spectral measurements. Since the column density of C III* $\lambda\lambda 1175$ relative to other carbon ions tracks the volume density of the outflow gas, it provides an ideal proxy for this parameter. We present lower limits on the kinetic luminosity of a sample of AGNs based on measurements of the restframe UV absorption spectra.

BREWSTER ANGLE MICROSCOPY AND CHARACTERIZATIONS OF LANGMUIR FILMS

Adrian Sanabria-Diaz and Timothy Reece, Department of Physics and Physical Science, University of Nebraska at Kearney, NE 68849

The behaviors of ferroelectric polymer Langmuir films are observed with the use of a Brewster angle microscope. In general, Langmuir films form a single molecular layer on water because they are often good amphiphiles. Since the polymer Polyvinylidene Fluoride (PVDF) is not a true amphiphile, parameters like solution concentration, water pH, and the amount injected on the trough may have an effect on film behavior and quality. With the aid of a Langmuir-Trough, a Brewster angle microscope, and the autonomous controls of a computer as a nexus between these instruments, different characteristics of the copolymer are studied.

SORTING LIGHT'S TOTAL ANGULAR MOMENTUM FOR COMMUNICATION SYSTEMS

Nathan Scott Brady and Liubov Kreminska, Department of Physics and Physical Science, University of Nebraska at Kearney, NE 68849; and Thein An Nguyen, Giovanni Milione, and Robert Alfano, Department of Physics, Institute for Ultrafast Spectroscopy and Lasers, City College of New York, NY 10031

We present a method to multiplex (combine) and demultiplex (separate) eigenstates of light's total angular momentum. Multiplexing is accomplished by utilizing tunable liquid crystal devices which allows for dynamically generating superpositions of light. Demultiplexing is accomplished by using a

device, analogous to a polarizing beam splitter, to separate light's orbital angular momentum. Encoding information in the combined degrees of freedom from the spin and orbital angular momentum, light's total angular momentum has great potential to increase information capacity in future classical and quantum communications.

THE PHOSPHORYLATION PATTERN OF RPA2, IN RESPONSE TO DOUBLE-STRAND BREAKS, DIFFERS DEPENDING ON THE LOCATION IN THE CELL AND THE PHASE OF THE CELL CYCLE

Kerry Brader and Gloria Borgstahl, Eppley Institute, University of Nebraska Medical Center, Omaha, NE 68198

Replication protein A (RPA) has multi-faceted roles in DNA metabolism. As the primary eukaryotic ssDNA- binding protein, RPA plays essential roles in DNA replication, recombination, and repair. Multiple regulatory mechanisms have evolved to ensure that homologous recombination takes place at the right time, place and manner. One of these is protein phosphorylation. It is well established that RPA is phosphorylated in response to DNA damage. Here we will deconvolute the phosphorylation pattern of RPA2 in response to the induction of double-stranded breaks induced during S and G₂ phases of the cell cycle. We will demonstrate that there exists a pattern of phosphorylation that differs depending upon the location of the protein (cytosolic, nuclear free, and chromatin-bound) upon induction of DNA damage as well as the location in the cell cycle (S vs. G₂).

THE DIOPHANTINE EQUATION $Ax^4+By^4=Cz^4$ IN QUADRATIC FIELDS

Melissa Emory, Department of Mathematics, University of Nebraska at Omaha, NE 68182

A. Aigner proved in 1934 that, except in $Q(\sqrt{-7})$, there are no nontrivial quadratic solutions to the Diophantine equation $x^4+y^4=z^4$. The result was later re-proven by D.K. Faddeev and the argument was simplified by L.J. Mordell. This talk discusses work to extend this result in finding quadratic solutions to $Ax^4+By^4=Cz^4$ and connections to congruent numbers, a Pell's equation, and the Ulam spiral.

THE SBML STANDARD TO SHARE COMPUTATIONAL MODELS OF BIOLOGICAL SYSTEMS

Bryan Kowal, Department of Mathematics, University of Nebraska at Omaha, NE 68182

Background: The Cell Collective (<http://www.thecellcollective.org>) is a free web-based collaborative platform for modeling biological processes and virtual cells. To help facilitate exchange of computational models with scientists worldwide, Systems Biology Markup Language (SBML) has been developed. However, SBML didn't support rule-based models (supported by the Cell Collective), a mathematical framework that has become popular due to its scalability towards large-scale models. The Solution: In collaboration with the SBML community, we developed the "qual" package, a SBML extension that makes it possible to describe share qualitative models. This extension not only allows various software tools to exchange computational models, but also enables models that are currently in the Cell Collective to be shared with the scientific community in a standard fashion. Results: The Cell Collective is now capable of exporting and importing models in SBML format. The exported models can be imported into any software that understands the standard SBML format.

HIGH SPEED ELECTRO-DISCHARGE DRILLING AND WIRE ELECTRODE-DISCHARGE MACHINING OF TITANIUM ALLOYS FOR AEROSPACE APPLICATIONS

K.P. Rajurkar, Department of Engineering, University of Nebraska–Lincoln, NE 68588

Research objective of this study is to develop a knowledge base for generating complex and highly accurate shapes in titanium alloys for aerospace applications using High Speed Electro-discharge Drilling (HSEDD) and Wire Electro-discharge Machining (WEDM) process. An extensive literature review of properties of titanium alloys, their applications in aerospace and defense industries, and limitations of machining processes currently being used in machining of titanium alloys has been conducted. Experiments using EDM drilling machine (which has been fitted with recently purchased high pressure pump) pressure up to 1500 PSI) and WEDM system available at the Advanced Manufacturing Laboratory at UNL, have been conducted to machine Titanium alloy (Ti-6Al-4V) workpieces by solid copper and tungsten electrodes as well small thin wires in WEDM. The presentation will include process performance results in terms of productivity and surface integrity.

ROUTING OVER THE INTERPLANETARY INTERNET

Joyeeta Mukherjee and Byrav Ramamurthy, Department of Computer Science and Engineering,
University of Nebraska–Lincoln, NE 68588

Future space exploration demands a Space Network that will be able to connect spacecrafts with one another and in turn with Earth's terrestrial Internet and hence efficiently transfer data back and forth. The feasibility of this technology would enable common people to directly access telemetric data from distant planets and satellites. The concept of an Interplanetary Internet (IPN) is only in its incubation stage and considerable amount of common standards and research is required before widespread deployment can occur to make IPN feasible. We have conducted a comprehensive survey of the current space networking technologies and architectures. In the survey, we discuss the IPN and Delay Tolerant Networking (DTN) concepts along with the various space networks that are currently deployed. We propose a design of the IPN and implement it with the Interplanetary Overlay Network (ION) software module on real time physical nodes on the ORBIT testbed. Two space network scenarios are designed and experimentally evaluated to verify the correctness of the network implementation. We also focus on the study of bundle transmission delay and separately evaluate the effect of bundle size and number of bundles. The experimental evaluation provides insights into the factors which caused delay in bundle transmission such as custody refusal, expiration of bundle lifetime and congestion.

WIRELESS INTEGRATED RELAY SYSTEM (WIRS)

Shawn Schumacher, Department of Mechanical and Materials Engineering, University of
Nebraska–Lincoln, NE 68588

This project is one which deals with wirelessly transmitting signals from a device incorporated on a space suit to any other piece of equipment. This device would allow a user, wearing a space suit, to manipulate any equipment on board the spacecraft with the touch of a finger. Technology like this has been developed for normal applications here on earth, but taking this technology and bringing it to life in space poses many obstacles that need to be crossed. Also, this idea references a mainframe computer which will receive the signal from the device on the space suit and will then relay it to the piece of equipment necessary on board. The device that will be attached to the space suit is already being developed at NASA Johnson Space Center in the form of a swatch. Further development may take the interface device into an arm-mounted touch screen display.

HUMAN REACTIONS TO FLUCTUATING NOISE CONDITIONS AS PRODUCED BY LOW-BOOM SUPERSONIC AIRCRAFT

Andrew Hathaway and Lily Wang, Charles W. Durham School of Architectural Engineering and
Construction, University of Nebraska–Lincoln, NE 68588

The goal of this research project is to quantify human performance and perception while being exposed to different types of noise fluctuations. Participants repeatedly performed an arithmetic task under assorted acoustic stimuli and then completed subjective questionnaires. Results from two

completed studies will be presented: one utilizing bursts of noise (similar to low level sonic booms), and one utilizing level fluctuations on a longer time scale (similar to a noisy HVAC unit turning on and off). An ongoing study utilizing bursts of noise accompanied by rattle noise, as may be produced in residential buildings from supersonic aircraft, will also be discussed. Our work coordinates with the current research taking place at NASA Langley Research Center that is evaluating the human response to low level sonic booms inside buildings.

NONINVASIVE, AMBULATORY, LONG-TERM, DEEP GASTROINTESTINAL BIOSENSOR AND IMPLANTER

Alfred Tsubaki and Benjamin Terry, Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68508

In this work we research and develop a component of a novel biosensing system that will enable the acquisition of long-term, ambulatory, deep implant biometrics without the need for invasive surgery or trained medical personnel for sensor implantation. The complete system has no ex vivo sensing component, so it is completely transparent to the host and offers minimal restrictions to the host's physical activity. We propose to build upon the state-of-the-art by researching methods and a novel system for maintaining the swallowed sensor in vivo, so that it becomes a long-term (>6 months) GI implant. Passive commercial sensors persist in the body typically less than one day, so we are seeking a multiple order of magnitude increase in the duration of intuitive, deep GI sensing.

RECONFIGURATION PLANNING OF MODULAR ROBOT UNDER UNCERTAINTY

Ayan Dutta, Prithviraj Dasgupta, and José Baca, Department of Computer Science, University of Nebraska at Omaha, NE 68182; and Carl Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

In this research we consider the problem of automatically reconfiguring or changing the shape of a modular self-reconfigurable robot (MSR) when it cannot continue its motion or task in its current shape. To solve the modular robot reconfiguration problem, we propose a novel technique based on a branch of economics called coalition game theory, which is used by people to divide themselves into teams or coalitions. The conventional computer algorithm used for forming coalitions and finding the best coalitions is very expensive to implement in terms of running time and energy (battery power) and not practical to implement on small-scale, modular robots. We have proposed a new, fast algorithm called search UCSG that intelligently reduces the number of coalitions it needs to inspect and eventually finds the best coalitions for the modules of the modular robot. Our proposed technique also incorporates an essential aspect of robotics - uncertainty in operation of the robots movements. We have verified the operation of our algorithm mathematically as well as experimentally using a computer simulated model of a modular robot called ModRED that we are developing as part of the NASA-sponsored ModRED project. Experimental results of our algorithm show that it is able to reconfigure a modular robot while taking significantly lesser time than other state-of-the-art algorithms and is able to form a configuration that is very close or at worst 80% away from the best possible configuration of the modules.

DYNAMIC GAIT ADAPTION IN FIXED CONFIGURATION FOR MODULAR SELF-RECONFIGURABLE ROBOTS USING FUZZY LOGIC CONTROL

José Baca, Raj Dasgupta, and Ayan Dutta, Department of Computer Science, University of Nebraska at Omaha, NE 68182; and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

Modular self-reconfigurable robots (MSRs) are robots that can dynamically adapt their shape and locomotion. They are useful in regions that are difficult for humans to maneuver in, such as in extra-terrestrial environments, inside volcanic craters, etc. When an MSR cannot continue its desired motion

in its current shape, the conventional approach is to reconfigure the MSR by detaching/attaching modules from/to its current shape to form a new shape or configuration. However, it is a costly operation in terms of time and energy, if performed frequently. In this research, we study the problem of how an MSR can continue its motion without reconfiguring its modules, but, by adjusting the way or *gait* with which the modules move. We have proposed a technique from the field of artificial intelligence, called fuzzy logic, for dynamically adapting the gait of MSR modules. We have demonstrated its operation through accurate computer simulations on an MSR called ModRED.

EARLY STAGE DEVELOPMENT OF A MEDICAL DEVICE FOR NON-INVASIVE MEASUREMENT OF INTRACRANIAL PRESSURE

Jeff Hawks and Tyler Ketchum, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588; and Max Twedt, Biological Systems Engineering, University of Nebraska–Lincoln, NE 68588

NASA flight crewmembers experience much lower pressure when they are subject to microgravity. When exposed to this condition, crewmembers experience a cephalic shift, leading to changes in intracranial pressure. These changes may permanently affect vision and lead to other complications caused by increased intracranial pressure. We have constructed a biomimetic phantom of the area surrounding the eye that allows for an accurate induction of blood flow dynamics near the optic nerve head and intend to show a change in flow velocity with applied force. This phantom will be imaged using Doppler ultrasound and will be used to show correlation between intracranial pressure and cerebral blood flow. Our final aim is to develop a small, low power, non-invasive transducer that will be used to bridge pre-flight and post-flight biomarkers with in-flight monitoring of intracranial pressure. This research could also be helpful when studying ocular neuropathies such as glaucoma.

COMPLIANT LAPAROSCOPIC SURGICAL GRASPER

Alan Goyzueta, Linxia Gu, and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588; and Brittany Woodin, Department of Biomedical Engineering, University of Iowa, Iowa City, IA 52242

In laparoscopic surgery, long-shafted tools are inserted through small incisions in the patient to access the surgery site with the ultimate goal of reducing trauma to the patient and decreasing recovery time. Through the use of these tools, surgeons lose tactile feedback during tissue manipulation and in some instances apply excessive forces when grasping tissues. The presented device aims to reduce the amount of tissue injury by implementing a compliant jaw that deforms as it grasps soft tissue. Tests were performed to characterize the maximum applicable pull and pinch forces and were compared to a commercially available laparoscopic grasper. Results showed a sigmoidal relationship between pinch force and jaw closure, indicating a safer grasp behavior. Pull force capabilities did not meet expectation due to the fact that the jaws do not currently have teeth.

MODULAR JOYSTICK FOR VIRTUAL REALITY SURGICAL SIMULATION

Michael Head and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588; and Ka-Chun Siu, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha, NE 68198

With modern surgical techniques becoming more and more technically difficult as invasiveness is minimized, the need for surgical training continues to increase. This training is made more difficult due to a lack of tools through which objective measures of performance can be implemented. One method of surgical training that is gaining in popularity is virtual reality simulators. In this project, a modular and reconfigurable joystick was designed and built to evaluate the impact of joystick kinematic topology on fidelity and effectiveness of surgical simulation. The joystick incorporates a full set of degrees of freedom to allow unconstrained motion within the surgical workspace, but permits locking of

specific joints to reproduce tool constraint conditions actually encountered in surgical scenarios. The joystick was equipped with position sensors and a data acquisition system and coupled to a simulated surgical environment.

AERONAUTICS AND SPACE SCIENCE SECTION

SESSION B

NOVEL ASSISTIVE LOCOMOTOR TOOL FOR GAIT REHABILITATION IN THE ELDERLY

Eric Cutler and Dan Blanke, Department of Health, Physical Education and Recreation,
University of Nebraska at Omaha, NE 68182

The goal of this research was to investigate the effect of horizontal assistive forces on gait variability in older adults. This novel approach has exciting potential for therapeutic applications in the prevention of falls, a major issue facing older adults. Gait variability has been strongly associated with the incidence of falls amongst the elderly. Our previous work has demonstrated that gait variability can be altered by applying a horizontal assistive force to a person while they walk. However, the effect of these forces on the gait variability of elderly populations was unknown. This research has furthered our understanding of gait variability as it relates to aging, and most importantly how amenable it is to training under these conditions. Results of this research may have laid the groundwork for the development of innovative rehabilitation protocols to improve physical function and decrease risk of falling in older persons.

GAIT VARIABILITY HAS NO RELATION TO COGNITIVE PERFORMANCE ON THE PHONETIC FLUENCY TEST

Ryan Hasenkamp and Sara Myers, Department of Health, Physical Education and Recreation,
University of Nebraska at Omaha, NE 68182

Astronauts experience changes in physical and cognitive function during and after spaceflight. These alterations can lead to decreased performance as astronauts need to accomplish a mission in outer-space. Thus, we sought to determine the interaction between cognitive and physical functioning, which are both affected by spaceflight. Thirteen subjects walked on a treadmill under single task (walking only) and dual task (walking while performing a cognitive task) conditions. Gait was evaluated by recording joint kinematics during walking. The largest Lyapunov Exponent (LyE) was calculated to quantify the temporal organization of variability in the continuous gait time series. The phonetic fluency test was used to assess cognitive function. Results show that the temporal organization of gait is altered (decreased LyE) with addition of the phonetic fluency task. However, there was no significant relationship between phonetic fluency scores and the temporal organization of gait variability.

EFFECT OF TACTILE STIMULI ON LOCOMOTOR RHYTHM

Jung Hung Chien, Mukul Mukherjee, Sara Myers, Yawen Yu, Mu Qiao, and Nick Stergiou,
Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Astronauts face balance problems after they return to earth from long-duration space flights. These problems arise because exposure to microgravity induces adaptive central reinterpretation of visual, vestibular, and proprioceptive information. Therefore, determining methods to accelerate adaptation and return to normalcy is critical. One way to achieve this is utilization of additional sensory feedback, such as tactile sensation, in the sensorimotor adaptation paradigms. Ten young healthy young (27.3 ± 5 years) were randomly assigned to either a tactile stimulation (TS) or a non-tactile stimulation (NTS) group. Each participant performed five walking trials: pre-adaptation over ground walking, baseline, split-belt adaptation, catch trial, and post-adaptation over ground walking. Preliminary results

showed enhanced locomotor adaption due to TS in stance time (161%), and swing time (159%). These observations may be because the perturbation to tactile sensory feedback caused by TS forcing participants to undergo multisensory reweighting of locomotor control.

UNDERGRADUATE RESEARCH PIPELINE IN MATHEMATICS

Griffith Elder, Department of Mathematics, University of Nebraska at Omaha, NE 68182

This is a report on an effort that is being made in the UNO mathematics department to develop and challenge the pool of strong mathematics students who come to UNO, will graduate and are then likely to pursue a PhD in mathematics or a related field. Since the mini-grant provided funding for two students to take a course in the p-adic numbers and pursue their research projects, this report will discuss these activities and their outcomes.

COLLEGE OF SAINT MARY ELEMENTARY SCIENCE OUTREACH PROGRAM

Kelly Lane, Kathryn Dearing, and Jeff Keyte, Department of Biology, College of Saint Mary, Omaha, NE 68106

The College of Saint Mary Elementary Science Outreach Program was developed during the 2011-2012 academic year to provide hands-on science learning activities to local elementary students. The purpose of this program is to increase elementary students' interest in the STEM fields by allowing them to explore science concepts while introducing them to lab equipment and materials delivered through the College of Saint Mary and the NASA Nebraska Space Grant. In the current phase of development, work is focused on expansion, so that the program may involve a greater number of elementary students and CSM science students. A website has been developed as an essential part of this expansion. It allows teachers to explore what the outreach program has to offer, schedule classroom visits, as well as providing science learning resources and activity descriptions. The program is teacher driven, so that K-6 educators may schedule CSM students to lead a specific activity in their classroom based on those available from the website.

FOSTERING STUDENT AWARENESS ON GLOBAL CLIMATE CHANGE AND ENVIRONMENTAL STEWARDSHIP THROUGH CURRICULAR AND CO-CURRICULAR ACTIVITIES

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

Global Climate Change and Environmental Stewardship are the key areas which will influence the development of human civilization in the 21st century. Educating our students in these areas will help employers find trained task forces, which will empower them to develop new Green strategies/Technologies. To foster students' interest in these areas, we organized activities such as classroom education, workshops, and field trips. Currently we are working on developing a new course on Global Climate Change. This course will address the whole complexity of climate change as an issue, by bringing together the science, impacts, economics, abatement technologies, and policy solutions into one course. In addition, students are also exploring the ways to reduce the negative environmental impact and promote the mantra of "Reduce, Reuse, and Recycle" in the campus/local community by organizing events, performing science demonstrations, visiting local landfills/recycling centers and hosting recycling and litter abatement campaigns.

AUTONOMOUS RC CAR

Blake E. Ross, Quinn Fogle, and Bill Spurgeon, Business and Information Technology, Western Nebraska Community College, Scottsbluff, NE 69361

Our goal is to program a radio-controlled car to autonomously navigate a predefined course for competition. We chose to use two Arduino single-board microcontrollers, one microcontroller is used to sample and compile the various sensor data and the other is used to compute where to travel. Sensors

include a GPS module, a compass, wheel speed sensors, and a custom light reflection-based proximity sensor. Bluetooth technology is used to stream real-time data, by transferring our data to a smartphone or PC for debugging purposes. Each pair of latitude and longitude values from the GPS corresponds to a direction for the robot to travel on the currently defined course. The compass is then used to travel the correct direction. If the proximity sensors detect any obstacles, a temporary deviation from the course will be made. We have learned how to work with the hardware and software side of navigating an object autonomously.

HIGH-ALTITUDE BALLOON SOLAR PANEL VOLTAGE VARIATION

Josh Gebbie, Department of Math and Natural Science, Metropolitan Community College, Omaha, NE 68111

This experiment tested voltage of solar energy on a high-altitude weather balloon to see if the altitude made any difference in voltage output of a regular solar cell. Due to many factors such as flying above clouds and less scattering of solar rays it was hypothesized that there would be an increase in voltage. After analyzing the data and plotting voltage in respect to altitude, this showed that at high altitudes there was a moderate increase in the solar cells voltage output. The implications for this knowledge could be used to help develop new ways to collect solar energy, an important part of sustainability studies for future energy consumption.

MICROBENTHIC ALGAE DENSITIES IN THE DUPLIN WATERSHED

Gina Gilson and John Schalles, Department of Biology, Creighton University, Omaha, NE 68178; and John O'Donnell, Department of Atmospheric Sciences, Creighton University, Omaha, NE 68178

The mudflat region of coastal marsh ecosystems is inhabited by a community of microbenthic algae that contributes significantly to the health and productivity of the marsh. These algae migrate vertically, surfacing at low tide and acting as a food resource to the surrounding ecosystem. Variation in microbenthic algal pigment features were evident in 2006 CALMIT AISA Eagle aerial imagery of the Duplin tidal watershed at Sapelo Island, GA. In 2012, hyperspectral scans were taken of different areas of mudflats using an Ocean Optics USB 2000 Spectroradiometer. Sediment samples were collected at these sites and analyzed to determine true chlorophyll pigment densities. We are analyzing data to find a distinct spectral signal that is unique to the microbenthic algae, eventually enabling remote estimation of algal density from hyperspectral imagery. A chlorophyll absorption spectral feature is evident and appears to deepen with higher chlorophyll concentrations.

ESTIMATING UNCERTAINTY OF REFLECTANCE AND ERROR PROPAGATION IN VEGETATION INDICES

Tarlan Razzaghi, Anatoly Gitelson, and Donald Rundquist, School of Natural Resources, University of Nebraska–Lincoln, NE 68588

The Moderate Resolution Imaging Spectroradiometer (MODIS) and Landsat satellites are two of the primary instruments for monitoring global terrestrial vegetation, including crop Bio-Physical Characteristics (BPCs) at regional to global scales. However, due to the coarse spatial resolution (30m/250-m/500-m) and the assumption of a single homogeneous reflectance for an entire pixel, satellites products are affected by sub-pixel mixing, a serious issue in croplands, especially where there is often a considerable discrepancy between the spatial resolution of the imageries and sizes of fields. This provides a challenge to assess the uncertainty of a brightness value across both space and time. The sub-pixel heterogeneity affects the accuracy of satellite-derived BPC estimation. Since vegetation indices computed from coarse-resolution pixels contain uncertainties, another challenge is to accurately model the propagation of uncertainties related to reflectance data as they related to retrieved BPCs. This study undertakes a simulation approach to analyze spatial uncertainty caused by MODIS and Landsat spatial

resolution and address resulting challenges. Hyperspectral Airborne Imaging Spectrometer for Applications (AISA) imagery was collected at 3 meter spatial resolution over irrigated and rainfed corn and soybean fields in 2003 and 2004. For each image, the reflectance values were scaled up from a spatial resolution of $3 \times 3 \text{ m}^2$ to pixel sizes of $30 \times 30 \text{ m}^2$, $250 \times 250 \text{ m}^2$ and $500 \times 500 \text{ m}^2$. The reflectance uncertainty inside simulated pixels were calculated and modeled as a function of crop phenological stages, pixel sizes, different crop, field water treatment, and for selected spectral bands. The results of this study demonstrate the importance of considering error and uncertainty as essential elements of satellite-derived image data.

ESTIMATING SURFACE VISIBILITY ON THE U.S. EAST COAST: INCORPORATING THE AEROSOL VERTICAL PROFILE FROM GEOS-5

Amy Kessner and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68588; and Robert Levy, Climate and Radiation Lab, NASA Goddard Space Flight Center, Greenbelt, MD 20771; and Peter Colarco, Atmospheric Chemistry and Dynamics Lab, NASA Goddard Space Flight Center, Greenbelt, MD 20771

In this study, we incorporate the vertical profile of aerosol into aerosol optical depth (AOD) retrievals in order to estimate surface visibility on the U.S. East Coast using satellite remote sensing techniques. First, AOD measurements from the MODerate Resolution Imaging Spectroradiometer (MODIS) are compared with one-minute extinction coefficient ($\text{visibility} = 3.0/b_{\text{ext}}$) data from twenty-two Automated Surface Observing System (ASOS) stations. Then, four methods of incorporating the vertical profile of aerosol from the Goddard Earth Observing System, Version 5 (GEOS-5) are tested. Results show that incorporating the vertical profile of aerosol by scaling the modeled surface b_{ext} with the ratio between MODIS AOD and the modeled AOD produced the best overall results, yielding a correlation of 0.72 and a small negative bias of -0.03 km^{-1} for three years of data. This study is among the first to demonstrate the use of the MODIS aerosol product over land to derive surface visibility.

EFFECTS OF VOLCANIC EMISSIONS ON THE EARTH-ATMOSPHERE SYSTEM

Levi Boggs and Cui Ge, Department of Earth and Atmospheric Science, University of Nebraska–Lincoln, NE 68588

Many things impact the atmosphere and the environment that we humans today live in. An area that is not well known and only beginning to be understood in the science community is atmospheric aerosols and the impact that they have on earth's climate system. For this research I will be studying the effects of volcanic ash and emissions on the atmosphere and how those emissions are transported globally. I will collect and analyze data about specific volcano eruptions from 2004 until 2012 from multiple continents. I will utilize data and imagery from the NASA instruments MODIS, OMI, CALIOP and MISR to examine the distribution and properties of the volcano emissions. With the aid from NASA instrumentation, personal observations, and official records of the volcano eruptions I will be able to evaluate how those emissions affect the areas to which they are transported.

