PROGRAM
and
PROCEEDINGS

THE NEBRASKA ACADEMY
OF
SCIENCES
1880-2010

including the

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

130th Anniversary Year

One Hundred-Twentyth Annual Meeting

April 23, 2010
OLIN HALL OF SCIENCE - NEBRASKA WESLEYAN UNIVERSITY
LINCOLN, NEBRASKA
The 2010 Fall Conference of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, September 23, 24, and 25th (Thursday, Friday, and Saturday).

President: Joan Christen, Beatrice High School, Beatrice, NE
President-Elect: Kirsten Smith, Lincoln Public Schools, Lincoln, NE

AFFILIATED SOCIETIES OF THE NEBRASKA ACADEMY OF SCIENCES, INC.

1. American Association of Physics Teachers, Nebraska Section
   Web site: http://www.cune.edu/facweb/brent.royuk/naapt/about.htm

2. Friends of Loren Eiseley
   Web site: http://www.eiseley.org

3. Lincoln Gem & Mineral Club
   Web site: http://www.lincolngemmineralclub.org/

4. Nebraska Chapter, National Council for Geographic Education

5. Nebraska Geological Society
   Web site: http://maps.unomaha.edu/ngs/
   Sponsors of a $50 award to the outstanding student paper presented at the Nebraska Academy of Sciences Annual Meeting, Earth Science Section

6. Nebraska Graduate Women in Science

7. Nebraska Ornithologists’ Union
   Web site: http://rip.physics.unk.edu/NOU/
   Publishers of the quarterly, The Nebraska Bird Review
   Spring Meeting, May 14 - 16, 2010, Chadron, 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/math/index.htm
   Spring Meeting, April 9-10, 2010, University of South Dakota, Vermillion, SD

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
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 $25.00 for General Registrants and $10.00 for students with a VALID student ID. Registrants are entitled to the PROGRAM/PROCEEDINGS and to attend any of the section meetings. Junior and senior high school students will register at a separate area, FREE.

Additional copies of the PROGRAM/PROCEEDINGS may be obtained at the Registration Desk or, after the meeting, at the Academy Office, for $3.00/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 annually by the Academy for 34 years.

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

The Transactions is printed in large format on coated stock, for clearest reproduction of figures and text. There are no charges for publication, except for color illustrations, and authors get 50 free offprints. The Transactions is distributed free to all members of the Academy and to about 400 libraries worldwide, and it is abstracted by major abstracting services.

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

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

FRIDAY, APRIL 23, 2010

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
     Chemistry and Physics, Section A, Chemistry, Olin A
     Collegiate Academy, Biology Session A, Olin B
     Collegiate Academy, Chemistry and Physics, Session A, Olin 324
8:30 Biological and Medical Sciences, Session A, Olin 112
     Biological and Medical Sciences, Session B, Smith Callen Conference Center
     Chemistry and Physics, Section B, Physics, Planetarium
     History and Philosophy of Science, Olin 325
     Junior Academy, Judges Check-In, Olin 219
     Junior Academy, Senior High REGISTRATION, Olin Hall Lobby
     NWU Health and Sciences Graduate School Fair, Olin and Smith Curtiss Halls
9:00 Junior Academy, Senior High Competition, Olin 124, Olin 131
9:10 Aeronautics and Space Science, Poster Session, Olin 249
9:30 Teaching of Science and Math, Olin 325
11:00 MAIBEN MEMORIAL LECTURE, OLIN B
     Dr. Mark Greip, Vice-Chair, Department of Chemistry, University of Nebraska-Lincoln
12:00 LUNCH, PATIO ROOM, STORY STUDENT CENTER
     (pay and carry tray through cafeteria line, or pay at NAS registration desk)
     Aeronautics Group, Conestoga Room
1:00 p.m. Anthropology, Olin 111
     Biological and Medical Sciences, Session C, Olin 112
     Biological and Medical Sciences, Session D, Smith Callen Conference Center
     Chemistry and Physics, Section A, Chemistry, Olin A
     Chemistry and Physics, Section B, Physics, Planetarium
     Collegiate Academy, Biology Session A, Olin B
     Collegiate Academy, Biology Session B, Olin 249
     Collegiate Academy, Chemistry and Physics, Session A, 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
1:30 Earth Science, Olin 224
     Junior Academy, Junior High Competition, Olin 124, Olin 131
2:00 NJAS Board/Teacher Meeting, Olin 219
5:00 Junior Academy, General Awards Presentations, Smith Callen Conference Center
5:00-5:45 BUSINESS MEETING, OLIN B
5:45-6:30 SOCIAL HOUR for Members, Spouses, and Guests
     First United Methodist Church, 2723 N 50th Street, Lincoln, NE
6:30-8:30 ANNUAL BANQUET and Presentation of Awards and Scholarships
     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. EFFECTIVENESS OF ULTRAVIOLET SANITIZING. Ashley Belmudez-Frakes*, P. Higley and B. Mauck, Department of Biology, College of Saint Mary, Omaha.

8:10  2. THE EFFECT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE ON GAIT. Jennifer M. Yentes* and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

8:20  3. DESIGN OF EXTERNALLY POWERED ANKLE-FOOT-ORTHOSIS FOR POST FLIGHT RECOVERY. Shane Wurdeman*, Department of Environmental, Agricultural and Occupational Health, University of Nebraska Medical Center, Omaha, and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

8:30  4. LANTHANUM HEXABORIDE NANOSTRUCTURES AS COLD FIELD EMISSION CATHODES. Robert Jacobberger*, Joseph Brewer, and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln; and Fereydoon Namavar, Department of Orthopaedic Surgery, University of Nebraska Medical Center, Omaha.

8:40  5. USE OF NATURAL ANTIOXIDANTS TO PREVENT THE DEGRADATION OF OILS AND FORMATION OF TOXIC REACTIVE ALDEHYDE PRODUCTS. Jami L. Mitchell* and Ganesh Naik, Department of Arts and Sciences, College of Saint Mary, Omaha.

8:50  6. MANNOSE 6-PHOSPHATE/INSULIN-LIKE GROWTH FACTOR II RECEPTOR DIMERIZATION INTERACTIONS. Jenna Allison*, Joseph Wheeler, and Jodi Kreiling, Department of Chemistry, University of Nebraska at Omaha.

9:00  7. SURGICAL ROBOTS FOR MINIMALLY INVASIVE SURGERY. Tom Frederick, Department of Mechanical Engineering, University of Nebraska–Lincoln.

9:10  BREAK/POSTER PRESENTATIONS

9:30  8. A FOUR-DOF MODULAR SELF-RECONFIGURABLE ROBOT. Khoa D. Chu* and Carl A. Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln.

9:40  9. RFID IN SPACE: EXPLORING THE FEASIBILITY AND PERFORMANCE OF GEN 2 TAGS AS A MEANS OF TRACKING EQUIPMENT, SUPPLIES, AND CONSUMABLE PRODUCTS IN CARGO TRANSPORT BAGS ONBOARD A SPACE VEHICLE OR HABITAT. Maurice D. Cavitt* and Eric Jones, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln.
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<th>Time</th>
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<td>9:50</td>
<td>10. DISCONTINUOUS GALERKIN METHOD. Bryan Johnson, Department of Mathematics, University of Nebraska at Omaha.</td>
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<td>10:00</td>
<td>11. DEVELOPING COATED TOOLS FOR MICRO ELECTROCHEMICAL MACHINING PROCESS. Ajay K. Swain* and Kamalakar P. Rajurkar, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln; and Murali M. Sundaram, Department of Dynamic Systems, University of Cincinnati, OH.</td>
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<td>10:10</td>
<td>12. QUADRATIC SOLUTIONS TO $x^4 + y^4 = m^2 z^4$. Melissa Emory, Department of Mathematics, University of Nebraska at Omaha.</td>
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<td>10:20</td>
<td>13. MATERIAL PROPERTIES OF COMPOSITE PATCH. Joan Yule*, Shijia Zhao, Ananth Ram Mahanth Kasavajhala, and Linxia Gu, Department of Mechanical Engineering, University of Nebraska–Lincoln.</td>
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<td>10:30</td>
<td>BREAK/POSTER PRESENTATIONS</td>
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<td>10:50</td>
<td>14. GREEN TECHNOLOGIES FOR PAVEMENT SURFACE ICING CONTROL IN COLD CLIMATES. Paul Downey, Department of Electrical Engineering, University of Nebraska–Lincoln.</td>
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<td>11:00</td>
<td>15. POLICY’S ROLE IN THE EVOLUTION OF ERROR-TOLERANCE IN NATIONAL AEROSPACE AND SCIENCE ADMINISTRATION (NASA). Patrick O’Neil* and Neil Gabrielson, Department of Aviation, University of Nebraska at Omaha.</td>
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<td>11:10</td>
<td>16. THE EFFECT OF ISCHEMIA ON MUSCULAR STRENGTH. Sara Myers* and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.</td>
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<td>11:20</td>
<td>17. BALANCE TRAINING FOR MULTIPLE SCLEROSIS PATIENTS. Jessie Huisinga* and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha; and Shane Wurdeman, Department of Environmental, Agricultural and Occupational Health, University of Nebraska Medical Center, Omaha, and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln.</td>
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<td>11:30</td>
<td>18. DIFFERENTIAL GENE REGULATION OF THE icaADBC OPERON IN STAPHYLOCOCCUS EPIDERMIDIS UNDER MICROAEROBIC AND AEROBIC GROWTH CONDITIONS. Erica Colbert* and W.P. Jamison, Department of Physical and Life Sciences, Chadron State College, Chadron.</td>
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<td>11:40</td>
<td>19. DOES EXPOSURE TO HEAVY METALS CORRELATE WITH ANTIBIOTIC RESISTANCE IN BACTERIA? Samantha Marquez* and B. Mauck, Department of Biology, College of Saint Mary, Omaha.</td>
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AERONAUTICS AND SPACE SCIENCE
Chairperson: Michaela Lucas
NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

SESSION B
Olin 224

8:00 a.m. 1. ENHANCING INTRODUCTORY COURSES WITH HANDS-ON PROJECTS. William E. Spurgeon, Division of Business and Information Technology, Western Nebraska Community College, Scottsbluff.

8:10 2. COMMUNITY ACTION PARTNERSHIP OF WESTERN NEBRASKA INFORMATION TECHNOLOGY INTERNSHIP. Jason Hamilton, Division of Business and Information Technology, Western Nebraska Community College, Scottsbluff.

8:20 3. COMPUTERIZED RANKING TASKS FOR INTRODUCTORY ASTRONOMY. Renee Augustyn* and Kevin M. Lee, Center for Science, Mathematics, and Computer Education, University of Nebraska–Lincoln.

8:30 4. INTRODUCTORY ASTRONOMY ASTROPHOTOGRAPHY PROJECT. Tom Robinson, Division of Business and Information Technology, Western Nebraska Community College, Scottsbluff.
SPACE IMAGING RESEARCH. Jonathan Spurgeon*, Division of Math and Science, Western Nebraska Community College, Scottsbluff.

8:40 5. DETECTING EXTENDED COSMIC RAY AIR SHOWERS WITH THE CROP NETWORK. Thomas S. McShane*, Bjorn Nilsen, Alejandro Echeverri, and Yury Gorbunov, Department of Physics, Creighton University, Omaha; and Lyle A. Sass, Consultant, Mount Michael Academy, Elkhorn.

8:50 6. ELECTRON OPTICAL EXCITATION FUNCTIONS IN METHANE. Riley Howsdren*, Eric Rybacki, and Kenneth Trantham, Department of Physics and Physical Science, University of Nebraska at Kearney.

9:00 7. INVESTIGATING MASS OUTFLOWS OF BAL QUASARS WITH CIII* ABSORPTION. David C. Austerberry, Department of Physics, Creighton University, Omaha.

9:10 BREAK/POSTER PRESENTATIONS

9:30 8. SIMULATION OF TRANSIENT ETHANOL EROPLET COMBUSTION IN CONVECTIVE ENVIRONMENT. Inkant Awasthi* and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln.

9:40 9. CRYOCOOLER VALIDATION FOR THE VASIMIR ISS DEMONSTRATOR MISSION. Eldon Summerson* and Kyrik Weidman*, Department of Mechanical Engineering, University of Nebraska–Lincoln.
10:00  11.  A CULTURAL APPROACH TO CONSERVATION UTILIZING MODERN SCIENCE. Hank Miller, Department of Natural Resources, Nebraska Indian Community College, Niobrara, and Troy Munhofen and Carly DeBilzan*, Department of Natural Resources, Nebraska Indian Community College, So. Sioux City.

10:10   12.  REGIONAL EVAPOTRANSPIRATION ESTIMATION USING LAND SURFACE MODELING, DATA ASSILILATION, AND SATELLITE REMOTE SENSING. Ayse Irmak*, School of Natural Resources and Department of Engineering, and Baburao Kamble, Department of Engineering, and Ian Ratcliffe, Center for Advanced Land Management Information Technologies, University of Nebraska–Lincoln.

10:20  13.  POLARIZING EFFICIENCY OF LYOTROPIC CHROMONIC LIQUID CRYSTALS. Jeremy Stromer*, Bobbi Arnold, Josh Beck, Liubov Kreminska, and Michael Larsen, Department of Physics and Physical Science, University of Nebraska at Kearney.

10:30  BREAK/POSTER PRESENTATIONS

10:50  14.  NEBRASKA 7-9 DECEMBER 2009 SNOW STORM: NASA’S SATELLITE VIEW AND NCEP’S WEATHER REANALYSIS. Amy Gehring* and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln.

11:00  15.  USING PHOTOGRAMMETRY AND GIS METHODS TO STUDY AND DIGITALLY PRESERVE FLUVIAL ICHNOFOSSIL ASSEMBLAGES AT TOADSTOOL PARK, NORTHWEST NEBRASKA. Jesse Zwiebel* and Michael Leite, Department of Physical and Life Sciences, Chadron State College, Chadron; and Hannan LaGarry, Department of Sciences, Oglala Lakota College, Kyle, SD; and Neffra Matthew, Bureau of Land Management, Denver, CO; and Brent Breithaupt, Department of Geology and Geophysics, University of Wyoming, Laramie, WY.

11:10  16.  WIND ENERGY IN THE MIDWEST: PAST, PRESENT AND FUTURE. Eric Holt* and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln.

11:20  17.  SATELLITE REMOTE SENSING OF AEROSOLS: FACTORS THAT AFFECT SMOKE PLUME INJECTION HEIGHTS. Catherine May*, Department of Meteorology, and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln; and Charles Ichoku, Department of Physics, University of Maryland and Baltimore County, Baltimore, MD.

11:30  18.  CORRELATING MODIS OBSERVATIONS AND CORRESPONDING AERONET STATIONS. Nicole Pothier* and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln.

11:40  19.  REMOTE SENSING AS A MEANS OF ENHANCING NEBRASKA’S EMERGING WINE INDUSTRY. Trisha Larson*, Donald Rundquist, and Brenton Willoughby, School of Natural Resources, 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 249

MULTI-FUNCTIONAL \textit{in vivo} ROBOTIC PLATFORM FOR LONG-TERM SPACEFLIGHT. Tyler D. Wortman, Department of Mechanical Engineering, University of Nebraska–Lincoln.

THE USE OF MULTIVARIATE FACTOR ANALYSIS IN THE DEVELOPMENT OF HAND SIZES. Trevor McLain and R.R. Bishu, Department of Industrial Engineering, University of Nebraska–Lincoln.

BEARING DRAG TORQUE AND STIFFNESS ESTIMATIONS. Justin Green, Department of Mechanical Engineering, University of Nebraska–Lincoln.

TWO ONLINE ENVIRONMENTS TO SUPPORT STEM EDUCATION. Neal Grandgenett, Department of Teacher Education, and Robert Shuster, Department of Geography/Geology, University of Nebraska at Omaha.

DESIGN OF A GPS-BASED COSMIC RAY DETECTOR USING THE BERKELEY DAQ. David C. Austerberry, Department of Physics, Creighton University, Omaha.

GEOMORPHOLOGICAL ANALYSIS OF STREAM IN THE PINE RIDGE, NORTHWESTERN NEBRASKA. Kodi Young and Michael Leite, Department of Physical and Life Sciences, Chadron State College.

USE OF SPECTRAL REFLECTANCE AND SATELLITE IMAGERY TO IDENTIFY AMERICAN BURYING BEETLE \textit{Nicrophorus americanus} HABITAT IN NEBRASKA. Michelle McPherron, Vijendra Boken, and W.Wyatt Hoback, Department of Sociology, Geography and Earth Sciences, University of Nebraska at Kearney.

USING REMOTE SENSING DATA FOR PALEONTOLOGICAL EXPLORATION IN MADAGASCAR. Timothy J. Stoebner and Christina Etzrodt, Department of Geography; and Todd Widhelm and Lisa D. Boucher, Department of Biology, University of Nebraska at Omaha.

CENTRAL AMERICAN SMOKE TRANSPORT TO TEXAS: METEOROLOGICAL CAUSES AND SOCIETAL EFFECTS. Melissa Huffman and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln.
THE EFFECT OF AUDITORY STIMULATION ON HUMAN MOVEMENT VARIABILITY. Jeffery P. Kaipust and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

LINEAR AND NONLINEAR ASSESSMENT OF POSTURAL CONTROL IN MULTIPLE SCLEROSIS PATIENTS. Jessie Huisinga and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha; and Mary Filipi, Department of Adult Health and Illness, University of Nebraska Medical Center, Omaha.

UNDERSTANDING AND DEVELOPING HPLC METHODS. Chelsea Dean, Ganesh Naik, and Jeremy Karr, Department of Arts and Sciences, College of Saint Mary, Omaha.

WORK TOWARD THE DEVELOPMENT OF A MICROFLUIDIC BIOSensor. Erin M. Gross, Sarah E. Roszhart, Nicholas R. Stukel, and Laura R. Anderson, Department of Chemistry, Creighton University, Omaha; and Charles S. Henry, Department of Chemistry, Colorado State University, Fort Collins, CO.

THE ASSOCIATIONS BETWEEN COGNITIVE AND PHYSICAL FUNCTION DURING DUAL TASK PARADIGMS. Sara Myers, Leslie Decker, and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

SURFACE HABITAT 1/6g SUITLOCK EVALUATION. Jack Mondry and Andrew Kelley, Department of Mechanical Engineering, University of Nebraska–Lincoln.

THE REAL WORLD EXPERIENCE. Greg Schwanke, Department of Instructional Technology, University of Nebraska at Kearney.
ANTHROPOLOGY AND GEOGRAPHY
Co-Chairpersons: Peter Bleed and Steven Damm
Department of Anthropology
University of Nebraska–Lincoln
Olin Hall 111

1:00 p.m.  WELCOME

1:10  1. EVALUATING THE EFFECTS OF MICROWAVABLE MEALS ON HEALTH AND CULTURE IN THE U.S. Bailey Armstrong, Department of Anthropology, University of Nebraska–Lincoln.

1:30  2. EDUCATION AND PUBLIC OUTREACH IN ARCHAEOLOGY. Christine Nycz, Department of Anthropology, University of Nebraska–Lincoln.

1:50  3. WILD POTTERY OF THE LINCOLN POTTERY WORKS: CAN ANTIQUE COLLECTIONS HELP ARCHEOLOGISTS? Linda Dammann, Department of Anthropology, University of Nebraska–Lincoln.

2:10  4. TIMBER, TRADE, AND THE HANSEATIC LEAGUE: AN EVOLUTIONARY PERSPECTIVE ON THE DEVELOPMENT AND ADAPTATION OF SHIP CONSTRUCTION TECHNIQUES. Jillian Smith, Department of Anthropology, University of Nebraska–Lincoln.

2:30  5. THE DECIDUOUS DENTITION OF CATARRHINE PRIMATES: IMPLICATIONS FROM MACACA NEMESTRINA (PIGTAILED MACAQUES). Emily Hammerl, Department of Anthropology, University of Nebraska–Lincoln.

2:50  6. HOW WOMEN ACHIEVE STATUS IN TRADITIONAL SOCIETIES. Melissa Garfield, Department of Anthropology, University of Nebraska–Lincoln.

3:10  7. THE PROSOCIAL DIMENSION OF STATUS IN EGALITARIAN SOCIETIES. Zach Garfield, Department of Anthropology, University of Nebraska–Lincoln.

3:30  8. RITUALIZED AND NONRITUALIZED RELATIONS BETWEEN CAPTORS AND CAPTIVES AMONG THE COMANCHE, KIOWAS AND CHEYENNES. Martha McCollough, Department of Anthropology, University of Nebraska–Lincoln.

3:50  9. READING IMAGES OF GENDER AND EMPIRE: PHOTOGRAPHS OF THE OJIBWE OF NORTHERN MINNESOTA. Ashley J. Barnett, Department of Geography, University of Nebraska–Lincoln.
SESSION A
Session Chairperson: Kimberly Carlson, University of Nebraska at Kearney
Olin 112

8:30 a.m.  1. EVOLUTIONARY CONSERVATION OF A POTENTIAL ANIMAL/MAMMALIAN RIBOSWITCH. Andrew Kavan*, Molly McDevitt, and Julie Soukup, Department of Chemistry, Creighton University, Omaha.