OBSERVING THE TRANSPORTATION OF DUST ON EARTH USING MISR

Carly Baumann and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68588

Digitizations of plume heights are vital in determining the motion of wildfires, dust storms, volcano eruptions, and aerosols across the globe on a meteorological and climatological scale. Accurate height and wind information can help predict the transformation of these particles across various terrains and possible impacts on local environment.

Linkages between dust plume information at the dust sources and dust properties in the downwind regions will be evaluated using the Multi-angle Imaging SpectroRadiometer (MISR) plume digitizations

and MISR aerosol products. The analysis of the MISR images will be done through the use of MISR Interactive eXplorer (MINX) software. MINX output includes plume extent, precise wind-corrected heights for visible plume tops, wind speeds at the plume top, top-of-atmosphere albedo, aerosol properties, and information on the radiative power and brightness temperature of fires associated with the plumes, when available.

ARGOS AND MICROGRAVITY FREE FLYER EVALUATION

Christian Laney, Department of Electrical Engineering; and Jacob Reher, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

The University of Nebraska–Lincoln Microgravity Team is 1 of 15 schools in the nation selected to participate in the NASA Microgravity University program. The team will evaluate the ability of NASA's Active Response Gravity Offload System (ARGOS) to provide a microgravity environment for a free-flying vehicle. The team is developing an octa-copter free flyer to be tested in both ARGOS and plane-induced microgravity environments. The team's devised data collection method will involve a combination of data sources that may include stereo-motion capture camera system and inertial guidance unit aspects. Parabolic flight maneuvers of a reduced gravity aircraft provide a testing environment against which to compare the ARGOS. Specifically, the team will be investigating any positional error between the data collected in induced microgravity onboard the plane and the data collected on the ARGOS. Ultimately, the data should allow for effective evaluation of the ARGOS and for the optimal tuning of the free flyer's control system.

UNL LUNABOTICS TEAM: DESIGNING A ROBOT FOR THE NASA LUNABOTICS ROBOT COMPETITION

Kevin Kreis, Department of Mechanical Engineering; and Avery Quandt, Department of Computer Engineering, University of Nebraska–Lincoln, NE 68588

With Curiosity safely landed we are about to enter a new era of exploring Mars, which shows us how important autonomous exploration vehicles are to space exploration. This will be our teams second year competing in the NASA Lunabotics competition. This robot will compete in a simulated lunar environment at the NASA Lunabotics competition this May. NASA Lunabotics is a competition working towards extending and sustaining human activities across the solar system. Most importantly, this competition is helping to train the next generation of human space exploration. The design and construction of this robot will give members invaluable experience on the application of their coursework. It will provide them with a chance to work on a project and see a physical result, something that is lacking in the course curriculum. The Lunabot will measure 2.5 feet by 5 feet and the weight limit is 176 pounds. The robot needs to be capable of collecting and depositing at least 10kg of lunar regolith simulant. During our first year of competition we learned a lot about the rigors a robot must survive in an alien environment. For instance we learned about how difficult it can be to properly seal your robot, and how you have to pay attention to ensure everything is properly reinforced. This year we have decided to go with a more complicated (backhoe style) digging mechanism on our robot. We wanted to challenge ourselves to create a complex machine and ensure it works as efficiently as possible. Our team believes that the more difficult the design, the more we will learn in the process of bringing it to life.

DESIGN, BUILD, FLY

Derek Stevens, Department of Mechanical Engineering; and Mirzoramshad Mirzokarimov, Department of Electrical Engineering, University of Nebraska–Lincoln, NE 68588

For the 2012/13 AIAA Design/Build/Fly competition, teams must engineer and construct a remote control airplane that can carry various payloads of internal and external missiles with a maximum payload of 3 lbs. The airplane must also be able to take off within a 30ft by 30ft square. Light planes with a short wingspan and short length receive higher scores. The UNL Design/Build/Fly team is

building a single motor bi-plane this year. The bi-plane configuration makes the plane heavier, but allows it to have a shorter wingspan and greater structural integrity.

UNIVERSITY STUDENT LAUNCH INITIATIVE

Bryan Kubitschek, Department of Mechanical and Materials Engineering; and Mirzokarimov, Department of Electrical Engineering, University of Nebraska–Lincoln, NE 68588

The best description of the University Student Launch Initiative (USLI) is on the NASA education website. "NASA University Student Launch Initiative, or USLI, is a competition that challenges university-level students to design, build and launch a reusable rocket with a scientific or engineering payload to one mile above ground level, or AGL. The project engages students in scientific research and real-world engineering processes with NASA engineers." This competition will last a full eight months of design, testing and building. The competition goes farther than just building a rocket, you also have to: write multiple design reports, conduct video conferences with NASA engineers, and put together outreach event that promote STEM based activities in the community. Our biggest goal for this year's competition is to provide the best outreach out of all the teams participating.

EHD THIN FILM BOILING IN MICROGRAVITY ENVIRONMENTS

Mirzokarimov, Department of Electrical Engineering, University of Nebraska–Lincoln, NE 68588

RockSat-C is a program for students to design and build a sounding rocket payload, and launch the payload on a rocket from Wallops Flight Facility! Payloads shall be student based with faculty and/or industry involvement only. This year, the UNL RSC team is closely collaborating with Goddard Space Flight Center to design and build an experimental payload. This experiment will test and acquire data on thin film boiling via an EHD system in microgravity.

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

ANALYZE THIS – BUILDING BETTER CRITICAL THINKERS THROUGH PROBLEM ANALYSIS

Andrew Montgomery, STEM Education, University of Nebraska at Omaha, NE 68105

“Analyze This: Building Better Critical Thinkers Through Problem Analysis” is a project based around manipulating and changing a regular high school mathematics problem in such a way that a student must critically think about what was just a static problem. Students were shown a pre-test consisting of a problem and were asked to write a paragraph about the problem. Then, a presentation on problem analysis was given displaying the types of questions students should ask and directions they should head in. Following this, students attempted a post survey where they were asked to write a paragraph about the same problem presented in the pre-test. The post-test was evaluated by the quantity and quality of content written by the student in comparison to the pre-test. Finally, the activity was repeated with pre-service mathematics students in a class at UNO.

IMPROVING NOCTURNAL FIRE PROPERTY RETRIEVAL WITH THE VISIBLE INFRARED IMAGING SPECTROMETER'S DAY-NIGHT-BAND

Thomas Polivka, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68522

On October 28, 2011, the Suomi National Polar-orbiting Partnership (NPP) satellite was launched and now orbits 824 km above the earth in sun-synchronous orbit. The satellite carries a plethora of instruments; however, one instrument in particular, the Visible Infrared Imaging Spectrometer (VIIRS), is of special interest because it enables nocturnal detection of visible light from sources including fires and cities with its Day-Night-Band (DNB). While the DNB has a wide variety of applications, it shows much promise in improving retrieval of fire properties at night. By using freely-downloadable data from the U.S. Government, sub-pixel fire area and temperature can be determined from the 4 μm and 11 μm channels, and with the inclusion of the DNB, flaming versus smoldering area can also be calculated. An algorithm can be created to provide more realistic fire size and emission estimates, which can lead to improved operational fire suppression by improving resource allocation.

COMBINING SATELLITE OBSERVATIONS OF FIRE ACTIVITY AND NUMERICAL WEATHER PREDICTION TO IMPROVE THE PREDICTION OF SMOKE EMISSIONS

David Peterson and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68588

Smoke emissions estimates used in air quality and visibility forecasting applications are currently limited by the information content of satellite fire observations. This study explores the potential benefits of a recently developed sub-pixel-based calculation of fire radiative power (FRP_f) from the MODerate Resolution Imaging Spectroradiometer (MODIS), which provides more precise estimates of the radiant energy (over the retrieved fire area) that in turn, improves estimates of the thermal buoyancy of smoke plumes. Results show that unlike the current FRP product, the incorporation of FRP_f produces a statistically significant correlation ($R = 0.42$) with smoke plume height data provided by the Multi-angle Imaging SpectroRadiometer (MISR) and several meteorological variables, such as surface wind speed and temperature, which may be useful for discerning cases where smoke was injected above the boundary layer. Drawing from recent advances in numerical weather prediction (NWP), an automated, 24-hour prediction of satellite fire activity is also developed. The ultimate goal is to combine NWP data and satellite fire observations to improve both analysis and prediction of biomass-burning emissions.

SEARCH FOR ASYMMETRIC INTERACTIONS BETWEEN CHIRAL MOLECULES AND SPIN-POLARIZED ELECTRONS

Joan Dreiling and Timothy Gay, Department of Physics, University of Nebraska–Lincoln, NE 68588

We present preliminary asymmetry results for transmission of longitudinally spin-polarized electrons through a vapor of chirally-pure bromocamphor ($\text{C}_{10}\text{H}_{15}\text{BrO}$) molecules. We define the asymmetry for transmission as $A = [(I_{\uparrow} - I_{\downarrow})/(I_{\uparrow} + I_{\downarrow})]_R - [(I_{\uparrow} - I_{\downarrow})/(I_{\uparrow} + I_{\downarrow})]_L$, where I_{\uparrow} (I_{\downarrow}) is the transmitted current measured for spin-up (spin-down) electrons and “L” and “R” subscripts correspond to left- and right-handed chirality of molecules. At present, we have measured A at 1.5 eV electron scattering energy to be $(5.4 \pm 2.5) \times 10^{-5}$ when the transmitted, magnetically collimated electron beam is attenuated to 10% of its initial value. This should be compared with the measurements of Mayer *et al.*, where they report an asymmetry (by our definition) of $\sim (3.4 \pm 0.2) \times 10^{-4}$ for the same incident energy and electron beam attenuation [1]. We discuss possible reasons for this discrepancy.

[1] S. Mayer, C. Nolting, and J. Kessler, J. Phys. B 29, 3497 (1996).

AUTOIGNITION IN AN UNSTRAINED METHANOL/AIR MIXING LAYER

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

Autoignition in an unstrained, laminar mixing layer of methanol/air is investigated using detailed reaction mechanism and full multicomponent mass diffusion formulation. The temperature of the fuel stream is varied from 400 K to 1200 K, whereas the oxidizer stream is held at a fixed temperature of

1200 K. The calculations are performed for pressure $p = 1$ bar. Transient evolution of the autoignition kernel from initial partially premixed flame structures to final diffusion flame is demonstrated. The flame structures have been analyzed for individual heat release rates. For equal fuel and oxidizer stream temperatures (1200 K), heat release in extremely fuel rich locations (with mixture fraction values up to 0.8) is found. A transient triple flame structure (two deflagrations and, one diffusion flame) is shown to exist even in cases when the temperature difference between the two streams is large. The heat release rates in the deflagrations depend on the temperatures of the two streams. When compared with the surviving diffusion flame, the heat release rate in the short-lived deflagrations is one to two orders of magnitude higher. It is shown that increasing the fuel stream temperature also decrease the ignition delay time in the mixing layer.

ANALYSIS OF THE HST/COS SPECTRUM OF THE MASS OUTFLOW IN SEYFERT 1 GALAXY MRK 279

Zach Monti and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

We present a preliminary analysis of an ultraviolet (UV) spectrum of the Seyfert 1 galaxy MRK 279. We're studying the intrinsic UV absorption lines of MRK 279 which indicate mass outflow from the Active Galactic Nucleus (AGN). These observations were made with the Cosmic Origin Spectrograph (COS) aboard NASA's Hubble Space Telescope (HST). We present measurements of the absorption features and explore variability of the outflow spectra by comparing to previous HST spectra.

CHARACTERIZATION OF A 5.8KV SiC PIN DIODE FOR ELECTRIC SPACE PROPULSION APPLICATIONS

Alexandra Toftul, Tanya Gachovska, and Jerry Hudgins, Department of Electrical Engineering, University of Nebraska–Lincoln, NE 68588

A new 5.8kV SiC PiN diode from Cree, Inc was characterized under static and dynamic conditions to determine suitability for use in the Faraday Accelerator with Radio-frequency Assisted Discharge (FARAD) pulsed electric thruster drive circuit. Of primary interest are losses associated with diode reverse recovery, as well as maximum peak current handling capability for a typical thruster pulse duration of 10 μ s. Experimental switching waveforms collected at 25°C are presented. These data provide strong evidence that, under the same conditions, reverse recovery time, peak current, and peak charge are significantly less for the newly developed SiC diode than for a comparable Si fast recovery diode. This supports the idea that a SiC diode will reduce energy loss in the FARAD drive circuit. This increased efficiency in turn decreases the amount of propellant that must be stored on board a spacecraft for a given mission, reducing overall weight and freeing space for scientific payloads and/or passengers.

WIRELESS POWER TRANSFER: DESIGN AND APPLICATION

Nicholas Goeser and Caleb Berggren, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

A common problem shared by nearly all technology is finding a way to power it, whether it is plugged into an outlet or carries a battery. Eventually, wireless power will be a viable tool to help power devices and sensors. When coupled with unmanned aerial vehicles (UAVs), devices in remote locations will be easily accessed and charged. The main principle behind this research is magnetic resonance. Tests were conducted on power transfer between transmission coils of a small quad copter scale (radius = 23cm) to receiving coils of a smaller scale (radius = 3.9cm). This setup was used to power an LED at a distance of up to around .75 meters. Optimal range for power transfer has been found to be within one radius of the transmission coil. Transmission through water appears to be nearly as effective as through air.

FORCE SENSING OF GRASPING EVENTS FOR MINIATURE SURGICAL ROBOTS

Thomas Frederick, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68505

Surgeons prefer to be able to palpate the tissue for diagnosis during surgical procedures. The open nature of traditional surgery provides adequate access to the patient, but the more advanced techniques prevent the surgeon from this direct access. These minimally invasive techniques rely on specialized tools passed into the body through several small incisions. Tools used in these procedures do not normally provide reliable feedback; however, the application of robots to these techniques creates the potential for accurate feedback. Two-armed miniature surgical robots have been developed that can perform surgical tasks through manipulation of standard surgical tools. These tools have been instrumented with a load cell such that the closing force of the grasper can be measured. From this value, the contact force can be passed on to the surgeon. Initial testing has shown measureable differences in the characteristic load curves that result from grasping different types of material.

UNDERSTANDING WALKING AND BREATHING COUPLING WHEN ABNORMAL BREATHING PATTERNS ARE PRESENT

Jennifer Yentes and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Astronauts suffer from general cardiovascular deconditioning and it is feasible that deconditioning in breathing biological rhythms could have an effect on the overall function. Biological rhythms mutually attract to one another. Known as coupling, each rhythm is influenced by the other's intrinsic rhythm, yet, maintains its own intrinsic rhythm. A coupled relationship between walking and breathing has been observed in humans and an optimal strength of coupling between these two rhythms is characterized by energy economization during walking. What we do not know is if both rhythms demonstrate an abnormal intrinsic rhythm due to space flight, does this affect the ability of the rhythms to couple. Over the past year, significant time has been spent on developing a methodology that can record breathing and walking patterns simultaneously. A physiological monitor was purchased and substantial time was devoted to writing LabView code that would synchronize this device with 3-dimensional motion capture.

EXAMINING THE QUALITY OF MODIS REFLECTANCE PRODUCTS USING A FOUR-BAND SPECTRORADIOMETER

Anthony Nguy-Robertson, Andy Suyker, Yi Peng, and Anatoly Gitelson, School of Natural Resources, University of Nebraska–Lincoln, NE 68583; and Toshihiro Sakamoto, Ecosystem Informatics Division, National Institute for Agro-Environmental Sciences, Tsukuba, Japan; and Timothy Arkebauer, Department of Agronomy and Horticulture, University of Nebraska–Lincoln, NE 68583

There is a need to validate satellite products. This study examines the quality of MODIS reflectance products over a two year period (2010-2011) in three agricultural fields near Mead, Nebraska using 4-band spectroradiometers. A pair of four-band spectroradiometers (SKYE instruments) at each site collect downwelling irradiance and upwelling radiance in four spectral regions (green, red, red edge, and near infrared). Reflectance was determined at half hour intervals. The MODIS reflectance products for both Terra and Aqua sensors were compared to their respective SKYE reflectance and vegetation indices (VIs; NDVI, EVI, WDRVI). These relationships were quite strong, suggesting that the atmospheric correction and pixel selection criteria for MODIS reflectance and VI products are accurate. Using ground measured LAI measurements and GPP measured by eddy-covariance flux towers, we found that both the SKYE and MODIS spectroradiometers are able to provide accurate estimation of crop biophysical characteristics such as LAI, biomass, and GPP.

INVESTIGATING LAND AND ATMOSPHERE CHARACTERISTICS DURING THE 2012

CENTRAL PLAINS DROUGHT USING MODIS AND TRMM PRODUCTS

Amy Kessner, Jun Wang, and Ambrish Sharma, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68588; and Laura Judd, Department of Earth and Atmospheric Sciences, University of Houston, TX 77204

Droughts are known to cause both natural and economical impacts as a result of a deficit in precipitation for a season or longer. Unlike most natural hazards (tornadoes, earthquakes, etc.), droughts approach slowly and the duration is difficult to forecast. During 2012 in the Central Plains of the United States, lack of precipitation and high heat led to a record drought in comparison to the last ten years. This research will focus on using remote sensing to study natural drought impacts to land surface and atmospheric properties using the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor aboard EOS-Terra and EOS-Aqua as well as the precipitation radar and microwave imager aboard the Tropical Rainfall Measuring Mission (TRMM) satellite. MODIS products will include day/night land surface temperatures, vegetation indices, and fire characteristics. The average accumulated monthly precipitation product from the TRMM satellite will also be included.

ANTHROPOLOGY

A MARXIST APPROACH TO US HISTORICAL ARCHAEOLOGY: A REVIEW AND SUMMARY OF THE HISTORY AND APPLICATION OF MARXISM ON THE FIELD OF HISTORICAL ARCHAEOLOGY IN THE US

John Fitzpatrick III, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Throughout the history of Historical Archaeology in the US its practitioners have been constantly striving for greater relevance and acceptance of the field as a viable and worthwhile area of study. This has seen the coming and going of both the processual and post-processual movements in the field. The latter of which created a new focus of study in both capitalism and marginality. In my paper I will show how the historical trends in the field have lead it to take up the use of a Marxist approach to archaeology in order to study both capitalism and class in an effective manner. I will also demonstrate that by taking up the use of Marxism archaeologists have been giving a unique chance to broaden the applicability and relevance of their field to a new class of audience through the critical look of archaeologies role in the US capitalistic system and how it can be changed and improved. I present two case studies from two carefully chosen dig sites, a cutlery factory in western Massachusetts and the Ludlow Massacre site in Southern Colorado, for their ability to provide modern, poignant and gripping real life examples of my arguments.

JOHN COLLIER, ANTHROPOLOGY, AND THE INDIAN NEW DEAL

Terry Ahlstedt, Department of History, University of Nebraska–Lincoln, NE 68588

This presentation contends that U.S. Indian Commissioner John Collier was an avid believer in the use of science to solve the “Indian problem,” the social and economic malaise griping the nation’s Native American population. Collier hoped that the use of scientific studies would provide detailed descriptions and solutions to the pressing problems of the nation’s First Americans. In the use of science he was especially interested in Anthropology, first seeking the aid of leading anthropologist Franz Boaz and, in formulating what would later become the Indian New Deal, seeking the assistance of Boaz protégé Alfred L. Kroeber. This presentation reviews Colliers application of Anthropology into his years as U.S. Indian Commissioner, including what Collier described as the two “epochs” of anthropological study during his tenure: a tentative early phase when anthropologists worked largely in isolation to obtain knowledge of particular questions and a phase described as a more mature epoch when field studies, reminiscent of *Bronislaw Malinowski*’s concept of functional anthropology, held sway. Collier believed that these studies allowed a deep investigation into Indian motivations and offered insight into human universals. This presentation will explore this use of Applied Anthropology and its use as a form

of social engineering.

COLONOWARE AND CULTURE: THE CHANGING INTERPRETATION OF 17TH CENTURY CERAMIC TRADITIONS IN THE SOUTH EASTERN UNITED STATES

Mike Chodoronek, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

The study of colonoware has often been overlooked in its importance. It was not until fairly recently that it was even identified as a historic technology of ceramic manufacture. Colonoware is a low fired, often undecorated, earthenware, that has as a long standing tradition as being developed in correlation to the slave trade and was only manufactured by slaves in the southern most colonies of the eastern United States- most notably in Virginia and South Carolina. It also contends that the often muted decorative traditions and technologies of manufacture are more closely related to those found in Native American eastern woodland and West Africa traditions than any European models, though made in the utilitarian forms reminiscent of European vessels of the time.

It is important to research and explore the relationship of this unique material culture in everyday life and what it can tell us of early American lifestyles on a broader plane. This interpretation that it is strictly a slave associated material culture, that it had no class transcendence to other classes and that it was uniquely west African in origin should be reexamined and new light should be shed on the growth of colonoware and its reflection of the new American society for which it is representative.

This paper will explore the history, the relationship to the culture, which produced it and the complexities in the development of this new form of material culture on the American colonial hinterlands from the 17th century to the early 19th century.

CREOLE COTTAGES AND GARDEN ESTATES: SPACE AND PURPOSE IN EARLY NEW ORLEANS

Nora Greiman, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Visitors to New Orleans are immediately struck by the varied and multicultural feel of the city. There are different areas of the city with distinct cultural influences, for example the Vieux Carré (or French Quarter). The Vieux Carré was the original settlement, housing French and Spanish elites as well as African-Americans and Afro-Caribbean freedmen and slaves. This colony was allowed to develop in isolation for roughly 100 years before becoming part of the United States. In the early nineteenth century, American and Northern European migrants started coming to the city to take advantage of economic opportunities. They encountered a Creole population that was very insular and foreign in their customs. While these migrants established themselves in the city in order to prosper, they wanted to maintain distinction and separation from the “foreign” population downtown. Due to the preservationist mindset of citizens of New Orleans, many of the structures from early New Orleans still stand today, mostly in their original form. This paper will examine one example of a Creole cottage from the Vieux Carré and one example of a Garden District mansion in order to show differences in the life-ways and values of the households. Differences at the community level will also be examined, using each structure as a representative for the larger neighborhoods.

QUALITY CONTROL FOR IN-FIELD PHOTOGRAPHY: DIGITAL CURATION AND NON-COLLECTIONS OF ARTIFACTS

Erin Carr, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

This presentation will focus on digital curation, and techniques as pertaining to the act of photographing artifacts that are documented in the field, but not collected, for curation also the use of artifact color to track lithic mobility. Photos are taken of artifacts in the Photo Bucket on an 18% grey background, Whi-Bal card with scale, and an identification tag. Placement of these items allow for a polished photograph fresh out of the field that will be ready for archiving once downloaded to a computer. Multiple photos are taken of the artifacts in the event of the blurry photos from human

operation error of the camera. Data about the artifact is collected on site and then the artifact is returned to its original location. Data collected from the field is then transcribed into an Excel and the photo hyperlinked to the spreadsheet. This technique is an alternative to collecting artifacts when space for curation is limited, funding is unavailable, or the wishes of the landowner are against the artifact leaving the property. This method also allows for additional analysis by utilizing the photographs, along with the metadata, and colorimetrics analysis. This technique will cut down increasing number of artifacts in collection storage.

ASSESSING LITHICS THROUGH COLOR METRICS

Erin Carr and Kasey Mathiesen, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

We will discuss applying the color metrics method as an analysis property so that digital photography can be a tool to better assess the archeological record. With the aide of the Photo Bucket we were able to maintain the lighting within a controlled setting. We also applied a ‘true grey scale’ value of 18% as the main background, along with a Whi-Bal card that has a true white and black value. Photographs were then processed with Adobe Photoshop CS6 and color corrected with the tools already provided in the photograph. Photographs were selected based on their visual qualities of being well lit and clear. Photos that were blurry, dark, or reflecting light were discarded from the data sample. From these photographs the gray, black, and white values were implemented to give a color corrected picture. A Gaussian Blur was applied to areas where there were variations of color within the artifact. This allowed a universal RGB value to be taken. With these RGB values we compared colors from artifacts within the sample to find similarities. We suggest by using color metrics, through Adobe Photoshop CS6, we are able to track lithic mobility, the refitting of lithic materials, and sourcing to geographic raw materials locations within a sample area.

REFITTING OF STONE ARTIFACTS USING COLORIMETRIC ANALYSIS

Kasey Mathiesen, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Color has been used as a tool for analysis in archaeology, including the refitting of stone artifacts. However, the evaluation of color within the field remains subjective and influenced by high inter-observer variation. Here, I report on the efforts to quantify color using digital photography and image color calibration, which was used to evaluate the utility of this quantification for increasing rates of refitting proficiency and decreasing inter-observer variation. Color values (RGB) were extracted from a sample of digital photographs of experimentally produced flakes and cores (some refitting and some not). Forty individuals from the Anthropology Department of the University of Nebraska–Lincoln, were then tasked with attempting to refit these artifacts. Twenty were given the RGB raw data along with an interactive graph that would help assist with data visualization, while the other twenty attempted to refit artifacts without assistance. The two group’s results are then compared to look at the effects of color quantification for increasing refit accuracy and proficiency.

THE RESTORER OF THE REPUBLIC: AN ANALYSIS OF AUGUSTUS’S SOCIAL, MORAL, AND POLITICAL REFORMS WITH REGARDS TO THE ROMAN FAMILY

Holly Staggs, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Imperator Caesar Augustus has been a captivating figure in ancient Roman history for over 2,000 years. As the founder of the Roman Empire and its first emperor, he forever changed the course of Roman history and politics. During his 45 year reign, Augustus initiated a comprehensive program of reforms intended to restore social order, improve morality, and govern the family. Augustus saw himself as the restorer of traditional Roman values and set into motion a number of laws that sought to increase marriages, promote child bearing, and penalize sexual indulgence. This presentation will include a study of various ancient literary sources including historians Suetonius and Cassius Dio on these reforms

along with iconographic data found on the artwork commissioned by Augustus in order to promote his legislation. By analyzing these data, it may be possible to successfully illuminate the impact of Augustan laws during the Early Imperial Period and its current impact in modern society. Ultimately, Augustus, the founding father of western civilization, forever transformed politics concerning the family.

A COMPARISON BETWEEN MID-EIGHTEENTH CENTURY RURAL AND URBAN CHESAPEAKE ELITE CONSUMPTION PATTERNS OF WILD FAUNA

Gaby Lapera, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Although pre-Revolutionary America has been the subject of intense academic investigation, there is still much that is unknown about the underlying cultural and social complexities. Foodways can help illuminate these dark recesses. This study examined differences in the consumption patterns of wild fauna between the rural and urban elite in the mid-eighteenth century Chesapeake using an anthropological groundwork to contextualize historic research and mathematical analysis of the zooarchaeological data from thirteen archaeological sites located in Virginia. Although the sample size is small, a subtle but important difference emerged between the two groups. Wildlife made up a greater proportion of the rural gentry's diet, but the urban elite consumed a greater variety of wild animals. There are two likely explanations for this disparity: market availability and in-group consolidation. Hopefully the results will spur more foodways studies that will advance the current understanding of late colonial culture in the Chesapeake.