8:42  2. ANTIBIOTIC DEVELOPMENT BY INVESTIGATION OF THE GLMS RIBOSWITCH. Danielle Renner*, Erin Johnson and Juliane Soukup, Department of Chemistry, Creighton University, Omaha.

8:54  3. CONFIRMATION OF BINDING SPECIFICITY AND GENETIC CONTROL BY POTENTIAL MAMMALIAN RIBOSWITCH. Kelley Wanneck*, Natalie Erbs, Katie Del Vecchio, and Julie Soukup, Department of Chemistry, Creighton University, Omaha.

9:06  4. WHOLE GENOME RIBOSWITCH SEARCHES. Karen L. Holly*, M.A. Pauley, College of Information Science and Technology, University of Nebraska at Omaha.

9:18  5. MIMICKING THE TARGETING OF RNA: REACTION OF DNA STEM-LOOP MOTIFS WITH PARTIAL COMPLEMENTARY STRANDS. Hollie Siebler*, Department of Biology, Dana College, Blair; and Carolyn Carr, University of Nevada, Reno, NV; and Hui-Ting Lee, Irine Khutsishvili, and Luis A. Marky, Department of Pharmaceutical Sciences, University of Nebraska Medical Center, Omaha.

9:30 BREAK

9:45  6. CHANGES IN OTK18 mRNA LEVELS USING RNAi AND qRT-PCR. Joshua Bauer*, Becky A. Fusby, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.

9:57  7. STABILITY AND MICROMECHANICAL PROPERTIES OF MODEL ALZHEIMER’S Aß-AMYLOID FIBRILS. Tana Friesth*, Creighton University, Department of Sociology, Omaha; and Benjamin Soukup, Montana State University, Department of Physics, Bozeman, MT; and Patricia Soto, Creighton University, Department of Physics, Omaha.

10:09  8. EVALUATING POTENTIAL MODIFIERS OF PARKINSON’S DISEASE USING A DROSOPHILA MODEL OF PD. Lokeshchandra Kalekar*, Kevin Barton, and Bruce Chase, Department of Biology, University of Nebraska at Omaha; and Katerina Markopoulou, Department of Neurology, University of Thessaly, Larissa Greece.
9. A NEW COMPUTATIONAL APPROACH FOR ASSEMBLING SHORT READS. Julia Warnke* and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha.

10. CCR4-NOT COMPLEX IN THE POST-TRANSCRIPTIONAL CONTROL OF Gcn4p TARGETED GENES’ mRNAs. Dhananjay M. Nawandar*, Wendy Vienneau, Kelly Westfall, Naomi Barcomb and Mark J. Swanson, Department of Biology, University of Nebraska at Omaha.

11:00 MAIBEN MEMORIAL LECTURE - OLIN LH - B

**BIOLOGICAL AND MEDICAL SCIENCES**

**SESSION B**
Session Chairperson: Brad Ericson, University of Nebraska at Kearney
Smith Callen Conference Center

8:30 a.m. 1. POPULATION GENETICS OF SICKLEFIN AND STURGEON CHUBS IN THE MISSOURI RIVER BASIN. Cal Borden*, School of Biological Sciences, University of Nebraska–Lincoln; and Jerrod Hall and Gerald Mestl, Nebraska Game and Parks Commission, Lincoln.


9:06 4. THE EFFECTS OF FLY CLEANING BEHAVIOR ON BACTERIAL TRANSMISSION. Sebastian Edwards*, B.J. Jacques, and J.J. Shaffer, Department of Biology, University of Nebraska at Kearney.

9:18 5. THE EFFECTS OF pH FLUCTUATION ON BACTERIOPHAGE ISOLATED FROM EPHEMERAL, ALKALINE LAKES. Andrew A. Block*, Cory Shield, and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney.

9:30 BREAK

9:45 6. ATRAZINE: WATER AND SOIL SAMPLES IN WESTERN NEBRASKA. Callan Driscoll*, Environmental Sciences Program; and J. E. Platz and Megan Konz, Department of Biological Sciences; and E. J. Haas and Charles Cohlmia, Department of Chemistry, Creighton University, Omaha.
7. IDENTIFICATION OF SIDEROPHORE PRODUCTION BY BACTERIA FROM HYPER ALKALINE-SALINE LAKES. Marcelle Strydom* and J.J. Shaffer, Department of Biology, University of Nebraska at Kearney.

8. FUNCTIONAL DIVERSITY OF MITOCHONDRIAL β-HYDROXYACYL-COA HYDROLASES IN A. THALINA. Kerry A. Lucas* and K. Ronhovde, Department of Chemistry, Doane College, Crete; and Z. Ke and J.W. Hawes, Department of Chemistry and Biochemistry, Miami University, Oxford, OH.


10. EVOLUTIONARY DEVELOPMENT OF PH TOLERANCE IN EXPERIMENTAL ESCHERICHIA COLI LINEAGES. Paul J. Akre*, Mandy H. Wong, and Alistair J. Cullum, Department of Biology, Creighton University, Omaha.

MAIBEN MEMORIAL LECTURE - OLIN LH - B

BIOLOGICAL AND MEDICAL SCIENCE

SESSION C
Session Chairperson: Emerson Crabill, School of Biological Sciences
University of Nebraska–Lincoln
Olin 112

1:00 p.m. 1. ANTIBIOTICS USAGE AND ITS EFFECT ON THE DEVELOPMENT OF ANTIBIOTIC RESISTANCE IN MEDICALLY IMPORTANT BACTERIA; A CORRELATION STUDY. Gillian M Cromwell* and Dhundy R. Bastola, College of Information Science and Technology, University of Nebraska at Omaha.

1:12 2. DROSOPHILA MELANOGASTER NORA VIRUS ORF-1 PROTEIN: ANTIBODY CHARACTERIZATION OF VIRUS REPLICATION IN VIVO. Brandon Mizner*, Ethan Cordes, Darby J. Carlson, Brad L. Ericson, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.

1:24 3. INVESTIGATION OF THE EFFICACY OF NANOPARTICLE ANTIRETROVIRAL DRUG DELIVERY SYSTEMS. Shelby Takeshita*, Department of Chemistry; and Chris Destache, School of Pharmacy & Health Professions; and Annemarie Shibata, Department of Biology, Creighton University, Omaha.

1:36 4. IDENTIFICATION OF HUMAN HERPESVIRUS TRANSMISSION SOURCE IN ZAMBIAN HOUSEHOLDS. Maxine White*, Danielle Shea, Veenu Minhas, and Charles Wood, Nebraska Center for Virology and the School of Biological Sciences, Lincoln Morrison Center, University of Nebraska–Lincoln.
5. RESPONSES OF SALICYLIC ACID METABOLISM RELATED TRANSCRIPTS IN THE SOYBEAN-SOYBEAN APHID INTERACTION. Jacqueline Blunck*, A.K. Barber, and P. Twigg, Department of Biology, University of Nebraska at Kearney; and T. Heng-Moss, Department of Entomology, University of Nebraska–Lincoln.

6. SOYBEAN GENETIC RESPONSE TO SOYBEAN APHIDS AT ADVANCED DAMAGE TIME POINTS. Anna K. Barber* and P. Twigg, Department of Biology, University of Nebraska at Kearney; and T.M. Heng-Moss, Department of Entomology, University of Nebraska–Lincoln.

7. SEX-SPECIFIC SPLICING OF THE PEA APHID DOUBLESEX GENE. Angela Brichacek* and Soochin Cho, Department of Biology, Creighton University, Omaha; and Alex Wilson, Department of Biology, University of Miami, Coral Gables, FL.

8. EXON-INTRON STRUCTURE OF THE IMMULECTIN-1 GENE OF MANDUCA SEXTA. Brittany Brown* and Brad Ericson, Department of Biology, University of Nebraska at Kearney.

9. EFFECT OF FOOD AVAILABILITY ON IMMUNE FUNCTION. Robert L. Stanton* and Claudia M. Rauter, Department of Biology, University of Nebraska at Omaha.

10. PSEUDOMONAS SYRINGAE INDUCES CHANGES IN HOST PLANT CHROMATIN IN A TYPE III SECRETION DEPENDENT MANNER. McKenzie Jarecki*, Andrew Karpisek, and Karin van Dijk, Department of Biology, Creighton University, Omaha; and Byeong-ryool Jeong and James Alfano, Center for Plant Science Innovation, University of Nebraska–Lincoln.

11. IDENTIFICATION OF THE RESIDUES IN THE TYPE III SECRETED TOXIN EXOU REQUIRED FOR CHAPERONE BINDING. Aditya Kulkarni*, Sai Kancharla, Suresh B. Kampalli, and D. W. Rowen, Department of Biology, University of Nebraska at Omaha.

12. HOST CELL RESPONSES TO NPRO MUTANT BVDV2 INFECTION. Abdulrahman Alkheraif*, C. Topliff, and C. L. Kelling, School of Veterinary Medicine and Biomedical Sciences, University of Nebraska–Lincoln.

13. ASSESSING PEROXIDASE GENE EXPRESSION IN BUFFALOGRASS CULTIVARS INFESTED WITH CHINCH BUGS. Quinn N. Willet*, A.K. Barber, S.D. Vitosh, and P. Twigg, Department of Biology, University of Nebraska at Kearney.

14. A NEW APPROACH FOR FINDING PROTEIN SORTING MOTIFS. Caleb V. Schmid*, Daniel H. Haft, and Hesham H. Ali, College of Information Science and Technology, University of Nebraska at Omaha; Department of Bioinformatics, J. Craig Venter Institute, Rockville, MD.
4:02  15.  SYSTEMATIC EVALUATION OF SEQUENCE COMPARISON METHODS.  Ximeng
Zheng* and Zhengxin Chen, College of Information Science and Technology; and
Guoqing Lu, Department of Biology, University of Nebraska at Omaha.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

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

1:00 p.m.  1.  ANALYSIS OF NEUROGENESIS AND NEURODEGENERATION IN ATOH1-CRE
DICER NULL MUTANT MICE.  Carrie Cusack*, A. Hake, C. Campbell, S. Hake,
and A. Shibata, Department of Biology; and M. Pierce and G. Soukup, Department of
Biomedical Sciences, Creighton University, Omaha.

1:12  2.  NEUROTROPIC FUNCTION OF MICROGLIAL AND UNDERLYING EPIGENETIC
MECHANISMS.  Alex Eisheid* and A. Shibata, Department of Biology, Creighton
University, Omaha.