CORTEX RATIO AS A MEASURE OF ARTIFACT TRANSPORT

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There are multiple ways to determine the amount and distance of lithic artifact transport. In addition to material sourcing and artifact typologies, Douglass et al. (2010) outline a method of analyzing real and theoretical cortex values to determine transport. By calculating the ratio between the amount of observed cortex and expected cortex in an assemblage, we can determine if materials were taken from or brought to a site and make inferences about the behaviors that took place. Here we report on artifact distributions located within the Pete Smith Hill and Sand Creek localities of the Oglala National Grasslands, N.W. Nebraska. These data were collected during the 2011 and 2012 UNL Summer Field Schools. Results are consistent with initial hypotheses as to the nature of each location, with Pete Smith Hill being a lithic source and Sand Creek representing a processing-oriented site.

GENERATING INFERENCES ABOUT PALEO-INDIAN MOBILITY AND ECONOMIZATION FROM MODELS OF LITHIC USE LIFE AND EXPERIMENTAL CORE REDUCTION

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In the field of lithic analysis, the concept of a stone artifact's use life (the duration that the tool can be used for or the reduction in energy costs during its career) has been the subject of considerable study for its ability to inform on stone economization and use intensity. Heretofore, measurements of use life have been restricted to formal tool forms (forms which have an established definition like a projectile point rather than an unmodified flake). In this study we apply the use life concept to the simple stone cores from which flakes were produced. This study makes use of a set of regression models developed based on measurements and features of experimentally reduced cores. Next we applied the models to stone cobbles taken from a source in the Oglala National Grasslands of Northwestern Nebraska. The results bring insight into the intensity of stone reduction and artifact removal- both important concepts with application to mobility and economization theory. They also further demonstrate the use life concept and develop its application to common artifact forms.

METRIC AND NON-METRIC INDICATORS OF SEX IN THE POSTCRANIA OF ADULT SKELETONS USING BINARY LOGISTIC REGRESSION

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We evaluate femoral neck angle as a predictor of sex and establish a logistic regression model for sex determination in the pelvis and femur of the adult skeleton. Male and female skeletons were sampled from the Iowa-Stanford skeletal series (n=202). Proximal femora were photographed with a scale so that femoral angle could be measured using ImageJ. Femoral head diameter was measured using sliding calipers. Qualitative assessment of pelvic morphology included the subpubic angle, pubic body, and greater sciatic notch. Binary logistic regression was used to model sex prediction based on the aforementioned predictors.

Femoral neck angle significantly differed in males and females ($p<0.05$). Logistic regression correctly predicted sex in 92.6% of the sample. In this analysis, the subpubic angle was not a significant predictor of sex ($p=0.78$), but all of the remaining predictors were significant, with pubic body morphology being the strongest predictor.

The femoral neck angle appears to be a useful predictor of sex in the adult skeleton. Binary logistic regression is a powerful analytical tool that can include both metric and nonmetric data to assess group membership. In terms of accuracy, our results are comparable to other methods.

GIVING OR SELLING?: EXAMINING ORGAN EXCHANGE IN THE GLOBAL ORGAN TRADE

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In today's world globalization can be seen everywhere, from the cuisine people eat, to the beliefs they hold. What is even more evident than those two examples are the massive amounts of people who partake in international travel. What is not evident are whose organs are sustaining said international travelers. A recent occurrence within globalization is the worldwide exchange and transportation of organs, and many organs have interesting provenances which include: harvested from those diagnosed as brain dead, extracted from Chinese prisoners, coerced from someone facing crushing amounts of debt, and bought through websites like “Livers-4-You.” There is strong evidence of organs being bought internationally, but the current rhetoric for organ transplantation does not seem to acknowledge this fact. Actually, the vocabulary surrounding organ transplantation uses such terms as “donor,” and “recipient,” implying that some sort of gift exchange is occurring. Yet, how can one say that he or she gave altruistically when there is monetary compensation? How can one reciprocate the gift of an organ? By using gift and commodity theory and the exchange of another equally flexible object, the rhetoric surrounding organ transplantation shall be examined in an attempt to answer a basic question that is gaining significance. Is this global exchange of organs one composed mainly of gifts or is there simply a worldwide, unregulated market for human organs and tissues?

WOMEN WARRIORS: AN INTRODUCTORY TO THE NEW MOROCCAN CULTURAL EQUESTRIANS

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This paper will concentrate on the recent phenomenon of women participating in a fantasia. Fantasia is a traditional equestrian display performed by men at cultural festivals. Since 2004, women have become increasingly involved in fantasia performances, participating along with men and also forming their own groups. The fantasia consists of a group of horse riders in traditional clothes armed with gunpowder rifles charging their horses about 200 meters before firing their rifles in the air. The beauty and difficulty of fantasia is the synchronization-the charge of the horses together and the simultaneous firing of the rifles, so that only one shot is heard. The Arabic word for gunpowder is

“baroud” and the fantasia is often referred to as “tbourida” meaning “to release the powder” or “the powder games.” Through primary literature and social media, my research shows how the groups function and how they are growing in Morocco. The paper will also explain the need for further formal, in-depth research for interviews, video, and photographic documentation.

WHAT DO YOU GET FROM HER STORY?- DISCOURSE ANALYSIS OF AN INTIMATE PARTNER VIOLENCE VICTIM’S POST IN A PUBLIC ONLINE DISCUSSION FORUM

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Intimate Partner Violence (IPV) is a major public health concern. A victim’s voice deserves to be heard and considered seriously; however, IPV is a “closed door affair” and is not easily recognized and understood by outsiders. Some myths blame the victims but do not address the perpetrator’s responsibilities. IPV experiences and victim’s voices are hard to obtain in an ongoing basis. This prevents effective interventions from taking place to address IPV in the early stages.

Most Chinese victims choose to seek informal help from the Internet anonymously. They ask for suggestions on how to stay in the intimate partner relationship as a “wife” or “partner” without battering, and complain about being victimized in the relationship at the same time.

The study was to explore how her social language in her online posts enacted the social identities of an IPV victim. A segment of a victim’s online posts were used for this analysis. The study focused on the linguistic features of the online post that made the IPV victim’s social language distinctive. Social language tool as a discourse analysis method was used. The victim’s conflicted identities as a “wife” and as a “victim” were expressed by her social language. Victim’s little awareness of the perpetrator’s identity and her denial of “victim” identity were discussed.

THE EFFECTS OF TRANSRACIAL ADOPTION ON FAMILY DIVERSITY

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“The idea that family is a stable and cohesive unit in which father serves as economic provider and mother serves as emotional caregiver is a myth” (emphasis added, Bruce, 1995 as cited in PEE p. 232). The reality is that there are a variety of trends in family diversity that are emerging not only in the United States, but across the globe. In the past, anthropologists (Murdock, 1949) identified three distinct forms of families: nuclear (married couple and offspring), polygamous (two or more nuclear units affiliated by plural marriage), and extended (two or more nuclear units affiliated through extension of the parent-child or sibling relationship rather than by plural marriage). Moving beyond these three categories, Kottak and Kozaitis (2008) purport that “Family diversity has become not only normative, but promoted, in society” (p. 292). This paper will examine one emerging trend of family diversity: transracial adoption. The process of legal transracial adoption in the United States was first documented in 1948 when an African-American boy was adopted by his white foster parents in Minnesota (Fogg-Davis, 2002); this was followed by an increase due to the humanitarian concern for children who became orphans of war, as well as the more recent popularity by famous celebrities. As the trend of transracial adoption increases, it is important to examine the effects it may have within the family composition as well as the implications it has for educators, policy makers, and society as a whole.

APPLIED SCIENCE AND TECHNOLOGY

INVESTIGATING THE PHYSICO-CHEMICAL PROPERTIES OF NAFION® MEMBRANE TO IMPROVE ITS EFFICIENCY IN DIRECT METHANOL FUEL CELL (DMFC).

Evan Canning and Darius Agoumba, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

Nafion® membrane is known to be one of the key components of fuel cells’ development.

However, in DMFCs, Nafion® membrane becomes a concern as it swells when in contact with methanol. This drawback has been extensively studied and many suggestions to correct them were presented in many research papers. For example it was found that the flow of methanol could be reduced by doping the membrane with monovalent cations such as cesium ions. The latter reduce the pores' sizes in the membrane and consequently slow down the flow of methanol through the membrane. The present inquiry is to study the affinity of Nafion® membrane to other monovalent metal cations in order to extend the list of material capable of reducing the methanol crossover in DMFC.

CHARACTERIZATION OF ANODIZED ALUMINUM PLATES FOR APPLICATIONS IN THIN LAYER CHROMATOGRAPHY

Alexis Sieh, Mary Ettel, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

TLC is a common, practical procedure in any organic chemistry lab; it can run several samples at once and with minimal expense. Although versatile, integration of TLC into qualitative and instrumental methods of analysis has been slow, thus newer methods of instrument-TLC integration would be highly desirable. Analysis of TLC plates directly with FTIR will be shown using diffuse reflectance adapter on the surface of the TLC plate. Our anodized TLC plates are characterized by determining the activity of anodized surface, the percent water, and the effective infrared transparency range. Also discussed will be the utility of regenerating and reusing the anodized aluminum TLC plates.

SPECTROSCOPIC STUDIES OF PLANAR CHIRAL CHROMIUM COMPLEXES

Seth Dallman and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

The synthesis and characterization of compounds that could be used as molecular motors (magnetically controlled in this research) continues to be an area of interest in the materials field. The spectroscopic properties of single planar chiral-arene-Cr(CO)₃ diastereomers in, and out of, a magnetic field will be presented. Construction of sample holders containing strong permanent magnets to generate low to moderate magnetic fields will be used in conjunction with conventional instrumentation to study of these compounds. Sample holders allow for variable strength magnetic fields (up to 1 Tesla) for FTIR, UV/Vis and polarimetry instruments. NMR analysis in different field strength NMRs will also be presented.

BIOLOGICAL AND MEDICAL SCIENCES SESSION A

BIOLOGICAL AND MEDICAL SCIENCES

STRUCTURAL CHARACTERIZATION OF A MAMMALIAN RIBOSWITCH IN THE SPERMINE BIOSYNTHETIC PATHWAY

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Riboswitches are found in the 5' untranslated region of mRNAs and bind cellular metabolites in order to 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 crystallization results have aided in optimizing the chemical conditions necessary for crystal growth. In addition we will study the thermodynamic properties of spermine binding to its riboswitch by utilizing Isothermal Titration Calorimetry (ITC). ITC directly measures the energy involved in the binding of ligand to the sample. 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 made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), 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 NIGMS or NIH.

EXAMINATION OF THE STRUCTURE AND FUNCTION OF A MAMMALIAN RIBOSWITCH IN ORDER TO DESIGN ANTI-CANCER DRUGS

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Riboswitches are elements within messenger RNA that bind small molecules and undergo structural changes, resulting in modulation of gene expression. Though many classes of riboswitches have been found in bacteria, there are no confirmed riboswitch classes in animals. The spermine riboswitch is a potential mammalian riboswitch. The function of the spermine riboswitch has implications on designing anti-cancer drugs, as spermine is required for nearly all cellular processes. To better understand how the spermine riboswitch can be targeted for the development of anti-cancer agents, the structure of the riboswitch must first be studied.

Structural studies of the spermine riboswitch utilize in-line probing and isothermal titration calorimetry (ITC). In-line probing is useful for determining conformational changes in the riboswitch RNA due to binding a specific ligand. Previous in-line probing analyses have focused on the natural ligand, spermine, whereas my studies will involve non-natural analogues similar to spermine, such as norspermine and N1,N11-Diethylnorspermine. These polyamines contain the same number of nitrogen atoms as spermine, but vary in the carbon spacing between amines. ITC is a biophysical technique that measures the heat absorbed or evolved during interaction between biomolecules in order to determine the stoichiometry of binding, as well as the equilibrium association constant for the RNA-ligand reaction. Results from both of these studies will determine the specificity of the riboswitch RNA for spermine, the conformational changes resulting from spermine analogs, and the affinities of different spermine analogs for the RNA.

INTRON DEGENERATION IN THE LICHEN FUNGI TELOSCHISTES

Derek Kleier 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

Introns are ubiquitous across eukaryotes, yet their origins are still unclear. There exists a variety of known intron types, including the autocatalytic group I and group II introns, as well as the more common spliceosomal introns. While introns have no known general function for their host, improper splicing can have serious consequences. Understanding intron origin and evolution may be important for understanding their function, however, they are often difficult to study because of reduced selection pressure that results in rapid sequence evolution. This makes the topic challenging and requires dense taxon sampling. The origins of spliceosomal introns in particular have been the subject of intense study and are now generally hypothesized to originate from group II introns. However, we have evidence that in ribosomal RNA (rRNA) they may also arise from group I introns. Specifically, in our study we focus on the densely sampled lineage of fungi, Teloschistes. This lineage has rRNA introns that are variable in

size, some displaying clear sequence hallmarks of spliceosomal introns and others that have conserved structures typical of group I introns. Spliceosomal introns in rRNA are mainly restricted to lichen fungi and therefore are recent acquisitions. Furthermore, we hypothesize that they are derived from rRNA group I introns. To support this hypothesis, we have evidence that there exist transitional forms within this lineage. Specifically, introns that have remnant group I-like secondary structural elements, as well as sequences typical of spliceosomal introns. In this study we focus on one position in the small subunit (SSU) that contains putative transitional forms. The primary objective is to increase sampling and discover additional introns that represent intermediate steps in the transition from group I to spliceosomal. Thus far we have collected 14 specimens of *Teloschistes* spp. from Central Nebraska. Of these we have focused on six samples that represent the diversity of sampling sites. In order to better characterize the species, as well as increase our data set of introns, we are currently sequencing the internal transcribed spacer (ITS) and a portion of the SSU rRNA from these lichen. After sequencing, phylogenetic analyses will be performed to characterize the host fungi, as well as sequence and structural analyses to characterize the introns. This work was partially made possible by Grant Number P20GM103427 from the National Institute for General Medical Science, a component of the National Institutes of Health.

THE ROLE OF SEPTIN CDC3 IN CELL WALL INTEGRITY IN *CANDIDA ALBICANS*

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Candida albicans is a common commensal yeast found within the majority of the population. It is the most common cause of vaginal yeast infections in women and diaper rash among infants and can cause serious systemic disease in immunocompromised patients, patients with indwelling medical devices, and patients taking broad spectrum antibiotics. Despite the development of a novel class of antifungal drugs about ten years ago, the echinocandins, there has not been a significant decrease in the mortality rates of these susceptible patients in the last twenty years. With an ever increasing susceptible population, it is vital that we further understand and interpret the mechanism of drug susceptibility and pathogenicity in this species. An understanding in cellular response to these antifungals should give good insight into pathogenic resistance and provide a better approach in the treatment of these infections. The antifungals designed to combat these infections target the glucose polymers within the cell wall of the organism. Previous work in the Blankenship lab has demonstrated that septins, highly-conserved GTP-binding proteins found at sites of cell separation, play a significant role in *C. albicans* response to caspofungin (Blankenship et al 2010). Septins are present at the bud neck of dividing cells that serves as a barrier to diffusion across the plasma membrane between mother and daughter cells. These proteins also play a major role in filamentation, a process vital for pathogenicity (Tang and Reed 2002, Mortenson et al 2002). CDC3, one of the seven septin proteins found in *C. albicans*, serves as an anchor for the other septins and is an essential protein in this organism. We will test the hypothesis that CDC3, as well as other septins, play a major role in drug susceptibility and pathogenicity in *C. albicans*. My goal is to identify regions of CDC3 that are important for cell wall integrity.

FUNGAL DIVERSITY OF A COTTONWOOD ROOT SYSTEM

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Mycorrhizal fungi are essential symbiotic partners of plants that facilitate nutrient uptake in the root system in exchange for improved access to carbohydrates. Historically, most research on these fungi was based on the microscopic examination of morphology. However, a better estimate of diversity can be obtained using molecular techniques, as even fungi that appear identical often vary at the molecular level. In this project, we used environmental PCR to investigate fungal diversity in a cottonwood tree root system. Based on morphological evidence, cottonwood trees (*Populus* spp.) are known to associate with both major classes of mycorrhizal fungi [ectomycorrhizae and arbuscular

mycorrhizae (AMF)]. Additionally, cottonwood trees have extensive root networks that intercept soil layers varying in texture, organic matter, and water content. Therefore, the assemblage of fungi is expected to differ throughout this root network, as different species are likely better suited to acquiring resources under various conditions. In this project, DNA was extracted from four spatially distinct locations within the root system of a single cottonwood tree. These sites vary considerably in soil characteristics (e.g., 70-fold difference in organic matter). Using PCR, a 1.4 kb region of the fungal internal transcribed sequence and large subunit of the ribosomal RNA was amplified, cloned, and sequenced. Phylogenetic analyses using these sequences were done to determine the fungal diversity within the root network. We sequenced 135 clones from these four sites. Rare fraction curves suggest that we have reached saturation with respect to species diversity in this system and that our samples adequately reflect the fungal assemblage at these sites. The sequences appear to fall into two broad categories: ectomycorrhizal fungi and general soil fungi, which include plant and human pathogens. Surprisingly, we did not find any AMFs using general fungal primers and amplified only one using AMF-specific primers. Species richness of the mycorrhizal fungi in this system was estimated using the Chao1 index. Based on this, we found more than 10 different clusters of mycorrhizal fungi, with each cluster approximating a distinct species. However, these clusters are closely related, each having a nearest BLAST match in GenBank to the same environmental sample. This suggests that there is diversity in mycorrhizae that is not yet represented in GenBank sequences. This work was partially made possible by Grant Number P20GM103427 from the National Institute for General Medical Science, a component of the National Institutes of Health.

CHARACTERIZATION OF AN ENVIRONMENTAL PHAGE LYSOGEN OF MYCOBACTERIUM SMEGMATIS

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Phage, viruses of bacteria, are the most abundant and diverse group of biological entities. Comparison of phage genomes within a bacterial host may aid insight into evolutionary models. Phage commonly exchange genes with their hosts and within related phage. In addition, to the basic science of phage biology, information from nonpathogenic *Mycobacterium smegmatis* studies may translate to the treatment of bacterial infections due to pathogenic *Mycobacterium tuberculosis* and *Mycobacterium leprae*. In this study we will present an environmental phage isolated from mulch in Ashburn, VA that was direct plated on *Mycobacterium smegmatis*. The phage was purified through streaking on a lawn of *Mycobacterium smegmatis*, then the number of phage were amplified through *Mycobacterium smegmatis* on plates so DNA could be purified. The phage will be further characterized by restriction analysis and DNA sequencing. The results of these experiments will be entered into the database of Mycobacteriophage (<http://phagesdb.org/>) administered by the Graham Hatfull lab at the University of Pittsburgh.

SEPTIN ASSOCIATING PROTEINS IN CANDIDA ALBICANS

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Septins are a family of filament forming proteins with various functions in diverse members of Eukaryota. The goal of this study is to identify proteins associated with septins in the pathogenic fungus *Candida albicans*. *C. albicans* is a significant human pathogen as well as a commensal in the gastrointestinal tracts of most humans. Septins are essential to pathogenesis in this pathogen, and also have a role in antifungal drug sensitivity by mechanisms we are just beginning to grasp. Undetected septin-protein interactions will potentially identify novel components of septin regulation and signaling which will advance our understanding of *C. albicans* as a pathogen.

INVESTIGATION OF THE ROLE OF SEPTINS IN CANDIDA ALBICANS

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Candida albicans is a pathogenic fungus that affects humans. It exists as a commensal in the gastrointestinal and genitourinary tracts of a majority of human beings. It is the major cause of diaper rash in infants and vaginal yeast infections in women. *Candida* species are also the fourth major cause of systemic infections in hospital settings (Wisplinghoff et al. 2004). Those at risk for systemic infection include patients undergoing immunosuppression, on broad spectrum antibiotics, or with indwelling medical devices. Infection has increased as the susceptible population has grown, yet, despite antifungal drugs, the mortality rate has not improved significantly in the last 15 years. The mortality rate remains as high as 40% for patients with systemic disease (Pfaller 2007). Our lab focuses on a particular group of genes in the *C. albicans* genome called the septins. Septins code for proteins that have been shown to play a role in cytokinesis and are also associated with the ring that forms at the junction between the mother cell and the bud in mitosis (Warenda et al. 2002). In addition to their cell cycle role, these proteins also play a vital role in filamentation and cell wall integrity in *C. albicans* (Warenda et al. 2002). The ability of cells to switch between filamentous and yeast-like forms is required for pathogenesis, and the cell wall is an important antifungal drug target. Thus, by studying septin function, we can gain insight not only into pathogenesis, but into antifungal drug response as well. The goal of my project is to map regions of septin CDC3 that are important for filamentation.

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BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

EXPERIMENTAL INOCULATION OF NESTLING HOUSE SPARROWS (*PASSER DOMESTICUS*) WITH BUGGY CREEK VIRUS

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The etiology of arboviral infections in wild nestling birds has been understudied. In this study, captive house sparrow (*Passer domesticus*) nestlings were inoculated with Buggy Creek virus (BCRV). BCRV is an alphavirus that is vectored by the swallow bug (*Oeciacus vicarius*) and amplified by house sparrow nestlings in the wild. Seven-day-old nestlings were inoculated with 3.5 log₁₀ plaque forming units (PFU) of BCRV lineage A (BCRV-A), BCRV lineage B (BCRV-B), or vehicle control, and the infection was monitored for 4 days post inoculation (4 DPI). Peak viremia occurred 1 DPI for both BCRV-A and B groups, with a mean peak virus titer of 4.24 ± 0.18 log₁₀ PFU/ml sera for BCRV-A and 4.29 ± 0.12 log₁₀ PFU/ml serum for BCRV-B. Additionally, virus was isolated from the lung, cerebrum, skin, skeletal muscle, heart, kidney, and small intestine for both BCRV-A and BCRV-B groups. Mucosal viral shedding was exhibited in 50% of BCRV-B nestlings and only 17% of BCRV-A nestlings. The impact of alphavirus infection on digestive parameters was also investigated. Digestive efficiency was 11% lower in BCRV-A group compared to the control ($P < 0.016$). Our results suggest that BCRV-A and BCRV-B are both effectively amplified in nestling house sparrows, and the infection

results in widespread viral dissemination. Additionally, BCRV-A appears to negatively impact digestion in nestlings, while BCRV-B does not. Reduced digestive capabilities may contribute to the higher virulence that is seen for BCRV-A in wild nestling house sparrows compared to BCRV-B.

AVIAN ADAPTIVE IMMUNE RESPONSES TO BUGGY CREEK VIRUS (TOGAVIRIDAE: ALPHAVIRUS) AND ITS ARTHROPOD VECTOR, THE SWALLOW BUG (OECIACUS VICARIUS)

Virginia Barak, Charles Brown and Carol Fassbinder-Orth, Department of Biology, Creighton University, Omaha, NE 68178

Life history decisions such as reproduction, growth, and development result in variability in physiological responses among avian species and likely impact a bird's immune response to both macro and microparasites. Here we examine the adaptive, humoral immune responses of a native bird and an invasive bird to an arbovirus (Buggy Creek virus; Togaviridae: Alphavirus), and its ectoparasitic arthropod vector (swallow bug; Oeciacus vicarius). Swallow bugs are closely associated with the native, colonially nesting cliff swallow (*Petrochelidon pyrrhonota*) and the introduced house sparrow (*Passer domesticus*) that occupies nests in cliff swallow colonies. We measured levels of BCRV-specific and swallow bug-specific IgY levels before nesting (prior to swallow bug exposure) and after nesting (after swallow bug exposure) in house sparrows and cliff swallows in western Nebraska. Levels of BCRV-specific IgY increased significantly following nesting in the house sparrow, but not in the cliff swallow. Additionally, house sparrows displayed consistently higher levels of swallow-bug specific antibodies both before and after nesting compared to cliff swallows. These results indicate that significant differences in the immune response to this arbovirus and its arthropod vector exist between these two avian species. These immune response differences may be influenced by the life history characteristics of these avian hosts, and may help to explain the differences in disease susceptibility that exist between these two species.

ANALYSIS OF CORTICOSTERONE LEVELS BETWEEN MALE AND FEMALE RED-WINGED BLACKBIRD NESTLINGS

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Corticosterone is a metabolic hormone and a stress hormone. When an organism becomes stressed, corticosterone levels spike, initiating a host of physiological responses which help the organism to overcome the stressor. Many factors affect stress levels in birds, and nest environment plays a large factor in stress levels of Red-winged Blackbird (*Agelaius phoeniceus*) nestlings. Nestlings of this species hatch asynchronously and display sexual size dimorphism. These two factors create competition in the nest for resources. In times of adequate food supply, the sex ratio of Red-winged Blackbird nestlings is 1:1, but in times of low food supply, the sex ratio favors females. For this study we hypothesized our sample population would have a sex ratio of 1:1. We also hypothesized that females will have a lower baseline level of corticosterone than males. Due to the drought during collection, the sample size was 8. Sex ratio of males to females was 1:1. Corticosterone levels showed no difference between male and female nestlings. Due to the small sample size these results cannot be considered representative of the entire population. We hope to be able to obtain a larger sample size for future studies. This work was partially made possible by Grant Number P20GM103427 from the National Institute for General Medical Science, a component of the National Institutes of Health.

EFFECTS OF CORTICOSTERONE ON THE MATERNAL BEHAVIOR OF THE PRAIRIE SKINK, PLESTIODON SEPTENTRIONALIS

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The effects of chronic corticosterone (CORT) increases on the maternal behavior of the Prairie Skink, *Plestiodon septentrionalis* were studied in the laboratory during the summer of 2012. It was hypothesized that chronic increases in plasma CORT would result in decreased maternal effort and higher egg mortality, with similar results to analogous studies in birds. Plasma CORT was elevated using a non-invasive, exogenous treatment and behaviors were observed using video recordings. CORT treatments significantly reduced the amount of time spent tightly coiled around eggs in experimental individuals, and significantly decreased the amount of time experimental females spend in contact with their eggs in comparison to control females. The treatment also weakly increased the amount of time that experimental females spend outside the nest. No significant difference was found on mortality of eggs, however all eggs that successfully hatched were from control females. These results indicate decreases in maternal effort following increases in CORT similar to those found in avian studies, as well as studies on other vertebrates.

POLLINATION PROCESSES AND RATES IN NUPHAR

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Nuphar is a genus within the order Nymphaeales, or water lilies, that is found in freshwater ponds and lakes throughout the temperate Northern Hemisphere. Nymphaeales, which consists of three families (Hydatellaceae, Cabombaceae, Nymphaeaceae), is one of the oldest independent lineages of flowering plants. Because of this, reproductive traits of water lilies are of considerable interest. Nuphar is the earliest-diverging genus with the family Nymphaeaceae and lacks many of the derived traits that are found in “core” Nymphaeaceae (Victoria, Euryale, Nymphaea), such as spheroidal pollen and a united stigmatic surface. This may have consequences for pollen germination and pollen tube growth; however these processes have not been comprehensively documented in Nuphar. Flowers in Nuphar open for four consecutive days. On the first day, flowers are female with have receptive stigmas, whereas on the following days, flower are male and have dehiscent stamens. Nuphar is insect-pollinated (beetles and bees), but self-pollination potentially occurs. The goal of this study was to characterize post-pollination processes in Nuphar advena, including the timing pollen germination, pollen tube growth rates, timing of ovule entry, and the pollen tube pathway. First and second-day flowers were hand-pollinated and collected sequentially over 12 hours. Pollen grains germinated within one hour after pollination in first-day flowers. Pollen tubes reached the ovule closest to the stigma between 5 and 7 hours after pollination and the ovules at the base of the stigma within 9 hours. Average pollen tube growth rate is comparable to that of Nymphaea. Pollen also germinated on “male” second-day flowers and pollen tubes reached ovules.

NEUTRAL LIPID ACCUMULATION IN CHLAMYDOMONAS AND ALGAL ISOLATES COLLECTED IN THE MIDWEST

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Unicellular green algae have emerged as an excellent biofuel feedstock, since they can accumulate high levels of neutral lipids under stress conditions including nitrogen starvation. Our group uses *Chlamydomonas reinhardtii* as a model strain to study lipid inducing factors, conditions and pathways. We also bioprospect for high lipid producing algae from the Midwest. For this project, one of our goals has been to determine if *Chlamydomonas* needs exposure to light to accumulate lipids. We found that lipid accumulation by cells grown under photoautotrophic conditions was high. This light-mediated lipid accumulation could be enhanced by supplementary carbon sources such as acetate. We also found specific conditions under which cells could accumulate lipids when grown heterotrophically, e.g. grown with acetate in the dark. This possibly could be applied to a biodiesel production scheme where plenty of organic carbon is available but light is limiting. In a parallel project our goal has been to

isolate high lipid producing algal strains collected from waters in the Midwest. From a collection of about 30 strains we have found one isolate more effective at accumulating lipids than *C. reinhardtii*. We are currently further characterizing this strain.

THE HrpG PROTEIN OF PSEUDOMONAS SYRINGAE IS A TYPE III CHAPERONE POTENTIALLY INVOLVED IN REGULATING THE TYPE III SECRETION SYSTEM

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The bacterial plant pathogen *Pseudomonas syringae* (DC3000) causes leaf spots and foliar necrosis on a variety of plants. This pathogen uses a Type III secretion system (TTSS) to inject proteins called effector proteins into plant cells. Collectively these proteins enable the pathogen to cause disease on a suitable host. However, the effector proteins can act as “double agents” in that non-host plants or resistant plants can recognize a subset of the effectors and trigger a programmed cell death known as the hypersensitive response (HR). The genes encoding the TTSS and effector proteins are controlled by the alternative sigma factor, HrpL. Some effector proteins require cytoplasmically located proteins called chaperones (specifically type III chaperones or TTCs) for secretion. This project is focused on determining the molecular role of a potential TTC, HrpG. This protein contains the molecular features of a TTC and through yeast two-hybrid screens we previously found that it interacts with several proteins, including the regulatory protein HrpV. Our hypothesis is that HrpG is a TTC that plays a role in regulating the TTSS.

To confirm HrpG interacts with HrpV, and to potentially isolate other interacting proteins, we have engineered a strain of *P. syringae* to encode a hemagglutinin (HA)-tagged version of HrpG. We have also engineered a mutant *P. syringae* strain that lacks the HrpG gene. We are in the process of using this strain in assays that will help us determine if a lack of this protein has a measurable effect on regulating the TTSS as we can look at expression of TTSS genes, actual secretion of proteins, and if this deletion affects virulence of *P. syringae*.

THE SEARCH FOR THE PSEUDOMONAS SYRINGAE EFFECTOR PROTEINS INVOLVED IN CAUSING EPIGENETIC CHANGES AND DISEASE IN THE HOST PLANT ARABIDOPSIS THALIANA

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Pseudomonas syringae, a Gram-negative plant pathogen, relies on a type III secretion system (TTSS) to proliferate and cause diseases in the model host plant *Arabidopsis thaliana*. The TTSS is essentially a molecular syringe that penetrates the host cell wall and membrane, enabling an arsenal of virulence proteins known as type III effectors (T3Es) to travel from the bacterium into host cells. Although the specific molecular mechanisms by which most T3Es contribute to disease have yet to be discerned, T3Es collectively contribute to disease primarily by suppressing plant innate immunity. Our laboratory has found a rapid deacetylation of histone H3 lysine 9 (H3K9) in *Arabidopsis* plants infiltrated with wildtype *P. syringae*. Plants infiltrated with a mutant strain incapable of injecting T3Es did not show this genetic modification. Using chromatin immunoprecipitation (ChIP) assays combined with quantitative PCR (qPCR), we found reduced H3K9 acetylation along a subset of innate immunity-related genes in only the wildtype pathogen-infected plants. This deacetylation correlated with reduced gene expression and suggests that T3Es play a role in modulating host chromatin and subsequent expression of innate immunity-related genes. Our current research focuses on determining which individual or set of T3Es from the roughly 40 *P. syringae*-injected T3Es are involved in the pathogen-induced deacetylation. To examine which T3Es are involved in chromatin modulation, we have started a systematic analysis of plants infiltrated with *P. syringae* polyeffector mutants that lack different

combinations of T3E genes. Using immunoblot analysis, we found no deacetylation in plants infiltrated with a mutant deleted for most of the T3Es, affirming that T3Es are responsible for modulating chromatin deacetylation. Our analysis of the *P. syringae* mutant collection will help elucidate which specific T3Es are involved in this chromatin modulation. Preliminary data suggests that multiple T3Es are involved in deacetylation as plants exposed to several polyeffector strains show a reduction in H3K9ac.

EFFECT OF ZINC AND NITROGEN DEPRIVATION ON LIPID ACCUMULATION IN CHLAMYDOMONAS

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Chlamydomonas reinhardtii is a model alga for the study of many processes. With the increasing emphasis on biofuels, *Chlamydomonas* and other algal genera have become more closely examined as possible fuel sources. Recently, it has been demonstrated that *Chlamydomonas* will produce large amounts of lipid droplets under conditions of nitrogen deprivation. The goal of this study was to examine how lipid accumulation was affected by zinc deprivation. Zinc is a required element for *Chlamydomonas* growth and is a cofactor of superoxide dismutase. Oxidative stress has also been shown to cause lipid accumulation and zinc was chosen as a target for this reason. We will present our lipid accumulation time course separately showing the effects of zinc, nitrogen, and a combination of both manganese and nitrogen deprivation. This project was funded by the NSF-EPSCoR program grant “Nebraska 2010-15 RII Project: Nanohybrid Materials and Algal Biology” (award number EPS-1004094) with funding for the microscopy facilities from the INBRE program (1P20RR164169).

BIOLOGICAL AND MEDICAL SCIENCES SESSION C

COMPUTATIONAL SELF-ASSEMBLY OF PHOSPHOLIPID BILAYERS

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We will present our results on the computational protocol that we have developed to self-assemble and equilibrate pure and 20% cholesterol containing palmitoyloleoylphosphatidylethanolamine (POPE), palmitoyloleoylphosphatidylcholine (POPC), and palmitoyloleoylsglycerophosphoglycerol (POPG) bilayers. Our protocol uses a coarse grain description of the phospholipids and of the solvent. A sequence of consecutive equilibrium molecular dynamics simulations brings the phospholipids from a random orientation inside the simulation box to an ordered lamellar phase. An in-house developed code measures the area per lipid and thickness (see Figure 1) of the equilibrated phospholipid bilayers. We found that our models closely match values reported in the literature. The bilayers we have thus assembled are useful to mimic the eukaryotic plasma membrane and to mimic the presence of cholesterol microdomains.

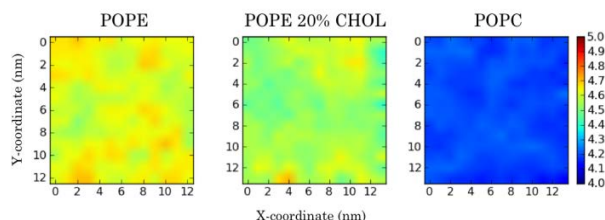


Figure 1. 2D plot of the thickness of pure POPE, POPE with 20% cholesterol and pure POPC bilayers, with the vertical bar to the right in nanometers. The analysis was performed over the last 50 ns of 100-ns

long coarse grain molecular dynamics trajectories. Our values match the reported experimental values at 320 K.

CONFORMATIONAL DYNAMICS OF THE SYRIAN HAMSTER PRION PROTEIN DURING INTERACTION WITH A MODEL LIPID BILAYER

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Prions are infectious agents responsible for transmissible spongiform encephalopathies, a fatal neurodegenerative disease in mammals, including humans. Prions propagate biological information by conversion of the non pathological version of the prion protein to the infectious conformation, PrP^{Sc}. The purpose of our study is to investigate the conformational changes that occur when the cell form of the prion protein (PrP^C) interacts with model phospholipid bilayers. This will provide insight into the first steps of PrP^C pathological folding. Specifically, we have explored the interactions of the Syrian Hamster prion protein with a DOPC bilayer using computational biomolecular modeling to elucidate possible binding conformations of the prion protein to the bilayer. We will present results on the validation of our coarse grain protein representation against all-atom Normal Mode Analysis. We will then discuss preferential binding sites, as predicted by our simulations. The anticipated outcome of the analysis is the identification of distinct conformations assumed by the protein during its interaction with the bilayer. The findings will be useful in understanding likely mechanisms of PrP^{Sc} induced toxicity by disruption of the cell membrane.

COARSE GRAIN MOLECULAR DYNAMICS ANALYSIS OF THE INTERACTION BETWEEN AB ALZHEIMER'S PROTOFILAMENTS AND A LIPID BILAYER

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Alzheimer's disease is a neurological disorder characterized by the presence of aggregate forms of the Ab peptide. The goal of this project is to test the hypothesis that polymorphic Ab protofilaments induce membrane disruption in a morphology dependent manner. To this end, we probe the dynamic conformational ensemble of distinct Ab protofilament morphologies interacting with phospholipid bilayers using coarse grain molecular dynamics simulations. Our results indicate that the Ab protofilaments diffuse at the aqueous interface. We will present results concerning the effect of this interaction on the thickness of the bilayer. Interestingly, our simulations to date do not support the hypothesis of aggregate insertion in the membrane. Understanding the mechanism of membrane disruption by Ab aggregates will shed light on toxicity pathways and will identify likely targets for the design of therapeutics.

CHARACTERIZATION OF THE PUTATIVE DNAK-SUPPRESSOR PROTEIN IN THE LYME DISEASE SPIROCHETE BORRELIA BURGDORFERI

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Borrelia burgdorferi is the causative agent for Lyme disease. *Borrelia* encounters many environmental challenges including shifts in temperature, pH, osmolarity, nutrient availability, as well as, oxidative and nitrosative stresses throughout its natural infectious cycle in *Ixodes* spp. ticks, birds, the white-footed mouse, white-tailed deer, dogs, cats, humans, and other small mammals. Many bacteria respond to environmental challenges by conserving energy using the stringent response mediated by ppGpp(p) and the DnaK-suppressor protein (DksA). DksA coordinates the interaction of ppGpp(p) with RNA polymerase resulting in the down-regulation of transcriptional and translational machinery gene expression. *B. burgdorferi* strain B31 open-reading frame bb0168 encodes a putative dksA homologue. We set out to characterize bb0168 using a heterologous system in *Escherichia coli*. This was achieved by cloning bb0168 into the arabinose-inducible plasmid pBAD/HisA to form the vector pBdksA. This

vector was introduced to a Δ dksA mutant in *E. coli* strain BW25113, which is hypersensitive to killing by 0.5 mM hydrogen peroxide (H₂O₂) and displays a growth defect in minimal M9 salts + 0.2% glucose (M9G) compared to wild-type controls. We have shown that in trans expression of bb0168 from the pBdksA plasmid functionally complemented the Δ dksA *E. coli* strain restoring wild-type levels of resistance to H₂O₂ and growth in M9G medium. Collectively, these data indicate that bb0168 encodes a functional dksA allele that may be crucial for the stringent response in *B. burgdorferi*. This work was partially made possible by Grant Number P20GM103427 from the National Institute for General Medical Science, a component of the National Institutes of Health.

STUDYING THE MECHANISM CAUSING ABNORMAL GROWTH OF *T. GONDII* IN COPS7B OVEREXPRESSING U-2 OS HOST CELLS

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Toxoplasma gondii is an obligate intracellular parasite and is the leading cause of congenital abnormalities in the United States. It is also estimated that 30% of the world's population is infected with the parasite. *T. gondii* is also a close relative to *Plasmodium falciparum*, the causative agent of malaria. Therefore, it is extremely important to know how the parasite lives within its host and what it needs from its host in order for the parasite to live. The Davis lab has created stable U-2 OS clones that over-express individual human genes, and the parasite exhibited abnormal growth in several of the clones. Those clones that exhibited abnormal parasite growth were selected for further research. Various assays were conducted to confirm the growth phenotypes of the parasite in the clones. Then research will be conducted into potential pathways and/or gene products that the parasite uses to grow abnormally fast or slow. By using chemical and/or genetic manipulation to elucidate the mechanisms of abnormal growth it is hoped that new information will be provided about new targets for drug development.

EFFECTS OF *TOXOPLASMA GONDII* GROWTH IN U-2 OS HOST CELLS THAT OVEREXPRESS THE GENE CYP17

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Toxoplasma gondii is an obligate intracellular parasite that can infect all mammals, including humans. Moreover, *T. gondii* is a close relative to *Plasmodium falciparum*, the causative agent of malaria. Due to the necessity of *T. gondii* to reside in a host cell, a cell based screening was used to determine what *T. gondii* is acquiring from its host. It was determined that when CYP17, a multifunctional enzyme involved in steroidogenesis, was transiently overexpressed in human cells *T. gondii* growth increased. To determine the mechanism of increased parasite growth, a vector containing CYP17 was transfected into a human cell line, which allowed for stable overexpression. This transfected cell line will be tested against wild-type human cells in three separate experiments, including: rate of parasite invasion into host cells, intracellular growth, and egress. The outcomes of these experiments will determine at what stage of growth CYP17 overexpression most affects. This new information will allow for new treatment regimens for toxoplasmosis possibly involving statin drugs.

CHARACTERIZING A POTENTIAL STAGE SPECIFIC TRANSCRIPTION FACTOR IN *TOXOPLASMA GONDII*

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Toxoplasma gondii is an obligate intracellular protozoan parasite that can infect all mammals, including humans. It is estimated that more than one third of the world's population is infected with *T. gondii*. Moreover, *T. gondii* is a close relative, and important molecular model, of *Plasmodium*

falciparum, the causative agent of malaria. Acute and latent toxoplasmosis, the disease caused by *T. gondii*, involves the tachyzoite and bradyzoite forms of the parasite, respectively, and is generally asymptomatic. On the other hand, toxoplasmosis is one of the leading causes of fetal malformations and deaths in immunocompromised individuals, and has been linked to risky behavior and suicidal tendencies. Furthermore, the transition from tachyzoite to bradyzoite is poorly characterized. To better understand this shift, RNA was extracted from parasites undergoing the tachyzoite to bradyzoite conversion and was submitted for microarray analysis. In total, 212 genes, comprising 2.4 % of the *T. gondii* transcriptome, were up-regulated early in the transition. Of these early up-regulated genes, 22 (31%) contained a 25 bp thymidine-rich consensus motif in their upstream regions. In addition, a hypothetical *T. gondii* transcription factor binds to this consensus motif and therefore poses a pivotal target for the development a *T. gondii* vaccine through its deletion.

A COMPARISON OF RIVER OTTER LATRINE SITES ALONG THE SOUTH LOUP RIVER AND THE PLATTE RIVER IN NEBRASKA

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The river otter was once a species prevalent through most of North America but can now only be found in 33% due to overharvesting and severe habitat depletion caused by pollution and human encroachment. Re-introduction programs in various states attempted to reestablish stable, healthy populations. Nebraska is among the states who have reintroduced river otters, specifically in both the Platte River and the South Loup River. Recent studies on the Platte River show there is a stable otter population, but population studies on the South Loup River are lacking. In this study, 10 miles of each river were examined, keeping track of the number of latrine sites and the number of scat piles at each latrine. The p-value of .067 for the number of scat piles present per latrine site is not considered significant.

BIOLOGICAL AND MEDICAL SCIENCES SESSION D

ANALYSIS OF A NOVEL COMBINATION OF ANTI-RETROVIRAL NANOPARTICLES FOR HIV PROPHYLAXIS

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Approximately 34 million people are infected with human immunodeficiency type-1 (HIV-1) world-wide. These statistics could be reduced if at-risk groups, including those individuals with a high likelihood of repeated exposure to HIV-1, were provided antiretroviral pre-exposure prophylaxis (PrEP). This experiment is designed to evaluate the efficacy of nanoparticles in gel as carrier systems for the simultaneous transport and sustained release of three antiviral drugs in cellular model systems for human disease associated with HIV infection. A thermosensitive vaginal gel containing raltegravir + efavirenz (RAL+EFV-NP), cellulose acetate phthalate (CAP), or cellulose acetate phthalate + efavirenz (CAP+EFV-NP) loaded PLGA nanoparticles for pre-exposure prophylaxis of HIV was prepared in order to test the efficacy of drug-loaded nanoparticles. The CAP, CAP+EFV and RAL+EFV-NPs were fabricated using a modified emulsion-solvent evaporation method and characterized for size and zeta potential. Thermosensitive vaginal gel containing RAL+EFV-NPs was successfully prepared using a combination of Pluronic F127 (20% w/v) and Pluronic F68 (1% w/v). A thermosensitive gel containing CAP-NPs and CAP+EFV-NPs was successfully prepared using a combination of Pluronic F127 (20% w/v) and Pluronic F68 (1% w/v). The EC90 of RAL+EFV-NPs was lower than raltegravir + efavirenz (RAL+EFV) solution but did not reach significance. Compared to control HeLa cells without any

treatment, RAL+EFV-NPs or blank gel were not cytotoxic for 14 days in vitro. The intracellular levels of efavirenz in RAL+EFV-NPs treated HeLa cells were above the EC90 for 14 days whereas raltegravir intracellular concentrations were eliminated within 6 days. The CAP, CAP+EFV, and RAL+EFV-NPs were evaluated for inhibition of HIV-1NL4-3 using TZM-bl indicator cells. Our preliminary data show that novel nanoparticle formulations of the CAP and EFV significantly inhibit HIV-1 replication at concentrations well below the IC50 of free drug or CAP alone. Transwell experiments of NPs-in-gel demonstrated rapid transfer of fluorescent nanoparticles from the gel and uptake in HeLa cells within 30 min. These data demonstrate the potential of antiretroviral NP-embedded vaginal gels for long-term vaginal pre-exposure prophylaxis of heterosexual HIV-1 transmission. Furthermore, novel drug carrier systems, such as nanoparticles, are promising tools that may help overcome current therapeutic obstacles and provide successful universal therapy. This work was partially made possible by Grant Number P20GM103427 from the National Institute for General Medical Science, a component of the National Institutes of Health and the Creighton University George Haddix Faculty Research Fund.

CHARACTERIZATION OF THE SITE OF NORA VIRUS REPLICATION IN DROSOPHILA MELANOGASTER

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Nora virus is a picorna-like virus that infects *Drosophila melanogaster*, but displays no apparent pathogenicity. The mode of transmission is hypothesized to be fecal-oral, but this has not been conclusively demonstrated. Therefore to examine the two most likely modes of transmission in *D. melanogaster*, fecal-oral and vertical, and to characterize the site of replication of Nora virus, we used infected and uninfected female *D. melanogaster*, removed their digestive tracts and ovaries, and tested each separately for the presence of Nora virus. Reverse transcription-polymerase chain reaction with Nora virus specific primers, and Western blot analyses with Nora virus monospecific antisera that we generate were used to locate the virus. The results demonstrate the presence of Nora virus primarily localized to the gut, demonstrating that the mode of transmission is fecal-oral and the site of replication is the gut. This research hopes to provide a method *Drosophila* uses to clear Nora virus, as well as contributing to the overall knowledge of picorna virus transmission. This work was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science, a component of the National Institutes of Health.

A COMPARISON OF NATURALLY OCCURRING VIRULENT AND AVIRULENT COXSACKIEVIRUS B3 5' UNTRANSLATED REGION SECONDARY STRUCTURE

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Coxsackievirus B3 (CVB3) is an enterovirus in the family Picornaviridae and relevant to human health, causing diseases including myocarditis, pancreatitis and aseptic meningitis. The viral genome includes a 742 nucleotide 5' Untranslated Region (5'UTR) that serves a critical role in CVB3 infection. Efficient viral replication and viral peptide synthesis require a specific 5'UTR secondary structure that has been extensively studied. Two naturally occurring strains of CVB3 include the virulent CVB3/28 and the avirulent CVB3/GA. Previous studies have used chemical probing to characterize the secondary structure of CVB3/28 and generate an experimentally supported structural model. This current study further examines and compares the CVB3 5'UTR secondary structure in both CVB3/GA and CVB3/28. The primary sequence of both strains has been determined in previous reports, and sequence changes occur at 63 of the 742 positions. Given this variability, the CVB3/GA 5'UTR may include mutations that disrupt or alter the formation of the specific secondary structures required for viral processes. Identification of 5'UTR structural differences between naturally occurring virulent CVB3/28 and avirulent CVB3/GA may provide a better understanding of the structures required for CVB3 5'UTR functionality as well as CVB3 virulence.

OTOTOXIC ANTIBIOTIC-INDUCED CHANGES IN COCHLEAR METABOLISM GENERATE CELL-DAMAGING FREE RADICALS

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More than 100,000 people treated with lifesaving antibiotics for bacterial infections develop hearing or balance disorders every year. Of the two types of sensory cells housed within the cochlea, inner hair cells (IHCs) are significantly more resilient than outer hair cells (OHCs) during age-related hearing loss or when exposed to acoustic trauma or ototoxins. We previously established that NADH intensity and lifetime analyses reveal differences in high- and low-frequency HC metabolism. We have also applied this metabolic imaging technique to show that the ototoxic antibiotic gentamicin (GM) alters mitochondrial metabolism. We now seek to determine if GM-induced changes in mitochondrial metabolism result in the production of cell-damaging reactive oxygen species (ROS). Specifically, ROS form and can rise to lethal levels when mitochondrial metabolism is significantly altered. Changes in mitochondrial metabolism and ROS production observed in high-frequency OHCs exposed to GM suggests ototoxic antibiotics alter the electron transport chain and mitochondrial metabolism. Understanding the metabolism of cochlear hair cells is crucial for preventing and treating hearing loss. This research was conducted at the Integrative Biological Imaging Facility at Creighton University, Omaha, NE. This facility, supported by the C.U. Medical School (CUIBF), was constructed with support from grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS, 8P20GM103427), a component of the National Institutes of Health (NIH). MN is supported by R15GM085776. This research was also supported by the National Institute on Deafness and Other Communication Disorders (R03DC012109), and COBRE (8P20GM103471-09) to HJS. The contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

SPATIALLY RESOLVED PROFILING OF MULTICELL SPHEROIDS BY NADH FLUORESCENCE LIFETIME IMAGING MICROSCOPY

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The ability of a cell to meet its energy demand with an adequate energy supply is a fundamental determinant of the health of cells and ultimately the body. Two-photon fluorescence lifetime imaging was used as a novel non-invasive technique to (1) quantify metabolic state in cells and tissues and (2) determine whether similar changes in metabolic state occur in various cellular and tissue samples exposed to aversive, often pro-apoptotic, stimuli. The ability to observe real-time changes in the fluorescence intensity and lifetime distributions (a sign of free and enzyme-bound states) of the metabolic intermediate NADH shows great promise as a powerful tool for unlocking the connection between metabolic activity and cell fate of three-dimensional living tissue. Employing this spatial profiling technique has revealed differences in metabolism of cells on the periphery of 300-500 μ m diameter tumor spheroids when compared to metabolic activity of cells housed deep within the nodule. This research was conducted at the Integrative Biological Imaging Facility at Creighton University, Omaha, NE. The facility, supported by the C.U. Medical School, was constructed with support from grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), a component of the National Institutes of Health (NIH). This investigation is solely the responsibility of the authors and does not necessarily represent the official views of NIGMS or NIH.

HABITAT OCCUPANCY OF RED-TAILED HAWKS IN AGRICULTURAL LANDSCAPES

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Red-tailed hawks (*Buteo jamaicensis*) are a common raptor in Nebraska. Despite this raptor's abundance, there has not been a lot of research into their potential habitat preferences. This study investigates whether or not Red-tailed hawks have an occupancy preference for either cropland or grassland prairie. Raptor density was measured at permanent sample sites along county roads uniformly located throughout Buffalo County, Nebraska. Sample sites consisted of a wide range of habitats ranging from exclusively row crops to pasture or rangeland. The study quantified the density of red-tailed hawks occupying each habitat. Density of raptors was estimated utilizing a variable circle plot methodology with distances determined with the use of a laser range finder. The resulting data were evaluated for statistical significance by Student's t-test and chi-squared test. This study is potentially important for providing basic information about the relationship between agricultural landscapes and Red-tailed hawk populations in Nebraska. In the future, these data could be useful for conservation or environmental monitoring.

EXPRESSION OF AVIAN TIMP2 IN *PICHTA PASTORIS*

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Tissue inhibitor of metalloproteinase-2 (TIMP2) regulates the activity of matrix metalloproteinase-2 (MMP-2). The interactions between TIMP2 and MMP-2 have been shown to play a role in cancer metastasis and other morphological processes. Ongoing studies in our lab suggest that TIMP2 helps determine cardiac neural crest pathway choice in avian embryos, and likely does so independently of MMP-2 interaction. To demonstrate this more concretely, we are working to establish a yeast (*P. pastoris*) line to produce both wildtype chicken TIMP2 and a non-MMP-binding mutant form of TIMP2 for further studies. In order to express chicken TIMP2 in yeast, we had to first modify the TIMP2 cDNA sequence in the following ways: 1) eliminate of two restriction enzyme sites within the cDNA for cloning purposes; 2) replace the chicken secretion signal with a yeast secretion signal; and 3) remove the 5' and 3' untranslated regions. Using overlapping PCR, we introduced two silent point mutations into TIMP2 to eliminate KpnI and MlyI restriction sites in the gene. We then ligated the modified TIMP2 into the pGEM-T Easy sequencing vector and transformed *E. coli* with the recombinant plasmid. Current work focuses on introducing the modified cDNA into the final expression vector for transformation into yeast.