1:24  3.  CELL PROLIFERATION OF PERITONEAL TISSUE BY PEROXIDE CONTAINING
WHITENING PRODUCTS.  Sara E. Kluver, Hastings College, Hastings.

1:36  4.  THE EFFECT OF THREE ESSENTIAL OILS ON CELL PROLIFERATION IN CELL
CULTURE.  Eddie J. Krajicek, Department of Biology, Hastings College, Hastings.

1:48  5.  IN VITRO ELONGATION OF PORCINE EMBRYOS USING ALGINATE
HYDROGELS AS A THREE-DIMENSIONAL EXTRACELLULAR MATRIX.
Catherine N. Sargus*, Sarah A. Plautz, and Angela K. Pannier, Department of Biological
Systems Engineering, University of Nebraska–Lincoln; and Jeremy Miles and Jeff Vallet,
USDA-ARS U.S. Meat Animal Research Center (USMARC), Clay Center.

2:00  6.  TERATOGENIC EFFECTS OF LOW DOSES OF NICOTINE ON EARLY AVIAN
DEVELOPMENT.  John T. Olley*, Evelyn Pham, and Mark. V. Reedy, Department of
Biology, Creighton University, Omaha; and Philip R. Brauer, Department of Biomedical
Sciences, Creighton University Medical Center, Omaha.

2:12  7.  THE CORRELATION BETWEEN MATERNAL ANDROSTENEDIONE LEVELS
AND NEONATAL MORPHOLOGY OF GEOFFROY’S MARMOSETS, CALLITHRIX
GEOFFROYI.  Ross A. Milam*, Department of Biology, Dana College, Blair; and Adam
S. Smith, Andrew K. Birnie, Jeffrey A. French, and Shelton Hendricks, Department of
Psychology, University of Nebraska at Omaha.

2:24  8.  OLFACTORY SOCIAL BUFFERING IN MARMOSETS (CALLITHRIX GEOFFROYI).
Emily B. Harrison* and J. A. French, College of Psychobiology, University of Nebraska
at Omaha.
2:36   BREAK

2:50   9. CENTRAL ANGIOTENSIN-(1-7) ENHANCES BAROREFLEX GAIN IN RABBITS WITH CHRONIC HEART FAILURE. Sumit Kar*, Department of Biology, Creighton University, Omaha; and Pam Curry and Irving H. Zucker, Department of Cellular and Integrative Physiology, University of Nebraska Medical Center, Omaha.

3:02   10. EFFECT OF ANTIOXIDANTS ON DEPLETED URANIUM INDUCED LIPID PEROXIDATION. Kelli Oelsligle*, A. Benz, and W. Briner, Psychobiology Program, Department of Psychology, University of Nebraska at Kearney.

3:14   11. THE EFFECTS OF 5-HOUR ENERGY DRINK ON HUMAN MOOD, CONCENTRATION, AND ENDURANCE. Adam J. Schapmann* and Janet E. Steele, Department of Biology, University of Nebraska at Kearney.

3:26   12. DISCARDED BOTTLES ENTRAP AND KILL SMALL MAMMALS ALONG ROADSIDES IN NEBRASKA. Owen J. Johnson* and K. Geluso, Department of Biology, University of Nebraska at Kearney.


3:50   14. BUTTERFLIES AND THEIR NECTAR PLANTS AT SPRING CREEK PRAIRIE AUDUBON CENTER. Nicholas C. Bracciano* and Theodore Burk, Department of Biology, Creighton University, Omaha.

4:02   15. A FLORISTIC ANALYSIS AND COMPARISON OF PLANT COMMUNITIES IN HARLAN COUNTY, NEBRASKA. Naomi D. Hastings and Steven J. Rothenberger, Department of Biology, University of Nebraska at Kearney.

4:14   16. THE EFFECTS OF STANOZOLOL ON MURINE THYROID FUNCTION AND ITS ABILITY TO PRODUCE THYROID HORMONE. Jeffrey R. Klug, Department of Biology, Hastings College, Hastings.

4:26   17. THE EFFECTIVENESS OF ESSENTIAL OILS WITH ANTI-MICROBIAL CLAIMS ON INHIBITING GROWTH OF BACTERIA COLLECTED FROM THE SURFACE OF HANDS AND ARMS. Jessica Herse, Department of Biology, Hastings College, Hastings.
CHEMISTRY AND PHYSICS
Chairpersons:
Andy Zhong, Department of Chemistry and Renat Sabirianov, Department of Physics
University of Nebraska at Omaha

SECTION A, CHEMISTRY
Section Chairperson: Andy Zhong, Department of Chemistry, University of Nebraska at Omaha
Olin LH - A

8:00 a.m. WELCOME

8:05 1. APPLICATION OF VIRTUAL SCREENING TOWARDS THE FUNCTIONAL ANNOTATION OF YNDB, AN AHSA1 PROTEIN. Jaime L. Stark*, Kelly A. Mercier, and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln; and Geoffrey A. Mueller, Laboratory of Structural Biology, National Institute of Environmental Health Sciences, Durham, NC; and Thomas B. Acton, Rong Xiao, and Gaetano T. Montelione, Center for Advanced Biotechnology and Medicine, Department of Molecular Biology and Biochemistry Northeast Structural Genomics Consortium, Rutgers University, Piscataway, NJ.


8:45 3. USE OF ENZYME ACTIVE-SITE COMPARISONS TO STUDY EVOLUTIONARY RELATIONSHIPS. Jennifer C. Copeland* and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln.


9:25 5. HIGH-EFFICIENCY MICROPHOTOXIDATION USING MILLIWATT LED SOURCES. John M. Carney*, Chad M. Lomas, Dayna Miyashiro, and Martin Hulce, Department of Chemistry, Creighton University, Omaha.

9:45 BREAK

9:50 6. TOPOLOGY CONTROL OF METAL-ORGANIC FRAMEWORKS THROUGH MULTISTEP SYNTHESIS. Brandon J. Burnett*, P. M. Barron, H. M. Chung, and W. Choe, Department of Chemistry, University of Nebraska–Lincoln.

10:05 7. ONE POT SYNTHESIS OF AMINES FROM HYDROPEROXY ACETALS. Shiva Kumar Kyasa, Thomas Fisher, and Patrick H Dussault*, Department of Chemistry, University of Nebraska–Lincoln.
10:20  8.  OPTIMIZATION OF POLYMERIZATION CONDITIONS FOR AFFINITY MONOLITH COLUMNS CONTAINING IMMOBILIZED PROTEINS. Erika Pfauemiller*, Rangan Mallik, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.


11:00  MAIBEN MEMORIAL LECTURE - OLIN LH - B

12:00  LUNCH

1:00  WELCOME

1:05  10.  ENERGY DECOMPOSITION ANALYSIS FOR OPEN-SHELL AND EXCITED MOLECULES. Nandun M. Thellamurege* and Hui Li, Department of Chemistry, University of Nebraska–Lincoln.

1:25  11.  CLONING AND EXPRESSION OF THE PATRIDGE PEA ENOLASE GENE. Bobbi Arnold* and Frank Kovacs, Department of Chemistry, University of Nebraska at Kearney.

1:45  12.  DOCKING STUDIES AND PHARMACOPHORE MODELING OF MATRIX METALLOPROTEINASE (MMP) INHIBITORS. Theresa D. Faure*, Melissa A. Wees, and Haizhen (Andy) Zhong, Department of Chemistry, University of Nebraska at Omaha.

2:00  13.  DETECHIP AND WILDPLUM. Andrea Holmes, Department of Chemistry, Doane College, Crete.

2:15  14.  SCREENING OF CHEMICAL LIBRARIES USING ELECTROSPRAY IONIZATION MASS SPECTROMETRY. Levi J. Zehr, Department of Chemistry, University of Nebraska–Lincoln.

2:30  15.  SECOND-ORDER MøLLER-PLESSET GRADIENT FOR THE POLARIZABLE CONTINuum MODEL. Dejun Si* and Hui Li, Department of Chemistry, University of Nebraska–Lincoln.

2:45  BUSINESS MEETING / SELECTION OF 2011 CHAIRS


3:10  17.  MOLECULAR DYNAMICS SIMULATIONS OF THE ZIF268/DNA COMPLEX. Sarah B. Norris*, and Haizhen (Andy) Zhong, Department of Chemistry, University of Nebraska at Omaha.
3:25 18. CONFORMATIONAL CHANGES OBSERVED FOR MINERAL-BINDING PEPTIDES UPON ADSORPTION TO HYDROXYAPATITE MINERAL SURFACE, Crystal Vander Zanden*, Mark V. Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete.

3:40 19. COMPETITIVE TRANSITION STATES AND ACTIVATION ENERGIES EXPLAIN C-1 VS C-4 PHOTODISPLACEMENTS BY HYDROXIDE ION ON 4-NITROANISOLE. Danielle Policarpio*, Hannan Daniel, and Gene Wubbels, Department of Chemistry, University of Nebraska at Kearney.

3:55 20. HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY STUDIES OF SULFONYLUREA BINDING TO HUMAN SERUM ALBUMIN IN DIABETES. Jeanethe A. Anguizola* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

4:10 21. INVESTIGATIONS OF THE ROLE OF PYRIDINE ON ALKENE OZONOLYSES. Brad M. Johnson* and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln.


4:40 CLOSING COMMENTS

**CHEMISTRY AND PHYSICS**

**SECTION B, PHYSICS**
Chairperson: Renat Sabirianov, Department of Physics, University of Nebraska at Omaha
Planetarium

8:30 a.m. WELCOME

8:30 1. KEYNOTE ADDRESS: FIRST RESULTS FROM THE ALICE DETECTOR. Bjorn S. Nilsen*, on behalf of the ALICE Collaboration, Department of Physics Creighton University, Omaha.

9:00 2. FIRST RESULTS FROM THE LARGE HADRON COLLIDER. Maxwell D. Gregoire, Department of Physics and Astronomy, University of Nebraska–Lincoln.

9:12 3. COLOR MATCHING FUNCTIONS AND CONE FUNDAMENTALS. Nakul Padalkar and Chuck Blatchley*, Department of Physics, Pittsburg State University, Pittsburg, KS.

9:24 4. OBSERVATION OF $\phi$ MESON PHOTOPRODUCTION AT RHIC THROUGH $\phi\rightarrow K^+K^-$. Jonathan Bruckman, Department of Physics, Creighton University, Omaha.

9:36 5. DARK MATTER AND DETECTION METHODS. T. J. Torpin*, Aruna P. Wanninayake, and G. Duda, Department of Physics, Creighton University, Omaha.
9:48 6. A METHOD FOR IDENTIFYING BOTTOM AND CHARM QUARK JETS USING THE ALICE ELECTROMAGNETIC CALORIMETER. Andrew J. Turvey* and M. G. Cherney, Department of Physics, Creighton University, Omaha.