NON-MUSCLE MYOSIN II MAINTAINS NEURAL PROGENITORS AND SUPPRESSES NEURONAL DIFFERENTIATION

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Explicit control of neural progenitor differentiation and self-renewal is essential for the proper formation of the complex neural circuitry in the developing brain. Recent studies suggest that self-renewal and appropriate differentiation of neural progenitors become unbalanced in various neurodevelopmental disorders such as autism spectrum disorders and lissencephaly. This abnormal development of neural progenitors may cause pathogenesis of these diseases. Thus, identifying regulatory mechanisms of the differentiation and self-renewal of neural progenitors could lead to a better understanding of the pathogenesis underlying neurodevelopmental disorders. Non-muscle myosin II (NM-II), a neuronal cell component, is an ATP-driven motor protein known to play a vital role in a variety of cellular processes. NM-II generates cellular contractile forces via interaction with actin filaments. Normal morphology and function of neural progenitors require appropriate control of actin-myosin contraction forces. Here we provide evidence that NM-II plays an important role in the maintenance and differentiation of neural progenitors. To explore the role of NM-II in neural progenitors, we cultured embryonic cortical progenitors and inhibited the activity of NM-II by treating

the cells with blebbistatin. Immunostaining with anti-MAP2, anti-tau1, and anti-nestin antibody showed that pharmacological inhibition of NM-II induced axon and dendritic extension in vitro. Maintenance of neural progenitors was also suppressed by NM-II inhibition. These results suggest that NM-II keeps neural progenitors from undergoing differentiation. However, the roles of NM-II in the regulation of microtubules and actin in neural progenitors remain to be explored.

CHEMISTRY AND PHYSICS CHEMISTRY

USE OF ENTRAPMENT TO PREPARE COLUMNS CONTAINING ALPHA₁-ACID GLYCOPROTEIN FOR RAPID STUDIES OF DRUG-PROTEIN BINDING BY HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY

Cong (Penny) Bi, Rong Li, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Alpha₁-acid glycoprotein (AGP) is one of the major acute phase proteins in humans. This protein has the ability to bind and to transport numerous basic drugs in the bloodstream. High-performance affinity chromatography (HPAC) is a powerful means for studying drug-protein binding that uses a biologically-related ligand as a stationary phase in a high-performance liquid chromatography (HPLC) system. This talk will focus on a slurry-based method for the entrapment of AGP in HPAC columns, which has been developed to study drug interactions with AGP. The conditions needed for this entrapment process were studied and optimized. Binding studies based on zonal elution experiments were conducted for *S*-propranolol, imipramine, disopyramide and other drugs, and the results were compared with results from the literature. The columns that were prepared were found to give entrapped AGP that had good agreement with the binding behavior that is seen for soluble AGP.

METAL DECORATED CERIUM OXIDE CATALYSTS: SYNTHESIS AND APPLICATION TO BIOPOLYMER HYDROLYSIS

Zane C. Gernhart, Y. Zhou, N.J. Lawrence, J.J. Burke, K.O. Sonnenfeld, and C.L. Cheung, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Cerium oxide based catalysts have been attracting an increasing amount of research attention due to their promising potential applications in energy production, chemical synthesis, and environmental remediation. The specificity of these catalysts towards a given reaction can often be modified through the use of surface functional groups and transition metal decorations. Herein we report on the synthesis and characterization of nanostructured cerium oxide catalysts. Effects of anionic functional groups and tin decorations on the catalytic activity of these nanostructured ceria nanorods towards hydrolysis reactions are investigated. This catalyst system has promising applications in the conversion of biopolymers to value added products.

DEVELOPMENT OF AN ON-LINE FORMAT FOR STUDYING DRUG-PROTEIN BINDING BY HIGH-PERFORMANCE IMMUNOAFFINITY CHROMATOGRAPHY

Ryan Matsuda, Donald Jobe, Jared Beyersdorf, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

The purpose of this study was to develop a new format for studying drug-protein interactions through the use of high-performance immunoaffinity chromatography. Columns were constructed by immobilizing antibodies against the protein human serum albumin (HSA) to a chromatographic support. Samples of HSA were injected and captured by the anti-HSA column with a capture efficiency of approximately 74%. The bound HSA was then used for various drug-protein binding studies. Frontal analysis was used to determine binding parameters such as the association equilibrium constants and

binding capacity for the drug warfarin with HSA. Zonal elution experiments were used to examine the binding of both warfarin and L-tryptophan with the captured HSA. The results indicated that high-performance immunoaffinity chromatography can be used as a tool for studying drug-protein binding. Information from this study could be applicable to clinical studies involving the extraction of specific proteins for drug-protein binding analysis.

USE OF PHILISA RAPID THERMOCYCLER IN UNDERGRADUATE BIOCHEMISTRY LABORATORIES

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Polymerase chain reaction (PCR) is a widely used and extremely valuable method for producing and analyzing small amounts of DNA, making it a valuable technique to teach to biochemistry students. Traditional PCR methods require longer cycle times which vary according to the size of DNA desired and therefore do not fit within the time periods of a typical laboratory period (approximately 3.5 hours). Previously, one lab period has been used for amplification of DNA and the next lab period has been used to analyze the amplicons using gel analysis. Although acceptable, in the past years it has been observed to be less optimal for student understanding. Newer polymerases (Hotstart Polymerase) coupled with a "rapid" thermocycler (Philisa) that is capable of decreased cycle times would allow the PCR and gel analysis of DNA products to be completed in a single lab period. We have used a Philisa thermocycler (Streck Laboratories, Omaha, NE) to determine if an instrument capable of decreased cycle times paired with Hotstart polymerase could allow completion of a PCR lab experiment during one academic lab period with optimal results. By comparing our current PCR lab protocol using an Eppendorf Mastercycler program (approximately 125 minutes) and the shortened Philisa protocol (approximately 25 minutes using manufacturer's recommended adjustments for the denaturation/annealing/extension times) with Hotstart polymerase, the Philisa did not produce an amplicon until magnesium ion concentration was increased from 1.5 mM to 4.5 mM. To optimize the process, the effects of polymerase concentration and nucleotide concentration (dNTPs) were also examined. The concentration of Hotstart polymerase appeared to have a modest effect, while the amount of dNTPs seems to have minimal effect on product formation. The Philisa rapid thermocycler paired with a rapid polymerase provides a very promising avenue to teach PCR in an academic setting. However, adoption of this technique requires optimization of the parameters for each experiment to make the PCR reproducible for undergraduate students.

EVALUATION OF MODIFIED MONOLITH COLUMNS USING HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY

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High performance affinity chromatography (HPAC) on monolithic columns has been shown in recent years to be a convenient tool for examining drug-protein interactions because of the fast analysis times and small sample requirements for this method. In this study, the polymerization process used to prepare monolithic column was modified to be based on photo-initiation and accelerator initiation instead of traditional thermal initiation. The modified monolithic columns were used to immobilize the protein human serum albumin (HSA) and tested at pH 7.4 and 21°C to compare the binding of these columns to the drugs carbamazepine and warfarin. The elution profiles of the two drugs were compared with a non-retained species on the HSA monolithic columns and control column over a broad range of flow rates and concentrations. The result gave good agreement with retention factors and binding data that had been obtained previously with other HSA supports.

STABILIZATION OF INTERNAL CHARGED TRANSFER BY INTRAMOLECULAR H-BOND IN N-ARYL-1,8-APHTHALIMIDES

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According to its unique photophysical properties, the 1,8-naphthalimide has been widely used in many areas of chemistry, particularly for fluorescence sensing. Several sensing mechanisms have been well developed, such as photoinduced electron transfer (PET), fluorescence resonance energy transfer (FRET), and internal charge transfer (ICT) for 1,8-naphthalimide. Recently, a family molecules based on N-aryl-1,8-naphthalimide structure have been synthesized in our research group to investigate the substituent effect to internal charge transfer (ICT). We found the internal hydrogen bond displayed strong ability to stabilize the ICT.

INTER AND INTRAMOLECULAR REACTION OF CARBANIONS WITH PEROXIDES: AN UMPOLED APPROACH TO CYCLIC ETHERS

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Ethers are important substructures in many natural products and bioactive molecules. One of the most widely used methods for ether synthesis involves displacement of leaving groups from sp³ carbon centers by oxygen nucleophiles (Williamson etherification). The umpoled version of this reaction, employs nucleophilic attack of a carbanion on electrophilic oxygen, this method, however has been investigated to a much lesser extent. We now present new methodologies to furnish ethers via inter and intramolecular reactions of dialkyl peroxides with both organolithium reagents and stabilized carbanions.

ANALYSIS OF FREE FRACTIONS FOR CHIRAL DRUGS USING AFFINITY MICROCOLUMNS AND MULTI-DIMENSIONAL HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY

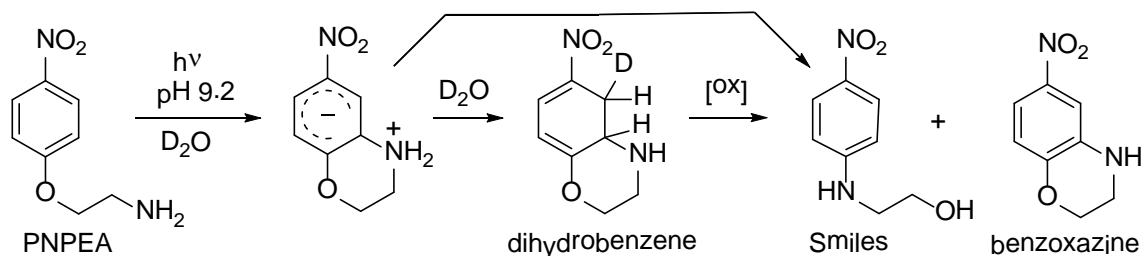
Xiwei Zheng, Michelle J. Yoo, and David S. Hage, Department of Chemistry, University of
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A multi-dimensional system based on affinity microcolumns, ultrafast affinity extraction and chiral separations was developed to measure the free fractions of drug enantiomers and to study their binding with serum transport proteins. R/S-Warfarin and the protein human serum albumin (HSA) were used as models to test this approach. Ultrafast extraction based on an HSA microcolumn was first used to separate the free and protein-bound fractions of R- and S-warfarin in the presence of a sample that contained soluble HSA. The extracted free fraction of R/S-warfarin was then delivered to a larger HSA column, which was utilized as a chiral stationary phase. It was found that the free fractions of R- and S-warfarin that were determined by this method gave good agreement with those measured by ultrafiltration. It was also found that this approach could provide a fast estimate of the association equilibrium constants for drug-protein interactions, giving results consistent with the literature and reference methods. This method could be utilized with clinically-relevant concentrations of warfarin and HSA and could be extended to other chiral drugs and serum proteins or used for the high-throughput screening of drug-protein interactions.

NOVEL SMILES PHOTOREARRANGEMENT AND INTRAMOLECULAR OXIDATIVE PHOTODISPLACEMENT OF HYDROGEN BY AN AMINE

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When 2-(4-nitrophenoxy)ethylamine (PNPEA) is irradiated ($\lambda > 330$ nm) at 0 °C in aqueous solution at pH 11, three dihydrobenzene intramolecular adducts can be detected by NMR. It seemed possible that the zwitterionic precursor of these adducts could undergo a novel sigmatropic rearrangement to give a Smiles photorearrangement, undergo oxidation to a benzoxazine, or suffer nucleophilic ring opening to give phenolic or aniline products. We report progress on unraveling this



complex solution photochemistry. Experiments with photolysis in buffered solution at pH 9.2 indicate by NMR and by UV-vis analyses that a minor amount of Smiles photorearrangement product is formed, and that in situ oxidation with 3,5-dinitrobenzoic acid causes major conversion to the benzoxazine.

HOMOLOGY MODELING AND DOCKING STUDIES OF CXCR7/LIGAND COMPLEXES

Jacques V. Anthony, Benadette Ngamelue, and Haizhen A. Zhong, Department of Chemistry, University of Nebraska at Omaha, NE 68182

CXCR7 is a structural homologous protein of CXCR4, a G-protein coupled receptor. Increasing evidence show that CXCR7 and CXCR4 promote tumor growth and metastasis, and induce angiogenesis. Inhibition of CXCR7 in CXCR4-positive breast cancer cells by small molecule inhibitors limited cell growth, suggesting that small molecule inhibitors targeting the CXCR7/CXCR4 pathway could be potential anticancer agents. The structure of CXCR7, however, is not known. Herein we report a homology model of CXCR7 by using CXCR4 as a template. By using docking studies of small molecules against CXCR4 and CXCR7, binding modes of small molecules for CXCR4 and CXCR7 are found, and our data suggest the binding residues that are responsible for ligand binding for drug design targeting the CXCR7 pathway.

PROTEIN ENTRAPMENT IN SILICA SUPPORTS FOR STUDYING INTERACTIONS OF PROTEINS WITH SMALL MOLECULES BY HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY

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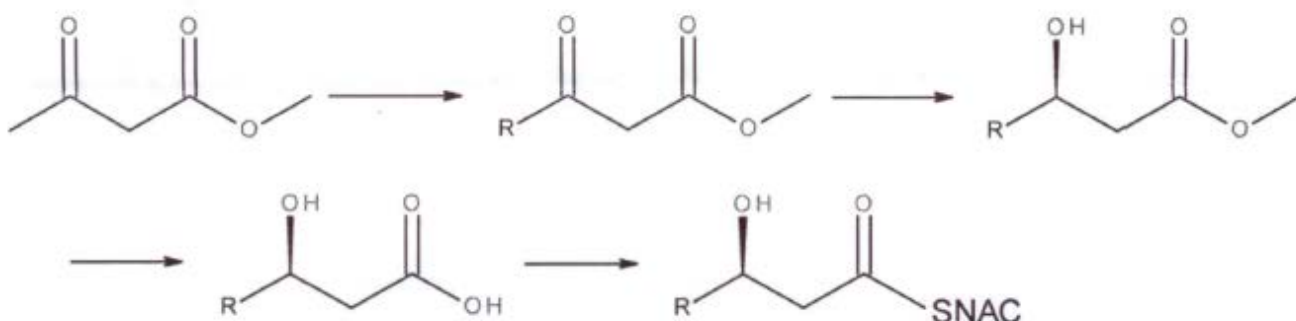
High performance affinity chromatography (HPAC) with stationary phases containing biologically relevant molecules is a powerful technique for studying the interactions of these ligands with other molecules. This approach often uses supports based on porous silica micro-beads to which a binding agent (e.g., a protein) is immobilized. The immobilization is commonly done via covalent attachment but this approach has possible drawbacks like the possibility of attachment close to the active site or the protein being attached through multiple sites. These problems can make the active site difficult to reach or inaccessible for the substrate, decreasing the immobilized binding agent's activity. An alternative immobilization methodology known as entrapment involves the encapsulation of the protein near the surface of the silica support instead of attaching it covalently. In this way, the native state of a soluble protein can be mimicked and higher protein activities can be reached. In this study, proteins were entrapped within hydrazide-activated porous micro-beads of silica that were then reacted with a mildly oxidized form of glycogen. Human serum albumin (HSA) was used as a model protein for optimizing the preparation conditions, with warfarin being utilized as a solute that binds to this protein and could be used for measuring the retention of the resulting stationary phases when placed in chromatographic columns. The reaction conditions were altered for maximizing the amount of HSA that was entrapped and the resulting retention factor for warfarin. The binding parameters determined for this drug were similar to those obtained when using silica containing covalently immobilized HSA. The protein activity obtained for the entrapment method was higher than the activities reported for covalent methods. An on-column entrapment approach was also examined, where HSA and oxidized glycogen were reacted with the modified silica in a flow-based format. This approach allowed even higher

retention factors to be obtained for warfarin, while using smaller amounts of reagents. These approaches are applicable to other proteins, as indicated by the results obtained with the lectin Concanavalin-A.

SIMPLE METHOD FOR THE ENANTIOSELECTIVE SYNTHESIS OF BETA HYDROXY THIOESTER DERIVATIVES OF N-ACETYL CYSTEAMINE

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As part of a collaborative investigation into processing of intermediates by fungal biosynthetic modules, we required an enantioselective route to a variety of N-acetyl cysteamine (SNAC) thioesters of 3-hydroxyalkanoates. We now report a convenient and general four-step synthesis of 3-hydroxyalkanoate SNAC thioesters. A variety of skeletons are readily prepared by alkylation of the dianion of acetoacetate. A subsequent Corey-Itsuno asymmetric reduction of the beta keto ester provides the beta hydroxy ester in 90-93% enantiomeric excess. Hydrolysis to the carboxylic acid can be accomplished in almost quantitative yield. Selective formation of an thioester in the presence of the free alcohol accomplished through carbodiimide-mediated coupling with SNAC.



CHEMISTRY AND PHYSICS PHYSICS

CONSTRAINTS ON UNIVERSAL EXTRA DIMENSIONS THEORY FROM DARK MATTER DIRECT DETECTION

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The theory of Universal Extra Dimensions (UED) contains an excellent dark matter candidate, the $B^{(1)}$, which is the lightest Kaluza-Klein excitation/particle (LKP). Constraints can be placed on the two most fundamental parameters of UED Theory, R (the size of the extra-dimension) and Λ (the cutoff scale of the theory) using recent dark matter direct detection results. Recent limits from the XENON experiment are used to calculate a generic WIMP-nucleon cross section for a range of masses. Using UED phenomenology, these cross section limits can yield limits on the mass splitting Δ , the ratio of the Lightest Kaluza-Klein particle (LKP) to the Lightest Kaluza-Klein quark (LKQ). This project builds upon previous work where constraints were placed on R and Λ for fixed values of the mass splitting. The presentation will address constraints on the fundamental UED parameters as a function of mass splitting and will comment on the usefulness of direct detection bounds to restrict UED theory. Results obtained are compared against recent accelerator bounds, specifically the lower bound for $1/R$ from the ATLAS experiment.

LARGE MAGNETORESISTANCE OF MNBI/BI/MNBI SPIN VALVE

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Recently, large transport spin polarization was demonstrated in MnBi films by Andreev reflection experiments [1]. Furthermore, a large magnetoresistance (MR) of 70% was observed in MnBi junctions at room temperature [2]. Because of this spin-valve MnBi/Bi/MnBi device is promising to have large MR that can be controlled by the varying the thickness of Bi spacer. Thin films of Bi show a semimetal-semiconductor transition at reduced thicknesses. Bismuth itself shows a substantial MR and a large mean free path of electron. In this system both the electrodes and the spacer have a hexagonal unit cell. A transport magnetoresistance of MnBi/Bi(6 layers)/MnBi film was calculated using density functional theory coupled with nonequilibrium Green's function method as implemented in SIESTA code. The calculations display a high transport spin polarization of MnBi. A transmission MR of the spin valve around 77% is calculated, consistent with the previous experimental observation of a large magnetoresistance in MnBi contacts. Thus, MnBi is promising candidate for high MR devices with tunable spacer properties.

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2. E. Clifford, M. Venkatesan and J. M. D. Coey, J. Mag. Magn. Mater. 272-276, 1614(2004).

MAGNETO-RESISTANCE IN THIN FILM BORON CARBIDES

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A new class of semi-conducting boron carbide polymers Chromium doped semiconducting boron carbide devices was fabricated based on a carborane icosahedra ($B_{10}C_2H_{12}$) precursor via plasma enhanced chemical vapor deposition. These polymers form a particular kind of materials which transition metal atoms found to dope pairwise on adjacent icosahedra site locations and may act as excellent spin filters when used as the dielectric barrier in a magnetic tunnel junction structure. In the case of chromium doping, there may be considerable enhancements in the magneto-resistance of the heterostructure. To this end, current to voltage curves and magneto-transport measurements were performed in various semiconducting boron carbide both in and out plane. The I-V curves as a function of external magnetic field exhibit strong magnetoresistive effects which are enhanced at liquid Nitrogen temperatures. Additionally, p-doped carbide polymers were deposited on n-type Si, showing excellent diode characteristics, suggesting that this class of materials has the potential for neutron detection and other device applications.

THE POSSIBILITY OF CAUSAL PARADOX WITH THE ALCUBIERRE DRIVE

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The Alcubierre Drive is an engine designed to allow faster than light travel without breaking Lorentz Invariance. By a clever manipulation of the local spacetime the engine locally travels at sublight speeds but globally travels at superluminal speeds. Causal paradoxes are quite problematic for more generic faster than light mechanisms. I discuss the possibility of such paradoxes with the Alcubierre Drive.

TWO PHOTON FLUORESCENCE CORRELATION SPECTROSCOPY OF PROTEINS IN GLUCOSE SOLUTIONS

Eric Hauger, N.S. Holman, M.G. Nichols, D.L. Sidebottom, and E.J. Haas, Department of Physics, Creighton University, Omaha, NE 68178

Cryopreservation is an effective method for stabilizing and storing biomaterials with a wide array of applications ranging from the preservation of organs to use in cellular research. Common cryoprotectants contain simple sugars such as glucose or fructose. However, the mechanism responsible for this protection is poorly understood on the molecular level. The water replacement model predicts that water molecules around the surfaces of proteins are replaced with sugar molecules, forming a protective layer against the denaturing ice formation. Under this scheme, one would expect an increase in the hydrodynamic radius with increasing sugar concentration. In order to test this hypothesis, we have developed two-photon fluorescence correlation spectroscopy (FCS) to measure the hydrodynamic radius of tryptophan-containing fluorescent proteins. To date, we have succeeded in measuring the diffusion characteristics and the relative detection sensitivities of both Avidin-coated polystyrene spheres and hemocyanin, an oxygen-carrying protein found in arthropods. Thus, we have demonstrated proof of principle that correlations with these proteins are possible and that FCS will be a useful method for testing the water replacement model.

This work was supported through funding from National Institutes of Health (grant #1R01EB009644-01)

A CHARACTERIZATION OF CROSSTALK IN THE PSI46V2 PIXEL READ OUT CHIP Cameron Bravo and Aaron Dominguez, University of Nebraska–Lincoln, NE 68588

The PSI46V2 analog read out chip used to read out the silicon pixel sensors of the CMS detector is characterized. This is a search of parasitic signals in the read out electronics. A laser is used to inject a signal into an individual pixel so the effects of the resulting read out chain can be studied. A crosstalk mechanism that causes pixels beyond the injected pixel to report a hit is of main interest. This study will also carefully consider effects that arise from the delays of signals in the electronics, due to limited current available to the amplification of the signal.

LESS THAN PERFECT C_{2v} SYMMETRY: LOSS OF MIRROR PLANE SYMMETRY IN ANGLE-RESOLVED PHOTOEMISSION.

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The effects of lack of in-plane C_2 invariance of the crystal on the angle-resolved photoemission spectra are investigated for Mo(112). The results indicate that, for Mo(112), the absence of C_2 symmetry gives rise to noticeable asymmetry in the ARPES band mapping along the $\langle 11\bar{1} \rangle$ direction. The apparent differences in the experimental band structure in $+k$ versus $-k$ wave vectors can be understood quantitatively in terms of the asymmetries in the electronic bulk band structure, photoelectron diffraction as well as the initial state contribution to the photoemission matrix elements.

MARTENSITIC TRANSITION IN SHAPE MEMORY NIMNIN ALLOYS

R. Sabirianov and N. Al-Aqtash, Department of Physics and Astronomy, University of Nebraska at Omaha, NE 68182; and A. Sokolov, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68588

We have performed density functional theory calculations of the effect of the martensitic transition on the electronic structure of Ni_2MnIn system. We used experimentally obtained lattice parameters for both phases. We find that both the cubic and tetragonally distorted (martensite) phases have a ferromagnetic ground state. The cubic phase has lower total energy than that of the tetragonal phase by $\Delta E = 0.3 \text{ eV/f.u.}$ Larger relative concentration of Mn with respect to In, i.e. $Ni_2Mn_{1.5}In_{0.5}$ change the relative stability in favour of martensitic phase. Mn sites have calculated local magnetic moment (LMM) of $3.2 \mu_B$, while Ni LMM is only $0.3 \mu_B$. The total densities of states exhibit a pronounced feature in the minority DOS at Fermi level. This feature is related mainly to Ni 3d states and it is very sensitive

to the local environment on Ni sites. Simple tetragonal distortion reduces $N(E_F)$. Furthermore, the increase of the Mn content, where Mn substitutes for In sites and orders antiferromagnetically to the magnetization of the regular Mn sites, causes substantial modification in densities of states near Fermi energy affecting the transport properties upon the phase transition. The band structure of the cubic and tetragonal phases reveals that the tetragonal distortion substantially changes Fermi velocity, $\hbar^{-1}dE_k/dk$, that may result in substantial change in resistance upon martensitic transition. We compare our results with the magnetic and transport measurements performed on the thin and ultra-thin films of $Ni_{50}Mn_{35}In_{15}$ grown by laser-assisted molecular beam epitaxy deposition from pre-synthesized targets.

NEBRASKA CHAPTER NATIONAL COUNCIL FOR GEOGRAPHIC EDUCATION

ESTIMATING RANGELAND BIOMASS WITH LANDSAT IMAGERY

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The need exists to create a reliable and accurate means of monitoring and measuring rangeland biomass. The following research was employed to determine whether Landsat 4-5 TM could be used to produce accurate biomass values for the Sandhills region of Nebraska. The vegetation indices NDVI and SAVI were derived using Landsat imagery. These values were extracted from the locations where ground truth biomass data existed. Linear regression was utilized to formulate predictive models for biomass from both vegetation indices. The resulting correlations ($0.42 \leq r^2 \leq 0.66$) indicate that this method is a fairly accurate way to predict biomass values. Additionally, correlation between cumulative precipitation data and the vegetation indices show that early spring precipitation is the best indicator of biomass health later in the growing season.

RADAR INTERFEROMETRY OF LAND CHANGES DUE TO RECENT EARTHQUAKES IN NEBRASKA AND SOUTH DAKOTA

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Interferometric synthetic aperture radar (InSAR) is increasingly used as a tool in the investigation of land surface changes due to earthquakes and other disturbances. We are investigating the use of InSAR to study surface effects from earthquakes in the region between the Black Hills of South Dakota and Nebraska's Pine Ridge. Challenges to InSAR analysis typical of this region include the low amplitude of ground movement, seasonal vegetation changes, snow cover and interference from atmospheric water vapor. We are using radar data from the European Space Agency's ERS1, ERS2 and Envisat satellites procured through the Western North America InSAR (WInSAR) Consortium. Our research is in the preliminary stages but indicates that InSAR is a promising technique for measuring ground surface changes due to small earthquakes typical of those in the Great Plains.

PLEISTOCENE HORSES FROM SIX MILE BUCKLE, CHAVEZ COUNTY, NM

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An assemblage of Late Pleistocene age fossils found at Chavez County, New Mexico, in the 1960's was donated to Chadron State College in the summer of 1970 by collector Walter Harbach. The Six Mile Buckle locality is interpreted as a fissure filling of tectonically-controlled karstic fractures. Re-excavation of the site in 2012 revealed fossils in a sandy matrix, similar to that adhering to the specimens in the Harbach collection. Screen sifting of collected matrix samples expanded the collection with small bones including those of rabbit, snake, and rodents. Larger fauna in the assemblage include *Stockoceros*, several carnivores, including a bear, and over 100 horse teeth. The dominant horse is

identified as *Equus conversidens* by comparison with horses at other late Pleistocene localities. Minimum number of individuals for *E. conversidens* was 8. A high proportion of both young and old individuals indicate a classic attritional assemblage with a bias toward inexperienced and less healthy horses and rules out a death event that sampled a cross section of the population.

COMPARING MEASURES OF THE DEMOGRAPHIC IMPACT OF MIGRATION

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Various measures have been developed with the goal of assessing the demographic impact of migration on locations, including net-migration rate, migration-effectiveness ratio, and migration-efficiency ratio. While each of these measures has received a level of support in the literature, to date there has been no comprehensive evaluation comparing these measures to each other. In this paper the relative strengths and weaknesses of each measure are discussed and county-level data from the 2000 Census for Nebraska are used to provide a case study in the comparison of these measures. The results show a high degree of correlation between all three measures, particularly between the effectiveness and efficiency ratios, indicating a significant amount of redundancy between them. Variability is greatest at the extreme high and low ends of comparisons between net-migration rate and each of the other two measures, which has implications for migration theory.

HISTORICAL GIS FOR SPATIAL ANALYSIS: CIVIL WAR WASHINGTON EXPERIENCE

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Historical geographers have noted serious challenges relating to the direct, quantitative study of urban geographic trends on a local scale prior to 1940. The United States Bureau of the Census maintains detailed records on individuals, but obtaining and matching historical addresses to contemporary locations is complicated by a number of factors, including changes to the built environment, renumbering of streets, and the difficulty of obtaining original house numbers from the available data.

The process of creating an interactive, geocoded dataset of 1860 Census records for Washington, D.C. is described thoroughly in this research as a model for future study. Preliminary analysis of geocoded data on heads of household records reveals that the city was fairly segregated along lines of race and socioeconomic status. Unlike many modern American cities that have class divisions or racial divisions across entire neighborhoods, Washington's privileged elite lived along the prominent street rail lines and parks, while the working-class whites and free black residents lived in outlying city blocks. Lastly, the experience of developing and using this historical dataset provides a strong case for standardizing the creation of historical geographic information systems.

Keywords: GIS, geography, historical geography, quantitative geography

GEOGRAPHY EDUCATION: PAST, PRESENT, AND FUTURE

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Geography education is a topic that has been long debated. When talking about geography education in public K-12 institutions, the who, what, how and how much have been hot topics since the 1800s when the Council of Ten started the discussion. As the years have progressed, education as a whole has seen many changes. The nineteenth century brought the National Council for Geographic Education, the National Geography Standards and the introduction of the Geography Education Specialty Group. These brought better alignment of the standards with the rest of the curriculum. The twenty-first century has brought the latest changes with the the Goals 2000 Initiative. The debate is ever evolving. So, has geography education changed since the 1800s? Are we any better at teaching

geography education today? Are American children any more geographically knowledgeable? The study of these questions is far reaching and not easily answered.

A POLITICAL-GEOGRAPHICAL PERSPECTIVE ON THE 2012 U.S. PRESIDENTIAL ELECTION

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Shelley, Archer, Davidson and Brunn ended Chapter 9 “Presidential Politics in Historical and Geographical Perspective” of their book Political Geography of the United States (Guilford, 1996, p. 307) asserting that “Whether the results of the 1992 election imply relatively uniform shifts in favor of one party or the other or whether it involves a deeper and more lasting realignment of the electorate remains to be seen.” The purpose of this paper is to extend the 1872 to 1992 time-period of the national county-level T-mode factor analysis reported upon earlier in order to additionally analyze the results of the 1996 to 2012 presidential elections. The results suggest that a new and distinctive “geographical normal vote” pattern has begun to emerge in the county-level popular results of early 21st Century U.S. presidential elections.

TEACHING OF SCIENCE AND MATH

PHAGE HUNTING WITH HHMI’S SEA-PHAGE PROGRAM

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Chadron State College (CSC) became an associate member of the Howard Hughes Medical Institute’s Science Education Alliance – PHAGE program (HHMI SEA-PHAGE) for the 2012-2013 school year. The SEA-PHAGE program is designed to immerse students in the scientific process while performing unique research. Students spend one semester isolating and purifying phages (in situ) and the second semester annotating the sequence of one phage (in silico). The original program was intended to reach freshmen students, but, as associate members, CSC had the ability to implement the course in any way that worked in our program. The upper-level biotechnology laboratory course housed in the in situ portion of the project in the fall semester, and the in silico portion is being embedded in the upper-level genetics course. The implementation of the SEA-PHAGES project brought a new level of vigor into the laboratory course. The students were excited to be performing science that would make a contribution to the greater scientific community. The project brought multiple opportunities for the students to further investigate topics they have learned about in the biology discipline. The real-life research project also opened the students’ eyes to the understanding that scientific investigations do not always go as planned and sometimes result in more questions than answers. The students in the genetics course will be performing sequencing analysis on the genome belonging to Buggy, a phage isolated and purified by one of the students in the fall. The students will be able to apply what they have learned about the sequences necessary to constitute a gene, including promoter elements, translational start and stop sequences, and 5’ and 3’ directionality. Hopefully, the students will have a better understanding and appreciate for what constitutes a gene. They will also gain a tremendous understanding of how databases can be used in annotating a DNA sequence, a skill that has not been previously taught in the course. Becoming a member of HHMI’s SEA-PHAGE program has opened up many new opportunities for CSC students that extend beyond the raw content knowledge, but add skills and understanding of the scientific process.

DEVELOPMENT OF A RESEARCH BASED ORGANIC LABORATORY SEQUENCE

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A research based organic chemistry laboratory sequence (involving primarily sophomore students) is being developed in conjunction with our undergraduate research program (primarily Jr. and Sr. students). The extraction of caraway seeds and identification of its components, and subsequent modification of commercial R- and S-carvone is the basis for the lab sequence. Carvone was chosen because of its common and well studied properties, it is chiral, and there are several literature articles and reactions, such as reduction with NaBH₄, to serve as a basis for these experiments. We have developed Grignard reactions to illustrate direct and conjugate addition and TLC, GC/MS, and IR analysis of the resulting diastereomers; molecular modeling is used to predict the major diastereomer formed. Diels Alder and ester formation reactions will be similarly discussed. The OSIRIS Property Explorer at the organic chemistry portal <http://www.organic-chemistry.org/> is used to illustrate several properties, including solubility, likeliness as a drug, and toxicity. These properties to help guide us in determining target compounds, since most of these are uncharacterized compounds.

A COLLEGIATE LABORATORY EXERCISE FOR GENOTYPING A HUMAN SINGLE NUCLEOTIDE POLYMORPHISM

James E. Fernando, B. A. Carlson, T. S. LeBard, M. R. McCarthy, F. Umali, F. F. Rose, Jr.,
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This presentation describes a protocol designed for collegiate use that genotypes a single nucleotide polymorphism (SNP) which controls the perception of bitter taste. Students can immediately assess their phenotype with phenylthiocarbamide (PTC) imbibed paper, and then compare it to their genotype from the PCR results. Approximately 20% of the population is unable to taste PTC. The PCR protocol is based off the amplification-refractory mutation (ARMS) system by Little (2001). Four primers, run in multiplex, give three bands; a positive control, tasting genotype band, and non-tasting band. DNA is easily acquired from a 30 second saline mouth rinse. Students garner an understanding of the relationship between phenotype and genotype, PCR, and how small mutations in genomic DNA, such as SNPs, give rise to a portion of the phenotypic diversity found in humans. The protocol is relatively inexpensive and used standard molecular biology reagents and equipment.

MOLECULES TO CELLS: A FIRST-YEAR LEARNING COMMUNITY COMBINING GENERAL CHEMISTRY 1 AND CELL BIOLOGY

Tessa Durham Brooks, Kate Marley, and Erin Wilson, Departments of Biology and Chemistry,
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Faculty members in the Chemistry and Biology Departments at Doane College identified an opportunity to 1) build a first-year science experience that reflects the close connections between biology at the cellular level and chemistry; and 2) reduce redundancy in content between Cell biology and General Chemistry 1. The result was Molecules to Cells, a collaboratively-taught 8 credit learning community course for first-year students combining content from General Chemistry 1 and Cell Biology. While maintaining the core content in both disciplines, this course was designed to emphasize connections between the disciplines (e.g. chemical structure and biological function of ATP). We will discuss our perspectives on three years of teaching Molecules to Cells, present materials and class activities used in the course, and give student feedback and ACS standardized exam evidence of the effectiveness of this course.

LEARNING THE TENANTS OF HUMAN BIOMECHANICS THROUGH RESEARCH ON THE HUMAN GAIT

Lara L Madison, Department of Physical and Life Sciences, Chadron State College, Chadron,
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Biomechanics is the study of the mechanics of human movement and the course is taught as a 400/500 level course. In an effort to engage students in discussion of the primary literature as well

inquiry based research, the class read the book *Born to Run* by Scott McDougall in addition to their text *Biomechanics* by Susan Hall. *Born to Run* discusses the growing movement in the running world that human beings should run barefoot and not in the modern running shoe. The premise of the class was to apply biomechanical tenants learned from the textbook to a small research project. Based on the students' primary literature reviews as well as data collected from videos and force sensors, the students refuted or supported the premise in *Born to Run*. As a class the students designed the research protocol for collecting data on professors, students, and track athletes walking and running in modern running shoes, minimal support running shoes, and barefoot running shoes. Upon completion of the research the students wrote a research paper summarizing their work and presented the project to Chadron State College as well as at Nebraska Academy of Sciences.

COMPUTER SIMULATION OF SLEEP APNEA AND CONGESTIVE HEART FAILURE

Emily Pfeifer, Elizabeth Warner, and Josef Kren, Bryan College of Health Sciences, Lincoln, NE 68506-1398

Sleep apnea is a medical condition in which a person's respiration is interrupted during sleep. It might lead to numerous health problems like heart attacks, heart failure, hypertension, stroke and diabetes mellitus. Stress level in patients with sleep apnea is increased and might have significant effects on cardiovascular physiology. Some recent studies have shown that people who suffer from sleep apnea are likely to develop congestive heart failure (CHF). It is not a common practice to test patients with congestive heart failure for sleep apnea. Based on clinical studies, it is obvious that a combination of sleep apnea and congestive heart failure might be fatal. In our computer model we focus on monitoring partial pressure of blood gasses as an inadequate function of the pulmonary system.

PATHOPHYSIOLOGY OF FATTY LIVER: COMPUTER SIMULATION AND MODELING

Melissa Sukhram, Rachel James, Amy Morton, and Josef Kren, Bryan College of Health Sciences, Lincoln, NE 68506-1398

A process called steatosis leads to accumulation of fat molecules in hepatocytes. Alcohol is metabolized in the liver by the cytochrome P450 enzymes. Chronic alcohol exposure increases hepatocyte inflammation beginning with the macrophages producing TNF-alpha. This causes the mitochondria to increase the production of reactive oxygen species, which promotes hepatocyte necrosis. The free radicals initiate peroxidation triggering inflammation and fibrosis ultimately leading to steatosis. The most common reason for a fatty liver is alcohol consumption. In our computer model we investigated the progression of fat accumulation in hepatocytes due to daily alcohol intake over time. We modeled various amounts of alcohol consumption and the time needed to produce a fatty liver.

COMPUTER SIMULATION OF ACUTE RENAL FAILURE

Allyse Edwards, Kurtt Kuhl, and Sarah Wadas, Bryan College of Health Sciences, Lincoln, NE 68506-1398

Acute kidney failure is a medical emergency that affects patients in many ways. This inhibits the kidney's ability to remove waste, balance fluids, and electrolytes in the human body. There are various causes of kidney failure like acute tubular necrosis, decreased blood flow due to hypertension, infections, complications of pregnancy, and Type 2 Diabetes. We developed a computer model stimulating acute renal failure in a patient admitted for a decreased urine output and edema in the legs. A decreased glomerular filtration rate and increased level of plasma creatinine were evaluated by using the modeling software Stella.

PATHOLOGY OF STRESS: PREDICTIONS AND SIMULATIONS

Emilea Harrahill and Lacey Huber, Bryan College of Health Sciences, Lincoln, NE 68506-1398

With the advancements of modern technology and our ability to utilize computer simulations, we have been able to model and simulate the processes leading to homeostasis of the human body. The education of health care providers and students everywhere has been forever changed by the computer simulations that can be seen today. We have developed a model to simulate the effects of everyday stressors and their effects on our bodies. We have predicted the short-term effects that stress can cause, and how over time, these can turn into more serious complications if stressors cannot be eliminated. Our model was developed by utilizing the software Stella.

UNDERSTANDING PHARMACOKINETICS THROUGH STELLA MODELS

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Commonly used Stella software allows us to design a model reflecting an actual or theoretical system, and executing that model to observe its behavior and analyze the results. Computer simulation and modeling enhances students' critical thinking required while working on the hospital floor, especially at intensive care units. Our model is depicting morphine dosing for a patient in a long-term care facility. The patient is currently on morphine sulfate 20mg every 4 hours. It is noticed upon rounds that the patient is experiencing sedation, constipation, bradycardia, respiratory distress, euphoria, dizziness, hypotension, signs of addiction, nausea and vomiting. The patient is rushed to the Emergency Room and examined. After stabilizing the patient and performing tests, it is determined that the dosage sent from pharmacy was incorrect. Our computer model shows the likely process of patient's overdosing.

COLLEGIATE ACADEMY BIOLOGY SESSION A

RNAi OF SPERMATHECAE GENES IN *DROSOPHILA MELANOGASTER*: FUNCTIONAL EFFECTS ON SPERM STORAGE

Jami Pritschau, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and L. Harshman and B. Stork, School of Biological Sciences, University of Nebraska–Lincoln, NE 68588-0118

Sexual reproduction is an essential element to maintain any population and females of many organisms have evolved ways to store sperm they receive during mating in specialized organs of their reproductive tract. A variety of proteins have been identified as being expressed in the spermathecae, yet the role of these proteases is unclear. This study investigated the role of 14 previously identified genes and their expressed proteins in the spermathecae of female *Drosophila melanogaster* by comparing the number of eggs, as a proxy for sperm storage, of mated RNAi induced females and control line females. Analysis of the 14 RNAi line crosses showed that lines CG17012, CG17234, CG17240, and CG31681 all had significant decrease in total egg number in the experimental lines compared to the control lines. These four genes appear to produce proteins that may play a role in how much sperm is stored and/or how fast sperm is utilized from the spermathecae.

DETERMINATION OF INTRA-SPECIES COMMUNICATION (QUORUM SENSING) WITHIN *MYCOBACTERIUM SMEGMATIS* USING *STREPTOMYCES COELICOLOR*

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Quorum sensing is a cell-cell communication system that is exhibited by all bacterial cells. The bacterial cells use special molecules called auto-inducers to interact with each other. The objective of this study is to find out if the bacterium *Mycobacterium smegmatis* possesses a quorum sensing system. Through the use of previous research, extraction of the molecule thought to be associated with the unknown quorum sensing system in *Mycobacterium smegmatis* will be obtained and tested for biological activity. To help determine if quorum sensing occurs in *Mycobacterium smegmatis*, the use of a well-defined quorum sensing system in *Streptomyces coelicolor* will be used to prove the presence of this system. The results show that there is biological activity occurring between *Mycobacterium smegmatis* & *Streptomyces coelicolor*.

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AN INVESTIGATION INTO THE CHANGES IN PROTEIN GLYCOSYLATION AND ANTIGENICITY DUE TO MUTATIONS IN THE *A064R* GENE OF THE *PARAMECIUM BURSARIA* CHLORELLA VIRUS

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Paramecium bursaria chlorella virus (PBCV-1) is a member of the *Phycodnaviridae* family (genus *Chlorovirus*). This large, dsDNA virus (330,611 bp) encodes nearly 400 proteins, many of which are not commonly found in viruses. Unlike other viruses that use the host machinery associated with the ER and Golgi for protein glycosylation of capsid proteins, PBCV-1 and its relatives encode most, if not all, of the machinery to glycosylate its proteins. PBCV-1 and its algal host, *Chlorella variabilis*, can be grown on Petri dishes. Plaques consequently form when PBCV-1 infects *C. variabilis*, a eukaryotic, endosymbiotic, and unicellular green algae. Five groups of PBCV-1 antigenic mutants have been isolated; the differences in the antigenic phenotypes are correlated with altered glycan structure of the major capsid protein. The purpose of this project was to gain a better understanding of the virus's role in the glycosylation of its major capsid protein. The genomic DNA of the PBCV-1 chlorella virus was isolated from antigenic mutant strains P9L7, P9L13, EPA-3, E1L3, P1L6, P1L10, and P41, and the *a064r* gene was amplified by PCR. The PCR product was cleaned using a QIAquick® purification kit and submitted to the Davis Sequencing facility for sequencing. The DNA sequences of the seven strains were compared to the wild type *a064r* gene. Successful amplification of domain 1 proved troublesome for all of the antigenic mutants with the exception of P9L7. (Future research will involve additional attempts at amplifying this region of the gene in the mutant strains.) All three domains of the P9L7 mutant were successfully sequenced and analyzed, revealing a point mutation in domain 2, 1102G>T, resulting in the substitution of G>W. These results are consistent with the antigenetic pattern of previously sequenced mutants of the P91 sero group. A mutation was also found in domain 2 of the mutant strain P1L6, which is of the sero group P100; a substitution mutation occurred within the nucleotide sequence, 1106T>G, resulting in an amino acid change from N>I. The remaining five samples in this study revealed no mutations in the regions of *a064R* that encode domains 2 and 3, suggesting that those antigenic mutants have mutations in the region of *a064R* that encodes domain 1, or they have mutations in some other unknown gene.

CARBON FIBER REINFORCED POLYETHERETHERKETONE (CF-PEEK)—NEXT GENERATION IN ORTHOPEDIC INTERNAL FIXATION MATERIALS

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The goal for treatment of long bone fractures is to stabilize the fracture in an anatomical position, allow the patient to heal with minimal complications, and to regain normal use of their extremity.

Fracture fixation has evolved over many centuries and intramedullary nails have proven to be valuable for long bone fractures. The nails are inserted during a minimally invasive surgical procedure allowing flexible fixation leading to prompt healing. Biomechanical and biocompatibility properties of continuous carbon fiber reinforced polyetheretherketone (CF-PEEK) composite nails are beneficial for use in orthopedic fixation implants and possess qualities not present in traditional metal nails. CF-PEEK composite properties include a modulus of elasticity similar to that of cortical bone, unparalleled fatigue strength, superior bending strength, and radiolucency; making carbon fiber implants suitable for internal fixation of long bone fractures.

EARLY LEARNING EXPERIENCE AND RESVERATROL SUPPLEMENTS AFFECT IL-6 AND NEUROTROPHIC FACTOR GENE EXPRESSION

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Early learning experiences and dietary supplements have been shown to affect learning and memory in middle-aged mice. The relationship between these enrichments and relevant inflammatory and neurotrophic factors was examined. Two cohorts of 14 month old mice [one exposed to an enriched learning experience at 6-8 weeks of age (EE), the other without that experience (NE)] were randomly assigned to receive diets supplemented with either .04% resveratrol (RES), 0.1% ethanol (EtOH), both .04% resveratrol 0.1% ethanol diet (RES+EtOH), or standard diet only (CON) for 9 weeks. After training on the Barnes maze, mice were euthanized and hippocampal brain slices were extracted for analysis. The qRT-PCR analysis indicated effects of early experience on expression of BDNF, IL-6, SIRT-1 and TNFA. Resveratrol supplemented diets led to lowered expression of IL-6. The significant interaction between experience conditions and dietary conditions indicated that this reduced expression of IL-6 was observed only in the mice with early learning experience.

THE EFFECT OF MOISTURE, RELATIVE HUMIDITY, AND GROWTH STAGE ON *FUSARIUM* SPP. IN AIR AND GRAIN SAMPLES OF SORGHUM

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Sorghum grain is valuable for livestock feed, human consumption, and bioenergy applications. This grain is susceptible to colonization by several fungal species of the genus *Fusarium* spp., some of which contain potential toxins. This preliminary study was designed to examine field variables that may impact the presence of fungal spores. Moisture, relative humidity, and growth stage are factors believed to increase colonization of *Fusarium* spp. These variables were examined by passive spore trapping in dryland and irrigated sorghum fields. Sorghum fields contained the greatest number of *Fusarium* spores with moderate amounts of moisture in the five days preceding sampling. Relative humidity of the field on sampling days had no impact on the number of spores collected. Finally, *Fusarium* were collected evenly across all growth stages: vegetative, anthesis, grain development, and maturity. In regards to collected grain, samples from mature sorghum in the irrigated field contained a greater number of *Fusarium* than did mature grain from the dryland field. The results of this study suggest that colonization of sorghum by *Fusarium* spp. is most likely to occur in the early growth stages, and that irrigation of sorghum fields increases the number of *Fusarium* present on mature grain samples.

EFFECTIVENESS OF BAYER INSECTICIDE EAR TAGS ON THE CONTROL OF FACE, HORN, AND STABLE FLIES AND THE IMPACT OF FLY REDUCTION ON WEIGHT GAIN IN CATTLE

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Three different species of flies parasitize livestock, and are visually distinguishable by the body region of cattle on which they are found. The face fly, *Musca autumnalis* De Geer, is found only on the face and more specifically around the eyes. The horn fly, *Haematobia irritans* L. is found on the back, shoulders and stomach. The stable fly, *Stomoxys calcitrans* L. is found on the legs. All three are obligate blood-feeding ectoparasites which often parasitize range or pasture cattle. They stay on the host constantly except to mate or lay eggs, and can feed up to 40 times per day. This is an annoyance to cattle which causes them to twitch, switch their tail, scratch at their eyes, rub on objects, twist their head around to lick the feeding areas, which could negatively affect weight gain in infected cattle. This study measures the effectiveness of Corathon insecticide ear tags (organophosphate tags that contain 35% diazinon and 15% coumaphos) made by Bayer Animal Health, to reduce fly numbers and possibly correlate that with weight gain. Flies were counted once a week for 15 weeks, and the cattle in the treated and controlled group were also weighed at the beginning, middle, and end of the study. Corathon significantly reduced horn flies for all 15 weeks ($p=.005$), but did not reduce face flies ($p=.5830$) or stable flies ($p=.6920$). There was no significant difference in weight gain between the treated and control groups. Differences in weight gain may not be the best way to evaluate the impact of fly reduction on the health of cattle.

THE ROLE OF NF- κ B SIGNALING IN MAMMARY EPITHELIAL CELL DIFFERENTIATION

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Breast cancer can be divided into several subtypes that closely resemble different stages of normal human mammary epithelial cell (hMEC) development. By understanding the molecular mechanisms of the normal development of these cells, we can make great progress in the field of breast cancer research. The cancer stem cell hypothesis suggests that a small number of tumor cells have stem cell characteristics and they are responsible for populating the entire tumor. The NF- κ B pathway plays an important role in the development, differentiation, and proliferation of human cells including MECs. Recent studies have found a relationship between the NF- κ B pathway and other diseases including breast cancer. However, precise mechanisms of MEC differentiation regulation by this pathway have not been fully clarified. By using human telomerase reverse transcriptase (hTERT)- immortalized MEC lines we can study the effects of inhibiting the NF- κ B pathway on hMEC differentiation and proliferation.

By inhibiting the NF- κ B pathway in MECs, we found that the NF- κ B inhibitor did not appear to affect cell proliferation; however, it did appear to induce apoptosis in undifferentiated hMECS with stem/progenitor characteristics. The myoepithelial and luminal populations did not seem to be affected by the inhibitor. Further experiments are necessary to determine reproducibility and specificity of these results. If the inhibitor is confirmed to induce apoptosis in the stem/progenitor cell population, this could become a potential target for breast cancer treatment.

ANALYSIS OF THE STRUCTURE, CONSERVED REGIONS, & EVOLUTIONARY HISTORY OF ULBP3 PROTEIN

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Autoimmunity is the main culprit in a variety of diseases, such as Alopecia Areata (AA). This disease is characterized by unpredictable hair loss causing random patches to appear on the scalp and body. Petukhova et al. (2010) identified eight genomic regions associated with AA; the ULBP3 protein stood out as a potential link to the onset of AA. Though the disease mechanism of AA is not clear, this study focused on analyzing the structure, conserved regions, and evolutionary history of the ULBP3 protein in relation to its closest relatives in mammals and other vertebrates. A variety of bioinformatics tools were utilized to uncover human ULBP3's closest protein relatives in other species, with *Homo*

sapien, *Pan troglodytes*, *Pan paniscus*, and *Nomascus leucogenys* having the closest evolutionary ancestor in regards to the protein. Areas of the protein sequence with high conservation across the top ten closest relatives are located from amino acids 50 to 200, and Figure 3 illustrates the degree of conservation across the sequence to provide an insight to the evolutionary history of the gene. These data may provide researchers with clues as to which regions of this protein have evolved to cause a more serious form of the disease among close and distantly related species.

BIG BLUESTEM ECOTYPIC DIFFERENCES IN LEAF NITROGEN CONTENT AS A POSSIBLE MECHANISM FOR INCREASED PERFORMANCE OF CENTRAL KS ECOTYPE IN RECIPROCAL GARDENS PLANTED ACROSS THE GREAT PLAINS

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Big bluestem (*Andropogon gerardii*) is a dominant C₄ grass in tall grass prairie found east of the Rocky Mountains and is widely planted for conservation purposes. Across its range, a strong precipitation gradient determines big bluestem productivity. Variation in precipitation levels (of 400-1200 mm per year from Kansas to Illinois), might result in genetic ecotypes within the species that differ in physiology, and growth. To investigate these possible differences, a reciprocal common garden was established across the precipitation gradient, with planting sites in Carbondale, Illinois and Manhattan, Hays, and Colby, Kansas. Seed from three ecotypes was harvested from four pristine prairie populations in each ecotype region (central Kansas, eastern Kansas, and Illinois) and were planted at all four garden locations in 10 replicate blocks, with plants growing singly in spaced plantings. Previous data have shown the central KS ecotype has higher photosynthetic rates and higher chlorophyll content. To investigate a potential mechanism for these results, we measured leaf nitrogen concentration (%N) in eight replicate blocks of twelve plants, representing four populations of each ecotype at all planting sites. As higher %N is typically correlated with higher rates of photosynthesis, we hypothesized the central KS ecotype would have higher %N than the other two ecotypes. Four leaves were harvested from each plant, and a randomized subsample of the leaf tissue was finely ground and analyzed on a Thermo CN analyzer. As hypothesized, the central KS ecotype had higher mean %N when measured across all sites ($P < 0.0001$). When measured across all ecotypes, the planting site in Hays, KS was found to have the highest %N ($P < 0.0001$). This research helps provide an understanding of the mechanisms that underlie the observed ecotypic variation in plant performance. Ultimately, this knowledge will help explain plant responses to drought in a dominant prairie species, and determine which ecotypes of big bluestem should be planted in the millions of acres of prairie under restoration.