10:00 7. THEORETICAL DETERMINATION OF FORM FACTORS USED IN DARK MATTER STUDIES. Aruna P. Wanninayake*, T. J. Torpin, and G. Duda, Department of Physics, Creighton University, Omaha.

10:12 8. ULTRA PERIPHERAL COLLISIONS AND THE TIME OF FLIGHT DETECTOR AT RHIC. Mark Ridder*, Jarrod K. Bang and J. Seger, Department of Physics, Creighton University, Omaha.


10:36 10. OLBER'S PARADOX IN AN EXPANDING UNIVERSE. Adam N. Davis, Wayne State College, Wayne.

11:00 MAIBEN MEMORIAL LECTURE - OLIN LH - B

12:00 LUNCH

1:00 p.m. 11. PHOTOPRODUCTION OF PHI-MESONS IN 200-GEV AU-AU COLLISIONS AT RHIC. Olamide I. Osinkolu* and Janet Seger, Department of Physics, Creighton University, Omaha.

1:12 12. STATIC AND DYNAMIC LIGHT SCATTERING STUDY OF AQUEOUS SUCROSE SOLUTIONS. Victor Ogunjimi, Department of Physics, Creighton University, Omaha.

1:24 13. DEVELOPMENT OF A DIGITAL HOLOGRAPHIC MICROSCOPE. Robert Thomen, Department of Physics, Creighton University, Omaha.

1:36 14. CORRELATION BETWEEN BIAS FIELDS AND MAGNETORESISTANCE IN CoPt BIASED NiFe/TA/NiFe HETEROSYSTEMS. Yi Wang*, Xi He, S. Sahoo*, and Ch. Binek, Department of Physics and Astronomy, University of Nebraska–Lincoln *Seagate Technology

1:48 15. ROBUST ISOTHERMAL ELECTRIC SWITCHING OF INTERFACE MAGNETIZATION: A ROUTE TO VOLTAGE-CONTROLLED SPIN ELECTRONICS. Xi He1*, Yi Wang1, N. Wu1, Siqi Shi1,4, A. Caruso2, E. Vescovo3, K. D. Belashchenko1, P. Dowben1, Ch. Binek1

1 Department of Physics and Astronomy, NCMN, University of Nebraska–Lincoln
2 Department of Physics, University of Missouri, Kansas City KS
3 Brookhaven National Lab, Nat. Synchrotron Light Source, Upton, NY
4 Department of Physics, Zhejiang Sci-Tech University, Hangzhou, China

2:00 16. NON-COVALENT FUNCTIONALIZATION OF BORON NITRIDE NANOTUBES WITH SIMPLE AROMATIC RINGS. Yu Zhao, Department of Chemistry, University of Nebraska–Lincoln.
17. LASER-DRIVEN ELECTRON AND X-RAY BEAMS FOR IMAGING OF DENSE STRUCTURES RELEVANT TO BIOMEDICAL APPLICATIONS. Laila Gharzai*, S. Banerjee, and D. Umstadter, Department of Physics, University of Nebraska–Lincoln.

18. STRAIN- AND DEFECT-ENHANCED CAVITY FORMATION AND GOLD PRECIPITATION AT THE INTERFACES OF AN Au IRRADIATED ZrO2/SiO2/Si HETEROSTRUCTURE. Philip D. Edmondson, Chongmin Wang, Zihua Zhu, William J. Weber, and Yanwen Zhang, Pacific Northwest National Laboratory, Richland, WA; and Fereydoon Namavar*, Department of Orthopaedic Surgery and Rehabilitation, University of Nebraska Medical Center, Omaha.

19. RADIATION RESPONSE OF NANOCRYSTALLINE RUTILE (TIO2). Jiaming Zhang* and Rodney C Ewing, Departments of Geological Sciences and Materials Science & Engineering, University of Michigan, Ann Arbor, MI; and Jie Lian, Department of Mechanical, Aerospace & Nuclear Engineering, Rensselaer Polytechnic Institute, Troy, NY; and Fereydoon Namavar*, University of Nebraska Medical Center, Omaha.

20. EXPERIMENTAL STUDIES OF THE GIANT DIELECTRIC CONSTANT MATERIALS CaCu3Ti4O12. Jianjun Liu* and W. N. Mei, Department of Physics; and R. W. Smith, Department of Chemistry, University of Nebraska at Omaha.

21. NEGATIVE MAGNETORESISTANCE IN CHROMIUM CONTAINING DIAMOND LIKE CARBON BASED HETEROSTRUCTURES. J.A. Colón Santana*, A. Sokolov, I. Ketsman, and P.A. Dowben, Department of Physics and Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln; and V. Singh, V. Palshin, and Y.B. Losovyj, Center for Advanced Microstructures and Devices, Louisiana State University, LA; and E.M. Handberg and A.G. Petukhov, Department of Physics, South Dakota School of Mines and Technology, Rapid City, SD.

22. PIEZOELECTRIC TUNING OF EXCHANGE BIAS FROM NEGATIVE TO POSITIVE BIAS FIELDS. Srinivas Polisetty* and Christian Binek, Department of Physics and Astronomy and Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln; and Sarbeswar Sahoo, Seagate Technology, Minneapolis, MN.

23. AGING IN MAGNETIC SUPERLATTICES. T. Mukherjee* and Ch. Binek*, Department of Physics & Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln; and M. Pleimling, Department of Physics, Virginia Polytechnic Institute and State University Blacksburg, VA.

24. MAGNETOCALORIC PROPERTIES OF CO/CR SUPERLATTICES. T. Mukherjee*, R. Skomski, D.J. Sellmyer, and Ch. Binek*, Department of Physics & Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln.

25. MAGNETO-ELASTIC PROPERTIES OF FRUSTRATED TRIANGULAR MAGNETIC STRUCTURE: FLEXOMAGNETIC EFFECT. P.Lukashev* and R. Sabirianov, Department of Physics, University of Nebraska at Omaha.
26. ORDERED-DISORDERED TRANSITION FOR CORRUGATED Au LAYERS. Keisuke Fukutani* and P.A. Dowben, Department of Physics and Astronomy, Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln; and N. Lozova and Yaroslav B. Losovyj, Center for Advanced Microstructure and Devices, Louisiana State University, Baton Rouge, LA; and S.M. Zuber, Institute of Experimental Physics, University of Wroclaw, pl. M. Borna 9, Wroclaw, Poland; and P. Galiy, Electronics Department, Ivan Franko National University of Lviv, 50 Dragomanov Str., 79005 Lviv, Ukraine.

27. BIOCOMPATIBILITY OF ENGINEERED NANOSTRUCTURES. Alexander Rubinstein* and Ali Khoynezhad, Department of Surgery, Creighton University Medical Center, Omaha; and John D. Jackson, Department of Pathology and Microbiology, and J. Graham Sharp, Department of Genetics, Cell Biology and Anatomy, University of Nebraska Medical Center, Omaha; and Renat F. Sabirianov, Department of Physics, University of Nebraska at Omaha; and Fereydoon Namavar, Roxanna M. Namavar, Hani Haider, Edward V. Fehringer, and Kevin L. Garvin, Department of Orthopaedic Surgery and Rehabilitation, University of Nebraska Medical Center, Omaha.

28. DOMAIN SWITCHING DYNAMICS IN THE FERROELECTRIC POLYMERS FILMS STUDIED AT THE NANOSCALE. P. Sharma*, T. Reece, A. Rasmussen, S. Roberts, S. Ducharme, and A. Gruverman, Department of Physics and Astronomy, University of Nebraska–Lincoln.

29. SPIN DENSITY DISTRIBUTION IN SYSTEMS WITH FRUSTRATED TRIANGULAR MAGNETIC STRUCTURE. P. Lukashev* and R. Sabirianov, University of Nebraska at Omaha.

4:48 CLOSING REMARKS

EARTH SCIENCES
Chairperson: Jennifer L. Balmat and Michael B. Leite
Department of Physical and Life Sciences
Chadron State College, Chadron
Olin 224

1:30 p.m. OPENING REMARKS

1:35 1. CONCRETIONS IN NEBRASKA SANDSTONES PROVIDE CLUES TO THE HISTORY OF UTAH’S NAVAJO AQUIFER. David B. Loope*, Richard M. Kettler, and Karrie A. Weber, Department of Geosciences, University of Nebraska–Lincoln.

1:50 2. EVIDENCE OF A LATE PALEOZOIC FAUNAL KILL IN THE HUGHES CREEK SHALE MEMBER, FORAKER FORMATION (LATE PENNSYLVANIAN?/EARLY PERMIAN?) IN SOUTH-EASTERN NEBRASKA. Roger K. Pabian* and Robert F. Diffendal, Jr., Conservation and Survey Division, School of Natural Resources, University of Nebraska–Lincoln.
3. IDENTIFICATION OF SUBTLE STRUCTURAL FEATURES IN THE BLACK HILLS-PINE RIDGE REGION, NEBRASKA-SOUTH DAKOTA, USA. Jennifer L. Balmat*, Michael B. Leite, and Joseph Reedy, Department of Physical and Life Sciences, Chadron State College, Chadron.

4. AN ANALYSIS OF DROUGHT IMPACTS IN KENTUCKY. Crystal J. Bergman, School of Natural Resources, University of Nebraska–Lincoln.

5. CONTROLS ON GEOMORPHOLOGY OF STREAMS FLOWING OFF THE PINE RIDGE, NORTHWESTERN NEBRASKA. Kodi Young* and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.

6. ASSESSING THE FEASIBILITY OF MONITORING NITRATES AND PHOSPHATES IN CHADRON CREEK, NORTHWESTERN NEBRASKA. Alula Mazengia, Department of Physical and Life Sciences, Chadron State College, Chadron.

7. DETERMINING THE PATHWAYS OF CALCIUM IONS BY EXAMINING NATURALLY OCCURRING HOT SPRINGS OF THE FALL RIVER, HOT SPRINGS, SD. Cole Vejraska* and Benjamin Puffer, Chemistry Department, Chadron State College, Chadron.

8. WAVELET INSPIRED ANALYSIS OF DISCRETE ATMOSPHERIC DATA. Grant Saltzgaber*, Michael L. Larsen, and Aaron Clark, Department of Physics, University of Nebraska at Kearney.

9. DIRECT IMAGING OF RAINDROP IMPACTS. Josh Beck*, Michael L. Larsen, and Aaron Clark, Department of Physics, University of Nebraska at Kearney.