IDENTIFICATION OF A PUTATIVE NUCLEAR LOCALIZATION SEQUENCE IN HUMAN MCM10

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DNA holds the genetic information that is required for life which must be replicated into two exact copies, in a timely and accurate manner, to be passed on to its daughter cells. The study of DNA replication helps us to understand how defects in the replication process lead to diseases, such as cancer. In order for this to begin replication proteins must be recruited to a segment on the DNA where replication can initiate. MCM10 (for minichromosome maintenance) is a protein involved in recruiting the DNA pol- α /primase complex to an origin of replication making it essential for DNA replication. In higher eukaryotes, including humans, MCM10 has a C-terminal extension of unknown function. In this project, we are examining the C-terminus of MCM10. We have used site-directed mutagenesis to generate C-terminal truncations of MCM10. The mutant proteins were stably expressed in HEK293T cells and were confirmed by western blot. Location of expression within the cell was observed by immunofluoresce. To appropriately identify the binding partners of the novel C-terminal extension the

mutants must be expressed in the cell nucleus, where the WT protein is observed. Future plans include using TAP (tandem affinity purification) to identify binding partners of MCM10 and understand what role they play in replication.

COLLECTION OF METABOLIC FINGERPRINTS FROM ROOTS OF *ARABIDOPSIS THALIANA* DURING A GRAVITY STIMULUS USING PROTON NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Autumn M. Longo, Mark V. Wilson, and Tessa L. Durham Brooks, Departments of Biology and Chemistry, Doane College, Crete, NE 68333

Root gravitropism is a field that has been heavily studied for many years. This is a unique phenomenon that all plants undergo. It is the process in which growth is redirected such that the above ground tissue grows upward against the direction of gravity and below ground tissue grows downward in with the direction of gravity. Various aspects of the response mechanism have been learned from studies of root gravitropism, particularly those events that occur after the initial sensory phase. *Glutamate Receptor-Like (GLRs)* genes have been found to be part of a novel phase of the response that is initiated midway through the tip angle trajectory. GLRs are peptide chains that come together to form a tetramer ion channel. Six amino acids have been shown to be activators of *GLR3.3*-dependent membrane depolarization and knockout mutants of this gene show no electrical response to these six specific amino acids in root tissue. Although we know that *GLR3.3* is important in mediating tissue responses to these six amino acids, we still don't know if and when amino acids might come into play during the root gravitropic response. To explore this question, root gravitropism is being artificially induced by turning *Arabidopsis thaliana* seedlings 90°. Metabolites are being extracted from *Arabidopsis thaliana* root tissue at five different time points throughout the response from populations coming from two different ecotypes and two different seed size classes, representing variation in genetic composition and maternal environment, respectively. The extracted metabolites are then analyzed using liquid-state NMR protocols that include standard ¹H NMR spectroscopy and J-Resolved Spectroscopy. In particular, the amino acid profile will be explored. In addition, the comparison of fingerprints between the two ecotypes will enable the investigation of genetic influences and parental environment on the metabolic composition of the root. An end-point analysis recently published has shown changes in amino acids that activate GLRs using mass spectrometry. Our study will add additional information about the dynamic changes in amino acid metabolism and genetic and environmental impacts on this metabolic shift. These data are contributing to characterization of a new pathway in the root gravitropic response and the first characterized pathway for a glutamate receptor in plant physiology.

HARVESTING AND PURIFYING BONE MINERALIZATION-REGULATING PROTEINS FROM UMR-106 RAT SARCOMA CELL LINE

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Understanding how mineralization-regulating proteins will provide insight into normal and pathological mineralization of tissues, as well as allowing us to mimic nature's strategy to produce advanced composite materials. One of the challenges of working with these proteins is their high degree of post-translational modification. They are highly glycosylated and phosphorylated, and in some cases further modified by sulfonation or carboxylation of glutamic acid. To further complicate matters, individual proteins differ from one another in the exact degree of modification, as well as proteins from different tissues. These factors make recombinant expression of these proteins in their functional forms impractical, and extraction from mineralized tissues is laborious and often yields degraded proteins. In the present work, secreted bone mineralization-regulating proteins from a UMR-106 cell line, a cloned derivative of a transplantable rat osteogenic sarcoma, were harvested and purified by chromatographic methods. Dot blot and Western blot analyses were used to confirm protein presence and identity.

LISTERIA MONOCYTOGENES INLA AS POSSIBLE DRUG DELIVERY SYSTEMS

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The internalin proteins (inlA and inlB) of *Listeria monocytogenes* induce phagocytosis by normally non-phagocytic human cells. This unique attribute makes inlA/inlB attractive as a possible therapeutic drug delivery system. inlB binds to the membrane protein “Met” present on non-phagocytic cells and results in actin rearrangement leading to uptake of the bacterial pathogen. However, inlA binds to E-cadherin on host epithelial cells, which mediate entry into the host cell through the recruitment of α -catenin and β -catenin. Either or both of these proteins may provide a means of drug delivery by conjugation of drug to the proteins. Current studies focus on the cloning, over-expression and purification of inlA. This publication was made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), 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 NIGMS or NIH.

ISOLATION OF INLB FROM *LISTERIA MONOCYTOGENES* AND ITS USE AS A DRUG DELIVERY AGENT

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Listeria monocytogenes is a gram positive human pathogen. It is able to grow in food during refrigeration and often causes severe illness, including dozens of recent deaths associated with foodborne outbreaks. In a host, *L. monocytogenes* uses a family of virulence proteins to cause normally non-phagocytic cells to engulf the bacteria allowing it to hide from a strong immune response. The bacteria gains entry into human host cells via a mechanism that involves internalin B (inlB) protein interaction with host cell Met receptors. This research focuses on the potential of the inlB protein as a possible drug delivery agent. Previous research has demonstrated that inlB can successfully trigger the uptake of associated test molecules within host cells. Here we discuss the harvest and purification of native inlB and begin to determine the efficiency of host cell uptake using traceable tags. Long term goals include the conjugation of therapeutic drugs to inlB as a potential drug delivery mechanism to host cells. This publication was made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), 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 NIGMS or NIH.

ACTIVITY AND FREQUENCY OF THE ITPA P32T VARIANT AMONG COLORECTAL PATIENTS

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Inosine Triphosphate Pyrophosphatase (ITPase) is an NTPase responsible for preserving genomic integrity through maintenance of dITP and dXTP levels within the nucleotide pool. Of the many variants of ITPA, the P32T variant is of interest due to high allelic frequency and pharmacological significance of its phenotype. ITPA variants P32T, F31Q and P32T/F31Q were tested for *in vivo* activity against HAP mutagenesis in *E.coli* and *in vitro* activity by PiPer assay with dITP and dXTP substrates. All variants were successful in protecting against HAP mutagenesis, and both single mutant variants (P32T and F31Q) showed enzymatic activity against both substrates. The assay result for the P32T/F31Q variant was inconclusive. In addition, the frequency of the P32T allele among colorectal cancer patients was tested by performing a HPY166II digest. 8 out of 53 samples tested were heterozygous for the P32T allele, as confirmed by DNA sequencing. The resulting allelic frequency of

0.075 is comparable to that for Caucasian Americans of 0.06 (Cao and Hegele, 2002). Therefore the P32T allele does not appear to be enriched among colorectal cancer patients. Activity of the variants is comparable to the wild type and the low levels of activity in P32T homozygous individuals does not appear to be due to a lack of enzymatic function of the protein. *In vivo* protection from purine base analog 6-mercaptopurine in variants hP32T and P32A is currently being tested. This publication was made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), 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 NIGMS or NIH.

OPTIMIZING MOMP, VIA MUTAGENESIS, FOR USE AS A *CHLAMYDIA TRACHOMATIS* VACCINE

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The major outer membrane protein (MOMP) from the bacterium *Chlamydia trachomatis* can potentially be used as a subunit vaccine. *Chlamydia* is known to cause blindness and can be passed down from mother to child. The protein is a homotrimer, where each monomer contains eight cysteines, four of which form disulfide bonds while the other four are in a reduced state. The cysteines crosslink, in an intra- and intermolecular fashion, making it difficult to purify the native form of MOMP. Site-directed mutagenesis of the MOMP gene (housed in a pET-45b vector) has been attempted in an effort to change several codons from cysteine to serine on residues that form disulfide bonds. Variations in the PCR parameters, including different annealing temperatures and elongation times have been attempted. Additionally, site-directed mutagenesis reactions are being carried out with supplemental DMSO as well as cycling individual primers separately for a few cycles to enhance single strand mutagenesis prior to traditional reaction parameters. Successful mutagenesis should result in a MOMP protein with fewer disulfide bonds and enhance its ability to refold under reducing conditions. This publication was made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), 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 NIGMS or NIH.

THE EFFECTS OF COTTON NEMATODE ON SOYBEAN AND CORN AND THE EFFECTS OF COVER CROPS IN SUPPRESSING SOY BEAN CYST NEMATODE NUMBERS

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The purpose of this experiment was to look at the different effects that *Rotylenchulus* (reniform) *nematodes* have on soybean and corn. The goal of this experiment was to see if reniform nematodes that infected cotton crops could infect plants of a different species and use this information for our second experiment. The purpose of the second experiment was to observe the effects that cover crops have on *Heterodera glycines* (soybean cyst) nematode numbers. The goal of this experiment was to investigate if soybean cyst nematodes that infect soybeans will be attracted to certain cover crops that allow for a large amount of premature hatchings that will decrease the amount of soybean cyst nematodes present. The experimental study uses soil with soybean cyst nematodes present that create cysts found on the roots of vegetative crops. In the field study, a plot of land with soybean cyst nematodes present was used to plant cover crops to gauge the overall success of the cover crops in suppressing the parasites. The purpose of the first experiment was to investigate if reniform nematodes were able to infect crops besides their typical host. The purpose of the second experiment was to observe if soybean cyst nematodes were able to be suppressed when presented in different cover crops. The outcome of the field experiment was that the cover crops were unable to suppress the soybean cyst nematode count. However, the results of the greenhouse study displayed that all four cover crops reduced the average

number of soybean cysts nematodes per 100 cc soil. The finding from this experiment may be useful in soil treatment between repetitive growing cycles.

EFFECT OF THE OVIPOSITOR ON LOCOMOTION AND PREDATOR AVOIDANCE IN HOUSE CRICKETS (*ACHETA DOMESTICA*)

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Most phenotypic traits possessed by animals likely aid in the survival and reproduction in one-way or another. In addition, many traits that have been shown to be important for a particular species' survival have been shown to be a hindrance in other parts of that animal's life. The ovipositor of the house cricket, *Acheta domestica*, is an example of an adapted trait found only in female crickets for reproductive purposes that, unquestionably, has increased fitness in this species. The needle shaped organ allows the cricket to deposit their eggs in soil as a way to protect the offspring from predators and decrease the risk of damage from environmental factors such as temperature, wind currents, etc. While previous studies have looked at the effects of ovipositor length on survival rates, no study has examined the influence of this structure on movement abilities, which can be related to its ability to escape predators. Our study examined jumping, incline running, voluntary locomotion, and predator avoidance in three experimental groups: 1) male crickets, 2) female crickets, and 3) female crickets with ovipositor removed. We hypothesized that the ovipositor would hinder locomotor and predator avoidance abilities compared to their male counterparts, hinting at an evolutionary trade-off between the presence of an extra primary sex characteristic and their ability to avoid predation.

We found no significant differences for any of the performance measures between cricket with the ovipositor and with the ovipositor removed. Although not significant, it was found that crickets with an ovipositor were slower in voluntary locomotion and was less active than their male counterparts. Body size-relative speed results suggest no significant correlation between the presence of the ovipositor, while absolute speed suggests the ovipositor slows the cricket and may make it more susceptible to predators. A lack of significant results may point to the lack of an evolutionary trade-off or that crickets possess compensatory traits that make significant results difficult to detect – though it can still be said that some cost comes with the presence of the ovipositor.

OBSERVATION OF COTTONTAIL RABBIT (*SYLVILAGUS FLORIDANUS*) TAIL BEHAVIOR IN NON-PREDATOR ENVIRONMENTS

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Cotton-tailed rabbits exhibit the same white underside of tail and rump as white tail deer. Comparison of rabbits with deer showed tentative conclusions that in rabbits, any of four hypotheses could be correct in regards to tail flagging, but flash behavior seems to be the best supported. To rule out a physiological or conspecific signal reason for flagging in cotton-tailed rabbits, rabbits were observed in non-predator environments and their tail position, as well as temperature, wind, time of day and other environmental factors were recorded. In non-predator environments, white-tailed rabbits did not flag their tails when they were alone as well as when they were with other rabbits. Therefore, tail flagging in rabbits does not serve as a physiological response or as a conspecific communication tool.

EFFECTS OF PRENATAL EXPOSURE TO CHLORPYRIFOS AND ATRAZINE ON ACETYLCHOLINESTERASE LEVELS IN SPRAGUE-DAWLEY RATS

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The effects of repeated prenatal exposure to chlorpyrifos and atrazine on acetylcholinesterase levels in adulthood were studied in developing rats. Four treatment groups were examined during this study, including one receiving 5 mg/kg of chlorpyrifos, one receiving 25 mg/kg atrazine, one receiving both dosages of chlorpyrifos and atrazine, and a control group. Acetylcholinesterase levels in whole-

brain samples were taken on postnatal day 121, corresponding to adulthood. My hypothesis is that prenatal exposure to chlorpyrifos will have adverse effects on acetylcholinesterase levels in adult rat brains. Atrazine has been known to have a synergistic effect on chlorpyrifos; therefore I expect that the treatment group given both chlorpyrifos and atrazine will show a decrease in acetylcholinesterase. Tests were done using an Abnova acetylcholinesterase assay kit, involving the use of optical densities in order to determine enzyme activity in the sample. Results showed that the two groups, one treated with chlorpyrifos and one with both chlorpyrifos and atrazine had significantly higher levels of acetylcholinesterase activity in brain tissue. These findings show that prenatal exposure to chlorpyrifos creates adverse effects on acetylcholinesterase levels in adulthood, despite “normal” levels in immediate post-exposure period.

EFFECTS OF LOW LEVEL INTERMEDIATE EXPOSURE TO ATRAZINE AND CHLORPYRIFOS IN SPRAGUE-DAWLEY RATS

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Atrazine and chlorpyrifos are each a commonly used herbicide and pesticide respectively. Mammalian studies have found similar effects between these chemicals including reduced birth weight of offspring and reduced numbers of viable offspring. Additionally, invertebrate studies have found synergistic toxicological effects between these chemicals. This study examined the effect of these two chemicals in Sprague-Dawley rats. Four groups were established: a control receiving corn oil, a group receiving only atrazine, a group receiving chlorpyrifos, and a group receiving both chemicals. It was hypothesized that these chemicals would not individually have statistically significant effects but that the combined group would show effects. No statistically significant effects were found between controls and any of the groups in number of offspring per litter, average weight of pups or numbers of mummified fetuses; however, notable differences were found between the groups.

THE DEVELOPMENT OF THE SENTINEL ORGANISM *RANA PIPPIENS*

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Due to the agricultural practices within the Midwestern United States, the human water supply is often contaminated with various chemicals that have a significant negative impact on human health, including the herbicide atrazine. Atrazine is the most commonly used herbicide in the world but is a suspected carcinogen and teratogen. In humans, atrazine exposure is associated with tumorigenesis, birth defects, menstrual problems, and low sperm counts. In amphibians, exposure to atrazine retards the ability of tadpoles to fight infections by parasites. In addition, tadpoles that are exposed to atrazine early in development exhibit malformed hearts, kidneys, and gastrointestinal tracts. Moreover, male frogs exposed to atrazine, at levels below the regulations set by the environmental protection agency, become sterile and in some cases turn into females and hermaphrodites. The central goal of this study is to develop the northern leopard frog *Rana pipiens* into a sentinel organism that can be used to assess atrazine contamination throughout the region. To this end, we first need to characterize biomarkers of atrazine exposure in *R. pipiens*. However, because *R. pipiens* is unsequenced, lacking ample DNA, RNA and protein sequences, we sequenced the RNA from several male and female tissues, including gonad, liver, kidney and brain, and tadpoles undergoing development. Using these data, we have designed primers that will allow us to evaluate the expression of the affected genes at the transcriptional level using reverse transcriptase-quantitative polymerase chain reaction.

VIRUSES AND STRESS RESPONSE OF *APHIS GLYCINES*

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Stress is a known modulator of immune response in invertebrates, but little is known about how stress affects the relationship between viruses and their insect hosts. The soybean aphid (*Aphis glycines*) is an invasive species of agricultural importance, known to harbor several insect viruses as well as vector multiple plant viruses. Understanding how stress affects the relationship between endemic viruses and their host aphid could contribute to the development of methods to control this pest, as well as an overall understanding of viral commensalism and endosymbiosis. Next generation sequencing (NGS) has emerged as a powerful tool for insect virus discovery. The aim of this study was to identify novel viruses in the soybean aphid and to search for possible changes in host-virus relationship in aphids under stress. An isoclonal line of *Aphis glycines* was exposed to three common stressors: heat (34°C), plant resistance (RAG2 soybean), and starvation for 36 hours. RNA was extracted from control and stress treatment groups and sequenced using Illumina NGS methods. The specific focus of this project will be to analyze this RNAseq data set to find evidence of novel aphid viruses and differential expression of aphid-viral response pathways across the different stress groups.

GENETIC BASIS OF FLOWER COLOR POLYMORPHISM IN *IOCHROMA CALYCINUM*

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Anthocyanin pigments, which are found in plant tissues, make flowers and fruits red, blue, or purple. Alterations in the anthocyanin pigment pathway function results in color differences. The objective of this project is to determine the genetic mechanisms responsible for the loss of anthocyanin production, which produces a white flower phenotype. *Iochroma calycinum*, a species within the family Solanaceae, was chosen as the study organism because it has both pigmented and unpigmented morphs. Our hypothesis is that the loss of anthocyanin production could result from a loss of function mutation in the pathway. We sequenced the coding regions of many of the genes responsible for anthocyanin production in both morphs. Thus far it appears that dihydroflavonol 4-reductase (DFR) is the only gene carrying a fixed difference of functional significance, an 11 amino acid deletion near the active site of the enzyme. We conducted functional assays of fixed differences using heterologous expression in *E. coli*, and found that the DFR deletion completely eliminates enzyme activity in the functional assay. Therefore, the production of the unpigmented flowers may be due to a loss of function mutation in DFR. This would be one of the few cases in which a structural mutation in the pathway has been associated with natural variation in flower color. We need to examine the rest of the pathway to rule out the potential contribution of structural mutations in other genes and compare gene expression between purple and white individuals to eliminate the possibility that differential expression plays a role in the difference in phenotype.

ANALYSIS OF MANNITOL CRYSTALS ON POTASSIUM LEVELS OF RED BLOOD CELLS UTILIZING HEART/LUNG PUMP

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Mannitol is a sugar alcohol widely used in the food industry as a sugar substitute. In pharmaceutical products it is utilized to decrease the taste of medicine and also serves as a diuretic agent, specifically during cardiopulmonary bypass. One potentially problematic characteristic of mannitol is that it easily crystallizes and cannot be administered intravenously in the crystallized form. The purpose of this research is to determine whether mannitol crystals result in red blood cell (RBC) damage by testing the potassium (K^+) levels of the blood. Bovine blood was treated with anticoagulant citrate dextrose while the bottles of mannitol containing visible crystals were submerged in a warm (51°C) bath of water. Trials were conducted using two heart/lung pumps; fifteen trials were of bovine

blood solution, while the other fifteen trials were completed with the addition of mannitol to the bovine blood solution. Each pre and post sample of blood was analyzed using a blood analysis system. The pre and post values of K^+ were calculated at a difference of +0.004. Concluding, mannitol causes an insignificant amount of RBC damage for healthcare professionals and patients to be concerned.

LINKING OF GENOMIC CONTIGS OF THE CHLOROVIRUSES IL-3A AND Br0604L USING PCR-DNA SEQUENCING

Tyler A. North and Garry A. Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

A large number of newly discovered giruses (giant viruses) infect green algae found in aqueous environments. Of particular interest, are the large double-stranded DNA viruses of the genus *Chlorovirus*. Some of the unicellular green algae infected by these viruses have symbiotic relationships with certain protists. The complete genomic sequences of these viruses can provide insight into their genetics and biology. A previous attempt was made to sequence the complete genomes of the chloroviruses IL-3A and Br060L. This effort did not meet with complete success. Not all contigs were able to be linked into one complete genome. Instead, there were sequence gaps between adjacent contigs. The purpose of this project was to develop primers that would enable the production of PCR products across these gaps using total genomic DNA as a template. The PCR products were cleaned and then submitted to the Davis Sequencing facility. In the cases of successful DNA sequencing, adjacent contigs were united.

COLLEGIATE ACADEMY BIOLOGY SESSION B

INVESTIGATION OF METHYLATION STATUS OF CADHERIN GENES IN CANCER CELL LINES FROM PROSTATE, OVARIAN AND BREAST CANCERS

Kelsey Stark, Maire Rose Donnelly, and Kate Marley, Department of Biology, Doane College, Crete, NE 68333

N-cadherin is a cell-attachment protein that is considered a tumor-promoter in many different types of carcinoma because its expression is often associated with more motile and invasive tumor cell behavior. Changes in methylation status of tumor-suppressor and tumor-promoter genes have been associated with cancer progression in many tissue types. In this study we are comparing the methylation of the N-cadherin gene and possibly E-cadherin gene in prostate, ovarian, and breast cancers. Depending on the results of the initial experiments, a better understanding could be gained about the occurrence of methylation of N-cadherin and E-cadherin in tumors derived from a variety of tissue types.

EVALUATION OF N-CADHERIN PROTEIN EXPRESSION AFTER TREATMENT OF BT-20 HUMAN BREAST CANCER CELLS WITH METHYLATION INHIBITORS

Maire Rose Donnelly, N. Lukens, S. Pracht, K. Stark, and Kate Marley, Department of Biology, Doane College, Crete, NE 68333

Cell adhesion plays a major role in constructing a functioning organism from an accumulation of its parts. Cadherins are a class of Ca^{2+} dependent transmembrane adhesion proteins found in a variety of different tissue types. There are several types of cadherins, each fulfilling needs specific to the tissue of which they are a part. Inappropriate expression of N-cadherin in a line of human breast cancer cells known as BT-20, which normally express E-cadherin, may enable the cells to acquire unusual and dangerous characteristics.

Previous research has determined that the N-cadherin promoter region is methylated in BT-20 cells. The presence of methyl groups on the gene promoter blocks the binding of transcription factors and thereby

prevents expression of N-cadherin. Methylation inhibitors have been approved for treatment of some non-solid tumors but have not been effective against solid tumors (Issa and Kantarjian, 2009). In light of the ineffectiveness of methylation inhibitors against solid-tumors, it is hypothesized that if BT-20 cells are treated with a methylation inhibitor, the N-cadherin promoter of the daughter cells will become unmethylated, allowing N-cadherin to be expressed. It is also hypothesized that the demethylated cells will increase in both motility and invasiveness. Data presented here will evaluate treatment of BT-20 cells with methylation inhibitors including azacytidine, decitabine, and zebularine and their ability to inhibit methylation and result in subsequent expression of N-cadherin protein.

STUDYING THE IMPACT OF EPIGALLOCATECHIN-3-GALLATE, A COMPONENT OF GREEN TEA, ON BREAST CANCER STEM CELLS

Zachary J. Wordekemper and Kate Marley, Department of Biology, Doane College, Crete NE 68333

Breast cancer has become a major issue with increasing human lifespan and is a particular concern in Nebraska, where it is the most common type of cancer. In the past decade cancer stem cells have been identified in breast cancers. These cells are capable of self-renewal and recreating the heterogeneous character of a tumor. Some naturally occurring dietary compounds, such as epigallocatechin-3-gallate found in green tea, are thought to interfere with tumor formation. Breast cancer stem cells can be studied using a tumorsphere assay where breast cancer tissue culture cells are plated on low-attachment plates that select the stem cells. We have hypothesized that incorporating epigallocatechin-3-gallate into the tumorsphere media will interfere with formation of breast cancer tumorspheres and reduce the rate of sphere formation after secondary and tertiary dissociation and plating.

THE EFFECT OF TEMPERATURE ON MINIMUM INHIBITORY CONCENTRATIONS OF ANTIBIOTIC RESISTANT BACTERIA

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The overuse of antibiotics has resulted in antibiotic resistance among bacteria worldwide. Resistance is growing at an exponential rate and has become a serious problem for treatments in healthcare. Studies have shown that in some pathogenic bacteria susceptibility to antibiotics increases with an increase in temperature. The objective of this study is to evaluate the role of temperature in antibiotic resistance. Bacteria were isolated from Platte River samples taken in November and June. Antibiotic resistance between those two samples is being determined. The effect of temperature on Minimum Inhibitory Concentration (MIC) will be determined for each group of isolates.

EFFECT OF OXYGEN ON ANTIBIOTIC RESISTANCE IN BACTERIA ISOLATED FROM THE PLATTE RIVER

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Rising antibiotic resistance in bacteria is quickly becoming one of the worlds' greatest environmental and public health concerns. The issue of generalized antibiotic treatment has increased natural resistance to antibiotics in bacteria growing in nature; a problem not only for physicians and scientists, but the population at large. In this study, samples were collected from the Platte River. Strains resistant to Ampicillin (100ug/ml) were identified and further evaluated for aerotolerance. Facultative anaerobic strains are being evaluated for their level of resistance to a variety of antibiotics as affected by low oxygen environments.