10. FILTER PAPER BASED DISDROMETER. Ben Fullerton* and Michael L. Larsen, Department of Physics, University of Nebraska at Kearney.

11. AFFORDABLE WAYS OF MEASURING RAIN ONE DROP AT A TIME. Michael L. Larsen, Department of Physics, University of Nebraska at Kearney.

12. DEVELOPMENT OF AN ACOUSTICAL RAINDROP DISDROMETER. Kyle A. McClary and Michael L. Larsen, Department of Physics, University of Nebraska at Kearney.

CLOSING REMARKS and SECTION MEETING
HISTORY/PHILOSOPHY OF SCIENCE
Chairperson: Claire M. Oswald
College of Saint Mary, Omaha
Olin 325

8:30 a.m.  1.  THE HISTORY OF THE DEVELOPMENT OF THE THEORY OF EVOLUTION: THE
THEOLOGICAL AND SCIENTIFIC UNDERPINNINGS, Claire M. Oswald,
Department of Biology, College of Saint Mary, Omaha.

8:50  2.  DID INDUCTION AND EMPIRICISM PLAY A ROLE IN DARWIN’S
DEVELOPMENT OF HIS THEORY OF NATURAL SELELCTION?  Claire M.
Oswald, Department of Biology, College of Saint Mary, Omaha.

9:10  SECTION BUSINESS MEETING

TEACHING OF SCIENCE AND MATH
Chairperson: Julia Polak
Exeter-Milligan Public Schools, Exeter
Olin 325

9:30  1.  DETERMINING THE NITRATE, ARSENIC AND ATRAZINE LEVELS ALONG
THE PLATTE AND REPUBLICAN RIVERS.  Randall Lienemann*, Franklin Public
School, Franklin; and Mike Zarate, Lexington Public School, Lexington.

9:50  2.  PUSHING ARROWS:  THE STEPWISE DEVELOPMENT OF ARROW PUSHING
SKILLS.  Josh Yost* and David Peitz, Department of Physical Science and Mathematics,
Wayne State College, Wayne.

10:10  3.  USING MOLECULAR ORBITALS TO ILLUSTRATE AND UNDERSTAND
ORGANIC REACTIONS.  David Peitz, Department of Physical Science and Mathematics,
Wayne State College, Wayne.

10:30  4.  ENHANCING LABORATORY SAFETY INSTRUCTION:  INTRODUCING MSDS
SHEETS INTO THE FRESHMAN LABORATORY.  Kendra Timm* and M. L. Ettel,
Department of Physical Sciences and Mathematics, Wayne State College, Wayne.

MAIBEN MEMORIAL LECTURE - OLIN LH - B
8:00 a.m. 1. INDIRECT TREE RECRUITMENT BY SMALL MAMMALS AS SIGNIFICANT DISPERSERS OF SWARTZIA CUBENSIS AND DIALIUM GUIANENSE SEEDS IN A NEOTROPIC FOREST. Eric A. Noel*, Department of Biology, Nebraska Wesleyan University, Lincoln; and B.R. McMillan, Department of Plant and Wildlife Sciences, Brigham Young University, Provo, UT; and J.A. Yunger, Department of Biological and Environmental Sciences, Governors State University, University Park, IL.

8:12 2. A YEAR LONG VIEW OF THE SEASONAL AND DIEL PRESENCE OF HUMPBACK WHALES IN THE ANTARCTIC. Taryn L. Overton*, Department of Biology, Nebraska Wesleyan University, Lincoln; and S.V. Parijs, Protected Species Branch, Northeast Fisheries Science Center, Woods Hole, MA; and I.V. Opzeeland, Ocean Acoustic, Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany.

8:24 3. THE ISOLATION AND ANALYSIS OF QUORUM SENSING MOLECULES IN MYCOBACTERIUM SMEGMATIS (TREVISAN) LEHMANN & NEUMANN. Bailey A. Maresh*, J. Harden, F. Iseka, and A. McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln; and J.D. Cirillo, Texas A&M University, College Station, TX.

8:36 4. IDENTIFYING GENES THAT FUNCTION IN QUORUM SENSING, A TYPE OF CELL-TO-CELL COMMUNICATION, IN MYCOBACTERIUM SMEGMATIS (TREVISAN) LEHMANN & NEUMANN. Kirsten L. Foster*, P.J. Aylward, and A. McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln; and J. Cirillo, College of Medicine, Texas A & M University, College Station, TX.

8:48 5. IN VITRO MECHANISM FOR THE INTERNALIZATION OF SUPERPARAMAGNETIC IRON-OXIDE NANOPARTICLES BY MONOCYTE-MACROPHAGES. Christopher L. Anderson*, Department of Biology, Nebraska Wesleyan University, Lincoln, NE; and A. Beduneau, C. B. Grotepas, H. Dou, and H. E. Gendelman, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.

9:00 6. THE DEVELOPMENT OF SILAC TO ELUCIDATE PHENOTYPIC CHANGES OCCurring DURING MACROPHAGE DIFFERENTIATION. Andrew R. Stothert* and D. Benham, Department of Biology, Nebraska Wesleyan University, Lincoln; and S. Kraft-Terry, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.
9:12  7. ETHANOL-ELICITED PROTEASOME INHIBITION AFTER CYTOCHROME P450 2E1 INDUCTION IN HEPATOMA CELLS. Alyssa A. Sickel*, Department of Biology, Nebraska Wesleyan University, Lincoln; and T.M. Donohue, Jr., Liver Study Unit, Omaha VA Medical Center, Omaha.

9:24  BREAK

9:36  8. MODULATION OF BACTERIAL BIOFILM FORMATION BY SPECIFIC AND NONSPECIFIC ANTIBODIES. Dane Bowder* and Barbara J. Clement, Department of Biology, Doane College, Crete.


10:00 10. A COMPARISON OF RANGE-OF-MOTION RECOVERY FOLLOWING ANTERIOR CRUCIATE LIGAMENT REPAIR WITH TWO GRAFT TYPES. Brett Cribelli* and Kate Marley, Department of Biology, Doane College, Crete.

10:12 11. DEVELOPMENT OF AN IN VITRO MODEL TO INVESTIGATE COMMUNICATION BETWEEN RESPIRATORY EPITHELIAL CELLS AND ANTGEN PRESENTING CELLS. Brian M. Robinson* and T.M. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.

10:24 12. EXPLORATION OF INNATE IMMUNE RESPONSES OF RESPIRATORY EPITHELIAL CELLS IN VITRO. Nathan Persell* and T.M. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.

10:36 13. INHIBITION OF BOVINE LEUKEMIA VIRUS mRNA EXPRESSION BY A COMBINATION OF RIBAVIRIN AND INTERFERON. Meghen L. Friesen*, and J. Isaacson, Nebraska Wesleyan University, Lincoln; and J. Reddy and C. Wood, Nebraska Center for Virology, University of Nebraska–Lincoln.

11:00 MAIBEN MEMORIAL LECTURE, OLIN LH-B

12:00 LUNCH

1:00 p.m. 14. KINETIC ASSESSMENT OF *STAPHYLOCOCCUS AUREUS* BIOFILM MATRIX GROWTH. Ian Engebretsen*, Department of Life Sciences, Wayne State College, Wayne; and Tammy Kielian, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha.

1:12  15. USE OF *LISTERIA MONOCYTOGENES* INLB AS A POSSIBLE DRUG DELIVERY SYSTEM. Derek Moormeier*, Shawn Pearcy and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.
16. USE OF *LISTERIA MONOCYTOGENES* INLC AS A POSSIBLE COMPONENT IN A DRUG DELIVERY SYSTEM. David Seger* and Doug Christensen. Department of Life Sciences, Wayne State College, Wayne.

17. MINIMALLY TRANSFORMED HUMAN EMBRYONIC PALATAL MESENCHYME (HEPM) CELLS EXPRESS N-CADHERIN. Anthony Bieck*, Sarah Merithew*, and K. Marley, Department of Biology, Doane College, Crete.

18. STEPWISE CLONING AND EVALUATION OF FRAGMENTS OF THE HUMAN N-CADHERIN PROMOTER. Kelsey Bryant*, Nicole Williams*, and K. Marley, Department of Biology, Doane College, Crete.

19. THE N-CADHERIN PROMOTER IS METHYLATED IN HUMAN BT-20 BREAST CANCER CELLS. Conner Christensen*, Sarah Pracht*, and K. Marley, Department of Biology, Doane College, Crete.

20. PROTEASES IN ENVIRONMENTAL DUST INDUCE AIRWAY EPITHELIAL INFLAMMATORY MEDIATORS. Chelsea P. Dean*, College of Saint Mary, Omaha; and A.J. Heires23, P. Dodmane4, M. Toews1, and D.J. Romberger23, Pulmonary, Critical Care, Sleep and Allergy Section2 and Pharmacology and Experimental Neuroscience Department4, University of Nebraska Medical Center, and Veteran’s Affairs Medical Center1, Omaha.

21. STRESS-INDUCED DIET CHANGES CAUSES WEIGHT GAIN IN MICE. Leanna J. Kalvelage, Department of Biology, Dana College, Blair.

22. AMERICAN PIKA (*OCHOTONA PRINCEPS*) SURVEY IN GLACIER NATIONAL PARK AND ITS RELATIONSHIP TO GLOBAL WARMING. Mason Lantz*, Department of Biology, Dana College, Blair; and Lucas Moyer-Horner, Gavin Jones, and John Stuhler, Department of Zoology, University of Wisconsin-Madison, Madison, WI.

23. THE EFFECT OF THE PRESUMPTIVE BLOOD-TEST REAGENT, FLUORESCIN, ON THE RECOVERY OF DNA. Abby S. Krueger, Department of Biology, Nebraska Wesleyan University, Lincoln.

24. THE EFFECTS OF DIFFERENT SHIPPING TEMPERATURES AND STORAGE TIMES ON THE DETECTION OF *TRITRICHOMONAS FOETUS* BY PCR. Laura J. Welch*, Department of Biology, Nebraska Wesleyan University, Lincoln; and D.R. Smith, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln.

25. Δ-9 TETRAHYDROCANNABINOL CONCENTRATION OF HEMP (*CANNABIS SATIVA* L.) IN LANCASTER COUNTY, NEBRASKA. Douglas A. Bauer, Department of Biology, Nebraska Wesleyan University, Lincoln.
1:00 p.m  1. PREDATOR RISK ASSESSMENT FOR THREE LEVELS OF THREATENING APPROACHES IN THE BLACK TAILED PRAIRIE DOG (*Cynomys ludovicianus* (Ord, 1815)). Chase B. Edwards, Department of Biology, Nebraska Wesleyan University, Lincoln.

1:12  2. EFFECTS OF VARYING LEVELS OF NITROGEN APPLICATION ON CORN YIELDS. Evan D. Janzen, Department of Biology, Nebraska Wesleyan University, Lincoln.

1:24  3. THE EFFECT OF HUMAN DISTURBANCE ON THE FORAGING BEHAVIOR OF PIPING PLOVERS (*Charadrius melodus* (Ord, 1824)) AND SANDERLINGS (*Calidris alba* (Pallas, 1764)). Logan McGuffey, Department of Biology, Nebraska Wesleyan University, Lincoln.

1:36  4. THE EFFECTS OF BLACK AND CLEAR PLASTIC MULCH ON SOIL TEMPERATURE, PREVENTION OF WEEDS, AND YIELD OF NORTH AMERICAN CANTALOUPE (*Cucumis melo* L. var. *reticulatus* (Naudin)). Samuel L. Thomsen, Department of Biology, Nebraska Wesleyan University, Lincoln.

1:48  5. A COMPARISON OF EXTRACTION TECHNIQUES FOR ISOLATING BIOLOGICALLY ACTIVE QUORUM SENSING MOLECULES FROM *Mycobacterium smegmatis*. Jessica J. Harden*, B.A. Maresh, F. Iseka, and A. McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln; and J.D. Cirillo, College of Medicine, Texas A&M University, College Station, TX.

2:00  6. SCREENING AN OVER-EXPRESSION *Mycobacterium smegmatis* LIBRARY TO DETERMINE THE GENE(S) INVOLVED IN QUORUM SENSING. Erica L. Thiel* and A. McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln; and J.D. Cirillo, College of Medicine, Texas A&M University, College Station, TX.


2:24  BREAK
8. GENETIC VARIATION IN FLUORESCENT PSEUDOMONAD *P* *l* *i* *d* IN RHIZOPHERIC POPULATIONS OBTAINED FROM WHEAT AND SORGHUM SOIL AT THE HAVELOCK AREA OF LINCOLN, NEBRASKA. Alexander D. Bednar*, Department of Biology, Nebraska Wesleyan University, Lincoln; and D. Funnell-Harris, USDA-ARS, Grain, Forage, and Bioenergy Research, University of Nebraska, Department of Plant Pathology, Lincoln.

9. CHARACTERIZATION OF SET DOMAIN PROTEINS FROM AN ALGAE AND A BACTERIUM. John R. Eisenhart*, Department of Biology, Nebraska Wesleyan University, Lincoln; and K. van Dijk and H. Cerutti, School of Biological Sciences, University of Nebraska–Lincoln.

10. CHEMICAL EFFECTS ON REPRODUCTIVE STRATEGIES OF SOYBEAN CYST NEMATODE (*HETERODERA GLYCINES*) IN FIELD CONDITIONS. Matthew A. Hagge*, Department of Biology, Nebraska Wesleyan University, Lincoln; and J.L. Behn and T.A. Jackson, College of Agricultural Sciences and Natural Resources, University of Nebraska–Lincoln.

11. SURVIVAL OF *CANDIDA ALBICANS* ON COPPER ALLOY METALLIC SURFACES. Travis M. Krans, Department of Biology, Nebraska Wesleyan University, Lincoln.

12. THE ROLE OF FEOB IN LOW AFFINITY MANGANESE TRANSPORT IN *SYNECHOCYSTIS* SP. PCC 6803. Erin Kubicek, Department of Biology, Nebraska Wesleyan University, Lincoln.

13. SOIL MICROBIAL COUNTS AS AFFECTED BY DECOMPOSITION OF PIGLETS. Angelia J. Francis and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha.

**COLLEGIATE ACADEMY**

**CHEMISTRY AND PHYSICS**

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

**SESSION A**

Session Chairperson, David Treichel
Olin 324

8:00 a.m. 1. DETECHIP® 2.0: AN ENHANCED MOLECULAR SENSOR ARRAY FOR DRUGS AND THEIR CUTTING AGENTS. Jordan Beaber*, J. Francis, J. Groathouse, M.V. Wilson, K.A. Lucas, and A.E. Holmes, Department of Chemistry, Doane College, Crete.

8:12 2. DEVELOPMENT OF AN ASSAY TO DETECT AND QUANTITATE ATRAZINE IN SOIL. Charles Cohlmia* and Eric J. Haas, Department of Chemistry, Creighton University, Omaha.

8:24 3. SYNTHESIS AND ENZYME INHIBITION STUDIES OF MULTIDENTATE RU(II) ORGANOMETALLIC COMPLEXES. David J. Jung* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
4. GENERAL SYNTHESIS AND ATOM-PROBE MAPPING OF RARE EARTH HEXABORIDE NANOWIRES. Joseph R. Brewer*, Robert Jacobberger, and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln.

5. PROBING BIOMINERALIZATION USING A NOVEL DOUBLE DIFFUSION GEL SYSTEM. Garrett Paulman*, E. Doane, K. Troxel, M.W. Plano Clark, M. Wilson, and E. Wilson, Department of Chemistry, Doane College, Crete.

6. DETERMINATION OF CAFFEINE AND TAURINE IN ENERGY DRINKS USING REVERSED PHASE CHROMATOGRAPHY. Jared Loschen* and Annette C. Moser, University of Nebraska at Kearney.

7. EXTRACTION OF DENTIN PHOSPHOPHORYN FROM BOVINE FEMUR. Elizabeth T. Doane*, Mark V. Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete.


9. MULTI-STEP ONE-POT CLICK REACTIONS OF ‘FAST’ DYE DIAZONIUM SALTS. Jacqueline E. Reilly* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

10. DEVELOPMENT OF A CHROMATOGRAPHIC IMMUNOASSAY TO DETERMINE THE CONCENTRATION OF VIRGINIAMYCIN IN WATER SAMPLES. Taylor Carlson* and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney.

11. SECONDARY STRUCTURE OF OSTEOPONTIN-BASED PEPTIDES CHANGE UPON ADSORPTION TO HYDROXYAPATITE. Crystal Vander Zanden*, M.V. Wilson, E. Wilson, Department of Chemistry, Doane College, Crete.


11:00 MAIBEN MEMORIAL LECTURE - OLIN LH - B
1:00 p.m. 14. ULTRA PERIPHERAL COLLISIONS AND THE TIME OF FLIGHT DETECTOR AT RHIC. Mark Ridder*, Jarrod K. Bang* and J. Seger, Department of Physics, Creighton University, Omaha.

1:12 15. OBSERVATIONS OF THE FRESNEL AND ARAGO LAWS USING A MACH-ZEHNDER INTERFEROMETER. Kayla Peltz, Physics Department, Hastings College, Hastings.

1:24 16. USING TWO-PHOTON EXCITED FLUORESCENCE INTENSITY AND LIFETIME-BASED NADH IMAGING TO INVESTIGATE THE EMT6 CELL LINE. Clifford S. Hecht* and Michael G. Nichols, Department of Physics, Creighton University, Omaha.

1:36 17. MEASURING ION FLIGHT TIMES USING AN EMBEDDED REAL TIME CONTROLLER. Nathan B. Clayburn* and D. R. Sieglaff, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln.

1:48 18. IN SEARCH OF THE PHI-MESON. Steven D. Pillen* and J. Duckworth*, Department of Physics, Creighton University, Omaha.

2:00 19. THE DOPPLER EFFECT USING THE METHOD OF IMAGES. Tyler Bartsch, Physics Department, Hastings College, Hastings.

2:12 20. CELL ELASTICITY DETERMINATION BY STATIC AND DYNAMIC OPTICAL STRETCHING. Anya Burkart* and Michael G. Nichols, Physics Department, Creighton University, Omaha.

2:30 BREAK

2:48 22. SYNTHESES OF DIARYLALKYNE-CONJUGATED PEPTIDES FOR CHEMOSENSING APPLICATIONS. Douglas E. Deever* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

3:00 23. LEFT-HANDED Z-DNA: A STRUCTURAL MOTIF THAT IS RECOGNIZED BY A CYANINE DYE. Jacob Francis*, M.V. Wilson, A. Draney, M. Guericke, H. Chu, D. Nott, J. Groathouse, J. Beaber, H. Barcena, K. Lucas, and A.E. Holmes, Department of Chemistry, Doane College, Crete; and A. D’Urso, M. Balaz, Department of Chemistry, University of Wyoming, Laramie, WY; and M.F. Rouhier, Department of Chemistry and Biochemistry, Miami University, Oxford, OH; and R. Purello, Dipartimento di Scienze Chimiche, University of Catania, Catania, Italy.

3:12 24. UNDERSTANDING ANTIBIOTIC RESISTANCE. Kassandra Connell*, April Wylie and David Peitz, Department of Physical Science and Mathematics; and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.

3:24 25. OPTIMIZATION OF EXTRACTION OF BONE NONCOLLAGENOUS MATRIX PROTEINS FROM PORCINE FEMUR. Alicia Exstrom*, Morgan Martin*, Elizabeth Doane, Mark V. Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete.

3:36 26. SYNTHESIS OF PYRENE-BASED METAL CATION CHEMOSENSORS USING CLICK REACTIONS. Thomas W. Whetstone* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

JUNIOR ACADEMY OF SCIENCES
Aurietha Hoesing, NJAS President, Omaha

8:30 – 9:00 a.m. Judges Check-In, Olin 219
8:30 – 9:00 Senior High Registration and Set Up Project Displays, Olin Hall Lobby
9:00 – 12:00 Senior High Competition (preliminary), Olin 124, Olin 131

12:00 – 1:00 p.m. LUNCH BREAK, Senior High, Story Student Center
1:00 – 1:30 Judges Check-In, Olin 219
1:00 – 1:30 Junior High Registration and Set Up Project Displays
1:00 – 4:30 Senior High Competition (Final), Olin 110
1:30 – 4:30 Junior High Competition, Olin 124, Olin 131

2:00 – 3:30 NJAS Board/Teacher Meeting, Olin 219
5:00 – 5:30 General Awards Presentations – Callen Conference Center

5:45 – 6:30 SOCIAL HOUR – First United Methodist Church
2723 N 50th Street, Lincoln, NE

6:30 – 8:30 BANQUET and AWARDS CEREMONY
First United Methodist Church
2723 N 50th Street, Lincoln, NE
EFFECTIVENESS OF ULTRAVIOLET SANITIZING
Ashley Belmudez-Frakes, P. Higley and B. Mauck, Department of Biology, College of Saint Mary, Omaha, NE 68106

NASA is concerned with bio-contamination during trips to the moon, Mars and beyond. Bacteria have been found that are capable of withstanding higher doses of ultraviolet (UV) radiation than most bacteria. This study documents the effectiveness of UV sanitizers on toothbrushes. The presence of both pathogenic and nonpathogenic bacteria has been documented in bathrooms and numerous articles espouse cleaning toothbrushes in a bleach solution. Because of this increased awareness of potentially dangerous bacteria in the bathroom, a relatively new product is being marketed: the UV toothbrush sanitizer. The objective of this project is to document the effectiveness of UV sanitizer. Toothbrushes were treated with known concentrations of bacteria, treated with a UV sanitizer, and sampled using dilution plating techniques to determine the effectiveness of the UV sanitizer. Bacteria known to be found in bathrooms and natural mouth flora were studied.