COMPARISON OF ANTIBIOTIC RESISTANT BACTERIA FROM URBAN AND RURAL WATER SOURCES

Ana Laura Ortiz-Morales, B.S. Mauck, and P.M. Higley, Department of Biology, College of Saint Mary, Omaha, NE 68106

Antibiotics are widely used in our society to treat and prevent disease. They are also used in modern agriculture for livestock growth promoters and to prevent, treat, and control diseases that are easily spread through herds due to overcrowding. The overuse and misuse of antibiotics has led to an era where antibiotic resistant bacteria are a major health concern for humans. Two surface water study sites have been established in Sarpy County NE: one in an urban environment, Walnut Creek Lake near Papillion, NE, and the other a rural site, the Platte River near Louisville, NE. The aim of this project is to compare the antibiotic resistance profiles of the isolates from the two different sites. An initial study indicated that a greater number of isolates from the urban site were resistant to vancomycin than were those from the rural site. The higher rate of resistance to vancomycin is troubling as this drug has typically been reserved for the drug of last choice when other drugs are not effective. This study will be expanded to determine if greater resistance to vancomycin in urban areas is a trend or isolated event.

HEAVY METAL RESISTANCE IN BACTERIAL ISOLATES FROM URBAN AND RURAL WATER SOURCES

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Antibiotics are widely used and have recently been exploited in the agricultural community. Many of the wastes from agricultural processes tend to be dumped into our rivers or other water sources. The overuse of antibiotics has allowed bacteria to become resistant to antibiotics with the gene for antibiotic resistance frequently carried on a plasmid. Another problem we are currently facing is heavy metal contamination due to improper disposal of chemical wastes. Some bacteria are also becoming resistant to heavy metals and that gene is also frequently carried on a plasmid. The project objective is to determine if there is a relationship between antibiotic and heavy metal resistance as both genes may be carried on a plasmid. Antibiotic resistant bacteria from urban and rural water sources were tested against a battery of heavy metals. Evidence suggesting heavy metal resistance was found at both sites with the urban site showing more organisms able to grow in the presence of metals.

AN EVALUATION OF VARIOUS LYOPHILIZATION STABILIZERS AND CYCLES USING A MONOVALENT BOVINE VIRUS VACCINE

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An experiment was conducted to determine which stabilizer and which lyophilization cycle would optimize a vaccines shelf life and effectiveness, or potency. Two different stabilizers were used here called, Stabilizer A and Stabilizer B. Two different lyophilization cycles that were used; the first was an existing cycle that optimizes the existing stabilizer, Stabilizer A. The second lyophilization cycle is a SMART cycle that is a computer-controlled program that calculates the optimum cycle based upon the products physical and chemical characteristics. Each stabilizer was run in each lyophilization cycle, testing for both a better stabilizer and a better cycle. The results for the experiment were relatively mixed. Stabilizer B proved to be the better stabilizer as it had a higher average potency and had less deviation than Stabilizer A. The results between the lyophilization cycles were more of a draw. A lyophilization cycle can be aggressive by freezing and heating the product quickly. The standard is the slower the freezing and heating times, the better the lyophilized product. The SMART cycle proved to be less aggressive, with slower freezing and heating times, and therefore a better match with Stabilizer B. The only problem with the SMART cycle is the amount of time it consumes to run, the existing cycle, although more aggressive, this cycle takes less time. Saving this time allows the

company to increase production while still providing a very sufficient product. In conclusion, the type of cycle is arbitrary, while the type of stabilizer does affect the overall potency and consistency of the lyophilized product.

ARE RUNNERS SUPPORTED OR SABATAGED BY THE MODERN RUNNING SHOE?

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Who is right? Should we be running in modern running shoes with arch support and devices to prevent pronation, or should we be running bare foot. The bestselling book, *Born to Run*, by Christopher McDougall brings the controversy to the general public. BIOL433 Biomechanics class will refute or support the claim of the author that the modern running shoe is creating unprecedented number of running injuries compared to before production of the modern running shoe. The class studied students, professors, and track athletes walking and running. Range of motion and forces the skeleton endures with heel strikes as well as to the balls of the feet in three different styles of shoes: modern running shoes, minimal support running shoes and barefoot running shoes. Data was collected from video and Flexiforce sensors using the WELF-2 System by Tekscan.

ARM REHABILITATION DESIGN FOR CEREBRAL PALSY

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The goal of this research is to develop a cost effective solution for therapeutic stretching of muscles and tendons in Cerebral Palsy. Currently, there is not much research done on an arm rehabilitation device. This research would help patients with Cerebral Palsy prevent the loss of progress gained in physical therapy sessions. With research advancement in this area of rehabilitation, patients will have the chance to increase their independence of the arm. The methods applied for this type of research involves an engineering design process aimed at therapeutic stretching. The questions that will guide this research project are the following: “What is the range of motion needed to be considered?”, “How many repetitions should be programmed for best results?” as well as, “What is the maximum anticipated loading in the device?” These questions will be answered through literature and research. With these preliminary research questions answered, the specifications for the design acquired will allow for several concepts to be generated. Using the Solidworks software, the most promising concepts will be converted into computer models, leading to the possibility of constructing a prototype for evaluation in the future.

MODELING CIRCADIAN BLOOD HORMONE FLUCTUATIONS IN *GRYLLUS FIRMUS*: IDENTIFICATION AND DEVELOPMENT OF MODEL PARAMETERS

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Previous studies have shown that morph specific circadian rhythms occur in the juvenile hormone (JH) concentration in the cricket, *Gryllus firmus*. Furthermore, previous attempts to model this phenomenon have confirmed discrepancies in our understanding of *in vivo* mechanisms causing the fluctuation in JH titer. Some such mechanisms include: the degradation rate of JH, fluctuations in the hemolymph volume, and the role of JH binding proteins in protection or facilitated degradation of JH. Previously, these mechanisms have been estimated using *in vitro*, in the case of degradation and binding protein interactions, or have been estimated using single measure time-independent methods, as in the case of hemolymph volume. In the present study, we confirmed, *in vivo*, a diurnal fluctuation in hemolymph volume, both in the short wing morph (SW) and the long wing morph (LW) of *G. firmus*. We noticed a decrease in hemolymph volume toward the end of the photophase in 5 day old adults in both morphs, the magnitude of which corresponds to previous measures of *in vivo* JH titer. There was also a subsequent increase in hemolymph volume toward the end of the scotophase early on the sixth

day. This finding clarifies one mechanism by which JH levels are kept relatively constant or fluctuate greatly in SW and LW morphs, respectively. Future studies will examine whether hemolymph volume fluctuates according to a circadian rhythm or not and the time dependence of degradation and how it plays into JH fluctuation.

COLLEGIATE ACADEMY CHEMISTRY AND PHYSICS

KEPLER MISSION TRANSIT SEARCHES IN THE COLLEGE PHYSICS ADVANCED LAB

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NASA's Kepler mission, in orbit since 2009, continues to discover exoplanets transiting in front of their host stars, through ongoing photometry of over 100,000 stars. We are developing an advanced laboratory project suitable for undergraduate physics, astronomy, and engineering students, who will process archival Kepler lightcurves with known transits, to find those transits and characterize any planets found. This project will allow undergraduates to use data from a current, forefront NASA mission, and to develop signal processing skills and astronomy understanding. The challenges of this development project include devising a suitably simplified transit search technique; identifying a subset of Kepler exoplanet lightcurves suitable for such a technique; and designing a procedure and guide suitable for students without extensive programming skills. We present details of the lab concept and our progress in meeting these challenges.

Φ MESON PHOTOPRODUCTION IN AU-AU ULTRAPERIPHERAL COLLISIONS AT RHIC

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The STAR (Solenoidal Tracker at RHIC) experiment collects data from nuclear interactions used to study ultraperipheral Au-Au collisions at 200 GeV. In these collisions, where the impact parameter is greater than twice the radius of the gold nuclei, the interactions are electromagnetic. We focus on Φ (phi) meson photoproduction through its decay channel into K^+ and K^- (Kaon-plus and Kaon-minus respectively) mesons. Coherent photoproduction results in Φ mesons with transverse momentum less than 0.15 GeV/c. However, the decay products from these are not within STAR's acceptance. Φ mesons with momentum greater than 0.15 GeV/c, whose decay products are within STAR's acceptance, may come from incoherent photoproduction. We investigate the possibility of experimentally separating Φ mesons produced from incoherent photoproduction from those produced in hadronic interactions in order to obtain a measurement its cross section. The Φ meson is much rarer than the previously measured ρ (rho) meson due to its larger mass. Observing the Φ requires the implementation of standard particle identification techniques. We compare our data with STARlight, a Monte Carlo simulator of the physics of ultraperipheral collisions.

THE DESIGN AND TESTING OF A ROBOTIC HAND TO DETERMINE ITS QUALIFICATION AS AN ADEQUATE PROSTHETIC DEVICE

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Prosthetic devices are artificial replacements for missing parts of the human body. For this experiment, the focus is on the prosthetic hand. By designing and building a robotic hand, as a substitute for a missing human hand, a comparison was made between the prosthetic substitute and a real hand. The design was a mixture of personal concept and reference models. Using Adobe Illustrator, a model of the hand was formed. The electrical and mechanical structure of the robotic hand was made to function using an external power source. The primary components of the hand are the

continuously variable transmission (CVT), the flexion-drive, and the force-magnification-drive. Once assembled the CVT, speed and grasping capabilities, flexion-drive opening/closing speed and the force-magnification-drive grasping force efficiency were investigated. The test results were then compared to those of a human hand.

DETERMINATION OF PIEZOELECTRIC CHARACTERISTICS OF PZT CERAMICS USING LASER INTERFEROMETRY

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The piezoelectric effect has been applied to a range of technologies, from grill igniters to high-resolution microscopy. Piezoelectric characteristics of a lead zirconate titanate (PZT) disc were studied. A modified Michelson interferometer was used to study the displacement of the disc as a function of voltage. A Sawyer-Tower circuit was utilized to observe the ferroelectric hysteresis loop. In particular, the d_{33} coefficient, the displacement as a function of applied voltage, and the P-E hysteresis loop were determined. Other characteristics of piezoelectric materials, such as the Curie point, are discussed and will be studied as time permits.

INTERFACING EPICS WITH THE LABVIEW CONTROL OF THE BARREL CALORIMETER AT STAR

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The control system for STAR (Solenoidal Tracker at RHIC) is based on EPICS (Experimental Physics and Industrial Control System). The STAR Barrel Electromagnetic Calorimeter was developed using LabVIEW as a control system for testing. The Calorimeter was integrated into the STAR experiment before the LabVIEW system was fully integrated with EPICS. This interface only allowed monitoring of the sub-detector. A new interface is being developed that will allow both control and monitoring of the Calorimeter. For the development of this a new multi-platform interface, a version of EPICS, STAR EPICS VM environment, was created. A progress report on both the development of this interface and the suitability of this new version of EPICS will be presented.

PHOTOPRODUCTION OF ELECTRON-POSITRON PAIRS IN ULTRAPERIPHERAL COLLISIONS AT RHIC

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At RHIC (Relativistic Heavy Ion Collider), two atomic nuclei are accelerated to near the speed of light in opposite directions. Ultraperipheral collisions are classified as interactions in which two nuclei have an impact parameter greater than twice their nuclear radius. Particles are produced from the intense electromagnetic interaction while the nuclei continue unimpeded along the beam line. Studying direct electron-positron pairs can aid in understanding the quantum electrodynamics involved in these interactions. This talk will discuss different particle identification methods used by STAR in relation to electron-positron pair production in ultraperipheral interactions. We will also present preliminary measurements of the invariant mass, rapidity, pair polar angle, and pair transverse momentum for these identified pairs.

MEASURING BILLIARD BALL DYNAMICS USING A HIGH-SPEED CAMERA

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Introductory courses use billiards in multiple discussions involving collision physics. A common subject is the conservation of momentum and its application to collisions between billiard balls. A Hi-Spec 2 high-speed camera was used to capture billiard ball impacts. Collision dynamics were then analyzed. The captured video was imported into Tracker and Logger Pro so collision variables

associated with the movement of the billiard balls could be determined. This information was used to calculate the momentum, energy, billiard ball deflection, and friction forces involved in the interactions. This information was then used to predict the overall path of the billiard balls post collision.

INVESTIGATING ORBITAL TRAJECTORY AND LUMINOSITY OF A PROMISING COMET

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Comet C/2012 S1, also known as ISON, is a sungrazer that will reach perihelion in November 2013. Images from the 14" telescope and CCD camera at the Sachtleben Observatory in Hastings, Nebraska were used to determine position and brightness information which contribute to a unique collection of ephemeris data for the comet. Based on this data, calculations were made to determine the distance ISON traveled, its velocity, luminosity, eccentricity of orbit, and orbital period. The trend is extrapolated to predict ISON's orbit to perihelion. The data collected and analyses conducted provide an important glimpse into the movement and attributes of a comet that will be seen by millions in the coming year.

ASSESSING CELLULAR METABOLISM BY NADH FLIM AND INTENSITY-BASED MEASUREMENTS OF MONOLAYER AND MULTICELL TUMOR SPHEROIDS

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In the field of cellular energetics, fluorescence intensity-based metabolic imaging techniques have provided useful and accurate measurements on a general level, yet there are details on a subcellular level which this technique simply misses. Recent work has demonstrated that fluorescence lifetime imaging (FLIM) provides details of the subcellular trafficking of energy which fluorescence intensity-based techniques fail to detect. Specifically, FLIM can measure the reorganization of NADH within distinct subcellular pools with change in the metabolic state induced by inhibitors, uncouplers and substrate availability. Here, we will compare NADH FLIM and intensity measurements of metabolism for cells grown in monolayer culture or as 300-500 μm diameter multicell tumor spheroids under different growth conditions. These studies shall be used to properly assess the accuracy and limitations found through sole use of NADH intensity-based metabolic imaging. This work was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (R15GM085776 and 8P20GM103427), 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 NIGMS or NIH.

THE USE OF PVSS TO MONITOR THE ALICE EMCAL SUB-DETECTOR AS PART OF THE LHC CONTROLS SYSTEM

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In High Frequency Physics experiments remote monitoring of ALL systems is critical to their operations. CERN, the LHC, and all of its experimentation, including ALICE, have adapted the PVSS monitoring package to perform this task. Its application to the ALICE EMCAL sub-detector is presented. The EMCAL monitoring system's integration into the full ALICE control systems will also be presented.

DESIGN AND CONSTRUCTION OF A SPATIALLY-RESOLVED OXIMETER FOR METABOLIC PROFILING OF MULTICELL TUMOR SPHEROIDS

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The condition of the metabolism of a cell is a direct reflection of its vitality. As such, developing

a method to measure the activity in a tissue can be useful in determining its health. The electron carrier nicotinamide adenine dinucleotide (NADH) is a ubiquitous and integral part of the eukaryotic metabolic process; it is also an endogenous fluorophore. The Fluorescence Lifetime Imaging Microscopy (FLIM) of NADH is a noninvasive technique to gauge the efficiency of the metabolism. FLIM yields information about the intensity and lifetime of the fluorescence which provides insights into the NADH concentration and enzyme binding. Solutions containing NaCN and FCCP - both metabolic inhibitors - simulate anoxic and glucose-deprived environments, respectively. They highlight the change in both NADH concentration and binding in various conditions and can be used to establish standards for determining the cause for metabolic inhibition in vitro. The direct relation of NADH trends to metabolic activity have yet to be correlated to the typical measures such as the consumption of glucose and oxygen. To correlate variation of NADH intensity and lifetime to oxygen availability, the spatially-resolved oxygen concentration within and around the spheroid will be measured using a Clark-style oxygen microelectrode. By measuring the oxygen concentration at different locations relative to the spheroid, the metabolic oxygen consumption rate can be determined. The oxygen electrode lies on a translation stage controlled by a motorized micropositioner. To ensure the electrode passes through the center of the spheroid, the tip is located using two orthogonal microscopes constructed with CMOS cameras to capture live video. Data acquisition and micropositioning is accomplished using a custom LabVIEW program. This work was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (R15GM085776 and 8P20GM103427), 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 NIGMS or NIH.

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

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The “electrolysis footbath” is advertised among alternative therapy healthcare providers as being able to remove “toxins” from the body. There are ample amounts of testimonials indicating improvement in the health of the patients, but only a few scientific studies to test these claims have been found. One such article concludes that there is no evidence to support that ionic footbaths are an effective technique for removing toxic elements. Another source focused on the removal of heavy metals and concluded that it is highly unlikely these metals are leaving the body through use of an ionic footbath. Using Gas Chromatography-Mass Spectrometry, HPLC, LC-MS-MS, and gel electrophoresis we will attempt to determine what, if anything, is being removed from the bodies of individuals, both healthy and ones in need of treatment. We have already determined the mechanism does not directly involve the subjects feet in the electrolysis; the cell only generates an iron(III) hydroxide flocculent precipitate which comes in contact with the feet. Current results from healthy subjects on HPLC shows peaks indicating compounds present. On-going work with LC-MS-MS will hopefully help with identification of these compounds from both healthy subjects and subjects in need of treatment. Our current hypothesis is these compounds or “toxins” being released from the body, after electrolysis footbath treatment, will be more prominent with subjects actually in need of treatment.

IDENTIFICATION AND ANALYSIS OF THE PRODUCTS REMOVED FROM HUMAN FEET BY AN ELECTROLYSIS FOOTBATH WITH THOUGHTS ABOUT POSSIBLE MECHANISM OF ACTION

Dan Story, Cara Flemmer, and Charles Freidline, Division of Science and Mathematics, Union College, Lincoln NE 68506

The “electrolysis footbath” is advertised 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 organic toxins. An article by Kennedy et. al. describes thoroughly testing for the release of toxic metals. However, no releases and no significant reductions in the amounts of these metals in the subjects were found. While there seems to be an ample supply of testimonials indicating improvement in the health of the patients there is a significant lack of scientific research on this subject. For this experiment the instruments that will be used to test for organic toxins include Gas Chromatography-Mass Spectrometry, HPLC, LC-MS-MS, and gel electrophoresis. The goal of this experiment is to attempt to determine what is being removed from the bodies of both healthy individuals and those in need of treatment. We have already determined the mechanism does not directly involve the subjects feet in the electrolysis; the electrodes only generate iron(III) hydroxide floc that is presumably somehow collecting organic compounds from the feet. Upon acidifying with enough nitric acid to dissolve the iron(III) hydroxide, we assume that most organics will be released to allow for analysis. A secondary objective is to determine the mechanism for which the materials can exit the body and either complex with the iron(III) hydroxide or form a new compound with it. There are several possible ways this could happen, which will be researched during the course of this experiment. Some possible ways compounds could be removed from the body include passing out through glands and diffusion through skin pores.

VALIDATION OF A DOUBLE-DIFFUSION GEL-BASED METHOD FOR *IN VITRO* DETERMINATION OF FUNCTION IN MINERALIZATION-REGULATING PROTEINS FROM TISSUE EXTRACTS

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A gel-based double-diffusion apparatus has been developed to study the functions and complements of mineralization-regulating proteins in a number of different types of tissues. These tissues will include aging tissue, diseased tissue, and the tissues of different species. Prior to its use with experimental samples, validation testing must be performed on the in-house built *in vitro* gel mineralization system called the GPC 5000. This apparatus was designed to improve on previous methods with reduced time requirements, smaller protein samples and no pre-separation of proteins. Once validated, this *in vitro* mineralization system will allow for more efficient study of roles of mineralization-regulating proteins on biomineralization in various tissues. Inhibition of gel mineralization by the known protein inhibitor fetuin has previously been demonstrated using the GPC 5000. Ongoing work focuses on control studies using known promoters of mineral growth and analysis of the mineral in the gels.

THE MINERALIZATION-REGULATING PROTEIN OSTEOPONTIN EXHIBITS NO ADOPTION OF ORDERED SECONDARY STRUCTURE UPON ADSORPTION TO HYDROXYAPATITE MINERAL SURFACE

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Bone is a composite material composed largely of organic proteins and inorganic hydroxyapatite (HA) mineral crystals. Mineralization regulating proteins (MRPs) control the nucleation, size, shape, and polymorphism of the mineral crystals in order to achieve optimal material properties in the resulting bone tissue. By understanding how mineralization regulating proteins exert diverse effects on the growth of mineral crystals it may be possible to produce composite materials with similar mechanical properties to those of bone. One model of MRP-mineral interaction is that folding of largely disordered MRPs is induced by interaction with the mineral surface to form an accessible surface complementary to specific locations on the mineral surface. A second model contends that no ordered protein structure is necessary and that interactions are governed by electrostatic forces alone. Circular dichroism and infrared spectroscopy can both provide secondary structure information on proteins and peptides in solution and adsorbed to the HA mineral surface. The goal of this work is to determine the secondary

structures of three mineral binding sequences from the protein osteopontin while in solution and adsorbed to hydroxyapatite mineral crystals. We will present the first experimental evidence that this protein interacts primarily through electrostatic interactions with the mineral.

DEVELOPMENT OF METHODS TO DETECT ATRAZINE IN WATER AND SOIL SAMPLES

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Analytical methods were developed to determine herbicides, atrazine in particular, in soil and agricultural drainage water. Soil samples were processed using microwave-assisted extraction (MAE) and analyzed by using gas chromatography-mass spectrometry (GC-MS). Water samples were processed using solid-phase extraction (SPE) with C18 cartridges and analyzed by using GC-MS. Validity for both methods was determined by using atrazine- d_5 as an internal standard. The MAE and SPE methods allowed for the determination and confirmation of atrazine with good reproducibility and low detection limits. These methods were then used to test atrazine levels in soil and water samples collected near the Platte River.

HETEROGENEOUS CATALYSIS: THE HORIUTI-POLANYI MECHANISM AND ALKENE HYDROGENATION

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The hydrogenation of alkenes by heterogeneous catalysts has been studied for 80 years. The foundational mechanism was proposed by Horiuti and Polanyi in 1934, and consists of three steps: (1) alkene adsorption on the surface of the hydrogenated metal catalyst, (2) hydrogen migration to the π carbon of the alkene with formation of a π bond between the metal and π , and finally (3) reductive elimination of the free alkane. Hundreds of papers have appeared on the topic, along with a number of variations on the Horiuti-Polanyi mechanism. The second step is highly reversible, leading to extensive deuterium/hydrogen exchange when $D_2(g)$ is used. We will describe our investigation of gas phase reactions between deuterium and 1-butene using a supported palladium catalyst under ambient laboratory conditions, and how the results are consistent with the Horiuti-Polanyi mechanism. An Excel spreadsheet for modeling the extent and distribution of deuteration within butane- d_x will be described. Analysis of the butane produced by 1H -NMR and GC-MS leads to numerous conclusions in support of the Horiuti-Polanyi mechanism.

CHEMOSENSING PROPERTIES OF NBD TRIAZOLE COMPOUNDS

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NBD-chloride is a strongly reactive electrophile that is commonly used for biolabeling studies due to the strong fluorescence emission often observed for its resulting substitution products. The aim of this study was to determine whether metal-binding functionality could be incorporated onto the NBD fluorophore for the purposes of creating new fluorescence chemosensors for detecting metal ions. NBD azide was converted to a variety of NBD-triazole derivatives using the 'click' reaction. These derivatives were assayed in a high-throughput manner in order to observe changes upon interaction with metal cations in ethanol/water solutions. Among the 20 metals studied, only $K_2Cr_2O_7$ resulted in significant increases in fluorescence intensity after mixing. It was also observed that the fluorescence responses were sensitive to the identity of the triazole substituent remote from the NBD ring. Because strongly oxidizing Cr(VI) compounds are toxic environmental pollutants, developing sensors able to selectively detect this ion is desirable. Attempts were made to determine the mechanism by which the

sensor and metal interact to generate fluorescence signal changes. Details regarding compound preparation, metal-binding assays, and mechanistic studies will be described.

DETECTION OF FORMALDEHYDE IN SHAMPOO AND LOTION PRODUCTS MARKETED FOR USE ON INFANTS AND YOUNG CHILDREN BY FLUORESCENCE SPECTROSCOPY

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Formaldehyde and 1,4-dioxane are well-established as contact, inhalation, and ingestion carcinogens. Both of these compounds have been found in infant care products at varying levels. Countries including Denmark, Norway, Finland, South Africa, Japan, Sweden, the Netherlands, and the U.K. have begun requiring the elimination of these compounds completely from commercial products or for the amounts of these compounds to be disclosed on the labels. The United States does not require such information on product labels. In this work the concentrations of formaldehyde and 1,4-dioxane were determined in a wide range of shampoos, oils and other products marketed for use in young children and infants. Formaldehyde was reacted with Fluoral-P, and the fluorescent product of the reaction was extracted and quantified using fluorescence spectroscopy. For the same products, 1,4-dioxane was extracted via liquid-liquid extraction and determined using gas chromatography-mass spectrometry (GC-MS). Results from the determination of formaldehyde revealed three out of the five infant care products tested did contain this carcinogen. These findings will aid in evaluation of the potential exposure of young children to carcinogenic compounds and increase awareness of the need to set new policies in the United States to safeguard public health.

DETERMINING THE STRUCTURE AND DYNAMICS OF MINERAL BINDING PEPTIDES FROM OSTEOPOINTIN BY SOLID-STATE NUCLEAR MAGNETIC RESONANCE

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Mineralization-regulating proteins (MRPs) are involved in normal calcified tissue development as well as abnormal calcification such as plaque formation in arteries. Determining the molecular-level interactions taking place between these proteins and hydroxyapatite (HA) mineral crystals will help us to understand how they exert control over the location, size, shape and mineral phase of mineral crystals. With this knowledge, we can understand not only how normal control of this process works, but gain further insight into abnormal conditions and find ways to use nature's methods to develop composite materials with unique properties. We studied ^{13}C - and ^{15}N -labeled mineral-binding peptides from osteopontin, a mineral growth inhibitor found in mammalian bone tissue, on the HA mineral surface using solid-state NMR techniques including relaxation and dipolar coupling determinations in order to investigate the structure and dynamics of these proteins in their functional environment. Using labels at different amino acid positions, backbone dynamics and specific peptide-mineral contacts were investigated to determine what regions of the peptide interact closely with the mineral surface.

MINERAL BINDING PROTEINS ASSUME HELICAL STRUCTURES IN CROWDED ENVIRONMENTS

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It is widely known that molecular crowding within cells influences the folding and structural stability of cellular proteins. In contrast, the role of crowding in influencing structure and function of extracellular proteins has not been extensively investigated. Bone mineralization regulating proteins

function in the crowded extracellular environment of the bone matrix, a dense collagen-rich region. Although these proteins are highly disordered in dilute solution, their conformations in crowded conditions have never been reported. This is critical for our understanding of how these proteins interact with mineral crystals to control mineralization. By circular dichroism the structures of two bone-mineral-binding peptides were investigated using crowding mimics. Evidence will be presented that significant structure changes from disordered to helical occur for osteocalcin and JAK1 in both Ficoll 70 and when encapsulated in a series of sol-gels of varying composition. Results of thermal denaturation experiments of both peptides in solution and in crowded environments will also be presented that demonstrate the effects of molecular crowding on helicity and thermal stability. These results suggest that molecular crowding may play an important role in the structures and functions of mineralization-regulating proteins in their native, crowded environments.