THE EFFECT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE ON GAIT
Jennifer M. Yentes, and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Astronauts suffer from oxidative stress leading to extreme muscle wasting and weakness from unloading and disuse during spaceflight similar to patients with chronic obstructive pulmonary disorder (COPD). It is possible to identify specific changes regarding skeletal muscle performance through biomechanical gait analysis. Five patients with COPD (age: 67.2 ± 6.8 years; gait speed: 1.01 ± 0.04 m/s) and 12 aged-matched controls (age: 68.3 ± 4.8 years; gait speed: 1.02 ± 0.15 m/s) underwent gait analysis. Patients with COPD demonstrated significantly decreased peak knee extensor torque in early stance (p = 0.046), significantly increased peak hip extensor torque in early stance (p < 0.001), and significantly increased hip power absorption in mid-stance (p = 0.046). These preliminary data are the first to demonstrate that patients with COPD possibly use a different strategy to ambulate by altering the distribution of joint torques in early stance to brake forward momentum and diminishing the ability of the hip flexors to eccentrically support the trunk during mid to late stance. COPD patients could be used as a model for exploring the effect of oxidative stress in astronauts returning from space.

DESIGN OF EXTERNALLY POWERED ANKLE-FOOT-ORTHOSIS FOR POST FLIGHT RECOVERY
Shane Wurdeman, Department of Environmental, Agricultural, and Occupational Health, University of Nebraska Medical Center, Omaha, NE 68198; and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Current literature reports that the calf muscles in astronauts returning from space have decreased force output, with more dramatic deterioration seen as flight time increases. The rehabilitation that is needed to strengthen calf muscles after returning from microgravity is long and burdensome, taking up to two months before full recovery of muscle strength. As the duration of missions increases so too will the rehab time and cost. The purpose of the proposed research is to build a wireless device which can be
used for post-flight recovery while encouraging continued activities of daily living. It will be powered by a battery worn at the waist. An electromagnet will work in series with springs to generate the force needed at the end of stance phase to help propel the subject forward. The device will offer a method of post-flight recovery that will encourage continued activities of daily living.

**LANTHANUM HEXABORIDE NANOSTRUCTURES AS COLD FIELD EMISSION CATHODES**

Robert Jacobberger, Joseph Brewer, and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln, NE 68588; and Fereydoon Namavar, Department of Orthopaedic Surgery and Rehabilitation, University of Nebraska Medical Center, Omaha, NE 68198

In space exploration, cold field emission devices are important alternatives to solid-state devices because of their immunity to the damaging effects on charge transport caused by cosmic rays and radiation. One-dimensional lanthanum hexaboride (LaB$_6$) nanostructures are desirable components for durable effect field enhanced emitters in cold field emission devices because of their refractory nature, low work function, and shape-enhanced electric field. We developed a chemical vapor deposition technique to synthesize LaB$_6$ nanostructures on conductive ZrN/Si substrates via the vapor-liquid-solid growth mechanism. These highly [100] oriented, single crystalline nanostructures have high aspect ratios and small, reproducible tip diameters. Field emission data of these nanostructures was obtained and used to determine the turn-on voltage, current density, and field enhancement factor of these materials. The effects of nanostructure geometry, array density, and cathode-to-anode distance on the field emission properties of these nanostructures will be discussed.

**USE OF NATURAL ANTIOXIDANTS TO PREVENT THE DEGRADATION OF OILS AND FORMATION OF TOXIC REACTIVE ALDEHYDE PRODUCTS**

Jami L. Mitchell and Ganesh Naik, Department of Arts and Sciences, College of Saint Mary, Omaha, NE 68106

This research is based on prevention of degradation of oils during the frying process. The oils undergo lipid peroxidation process during frying and oxidation in the oil can be inhibited by addition of antioxidants. I am using natural antioxidants to prevent the degradation of oils and formation of toxic reactive aldehyde products such as 4-Hydroxynonenal and malonaldehyde. These aldehydes are the carbonyl compounds that are formed by the decomposition of hydroperoxides. This research provides data on lipid peroxidation levels in french fries prepared in different cooking oils. The degradation of oils was monitored by $p$-anisidine values assay which is to determine the amount of reactive aldehydes present. In addition, an HPLC analysis method has been used to monitor levels of lipid peroxidation products formed during degradation of oils.

**MANNOSITE 6-PHOSPHATE/INSULIN-LIKE GROWTH FACTOR II RECEPTOR DIMERIZATION INTERACTIONS**

Jenna Allison, Joseph Wheeler, and Jodi Kreiling, Department of Chemistry, University of Nebraska at Omaha, NE 68182

The mannose 6-phosphate/insulin-like growth factor II receptor (M6P/IGF2R) is a growth/tumor suppressing protein capable of protein dimerization. This protein consists of 15 similar domains that form five triplet repeats. Prior research indicates the protein contains several interaction sites. To test the importance of specific domains on dimerization, our goal is to see if the triplet containing domains 7-9 is able to interact with all five M6P/IGF2R triplets. The hypothesis is that association between two triplets will be stronger for identical domains and/or domains sharing common function. The triplet proteins
were co-expressed by cellular transfection using lysates from Human Embryonic Kidney 293A cells. ImmunobLOTS were performed to test protein expression, followed by immunoprecipitation assays to test interaction strength between two triplets. The results indicate that 7-9 stably associates with all five triplets, suggesting that the M6P/IGF2R does not require alignment of identical domains to form protein dimers.

SURGICAL ROBOTS FOR MINIMALLY INVASIVE SURGERY
Tom Frederick, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68508

Robotics is an ever-growing field that in recent years has continued to branch out, finding new applications for this technology. One such field is healthcare, specifically surgery. This application is being researched in order to provide assistance to surgeons so that the negative affects upon a patient due to extended surgeries and hospital stays can be limited. The current robot has made great strides forward in making this a reality, but it has a few limitations. One of these limitations is its size. The robot is just too big at the moment to work effectively. This size issue is due largely to the size of the motors. In an attempt to solve this, the drive train of certain joints is being reconfigured to make the effective limb length shorter. The goal of this is to make the effective workspace of the robot something that could be used in a patient.

A FOUR-DOF MODULAR SELF-RECONFIGURABLE ROBOT
Khoa D. Chu and Carl A. Nelson, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68508

One of the primary frontiers for modern exploration involves planetary and lunar environments. Exploration in these unstructured environments can involve many different types of tasks. Modular Self-Reconfigurable Robots (MSRs) would be beneficial for completing these dynamically assigned tasks, having the ability to complete multiple assigned functions. Since payload is a critical concern for deployment in space, a lighter and more dexterous MSR is desirable. This research focuses on the design of a robot with these qualities. A chain-type modular robot with four degrees of freedom per module has been built with the goal of reducing occupied payload while increasing kinematic capabilities. Kinematic equations were derived to analyze the available workspace provided by the robot. A specialized transmission was incorporated to increase dexterity while maintaining low weight. Locomotion gaits using this robot design were also investigated.

RFID IN SPACE: EXPLORING THE FEASIBILITY AND PERFORMANCE OF GEN 2 TAGS AS A MEANS OF TRACKING EQUIPMENT, SUPPLIES, AND CONSUMABLE PRODUCTS IN CARGO TRANSPORT BAGS ONBOARD A SPACE VEHICLE OR HABITAT
Maurice D. Cavitt and Eric Jones, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln, NE 68508

Current inventory management techniques for consumables and supplies aboard space vehicles are burdensome and time consuming. The inaccuracy of reading barcodes and the excessive time required would be better spent performing scientific experiments. Radio Frequency Identification (RFID) has the potential to create a more effective and user-friendly inventory management system (IMS). A Design for Six Sigma Research (DFSS-R) methodology is introduced that allows for reliability testing of commercially available RFID technology. The results are compared to NASA requirements to evaluate the feasibility of using passive Generation 2 RFID technology to improve inventory control aboard crew exploration vehicles.
DISCONTINUOUS GALERKIN METHOD
Bryan Johnson, Department of Mathematics, University of Nebraska at Omaha, NE 68182

Conservation laws constitute very powerful and important models for physical phenomena which have many important applications in science and engineering. They often have discontinuous solutions, making standard numerical methods either very inefficient or impossible to use. An active research direction now is the search for a more robust and high order methods. The Discontinuous Galerkin Method can be used to efficiently and accurately compute solutions to this class of partial differential equations. The method has recently found rapid applications in such diverse areas such as aeroacoustics, electromagnetism, gas dynamics, meteorology, oceanography, turbulent flow and weather forecasting. This paper includes a general overview of the method, several basic examples, and a discussion of applications.

DEVELOPING COATED TOOLS FOR MICRO ELECTROCHEMICAL MACHINING PROCESS
Ajay K. Swain and Kamlakar P. Rajurkar, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln, NE 68508; and Murali M. Sundaram, Department of Dynamic Systems, University of Cincinnati, OH 45221

Coating of tools with appropriate materials in general, enhances the tool performance. This research focuses on the development of nickel coated tungsten micro electrodes for micro electrochemical machining process (micro ECM) which is used in aerospace and medical device manufacturing. Tungsten possesses several properties that are desired in an ECM tool material. Corrosion resistance of these tools can be enhanced by Nickel coating. This paper reports results of the experimental study of pulse electroplating of Nickel on micro tungsten electrodes. The effect of pulse parameters such as duty cycle, current density, pulse frequency, and real time on the thickness, surface roughness, grain size and chemical composition of the coating was analyzed. The coated tool with optimized parameters was used for micro ECM experiments and results indicate that coating could be a viable technique to improve the properties of the tungsten micro electrode as well as the quality of the machined surface in micro ECM.

QUADRATIC SOLUTIONS TO $x^4+y^4=m^2z^4$
Melissa Emory, Department of Mathematics, University of Nebraska at Omaha, NE 68182

The Austrian mathematician Alexander Aigner proved in 1934 that there are no nontrivial quadratic solutions to the Fermat equation, $x^4+y^4=z^4$, except in $\mathbb{Q}(\sqrt{-7})$. This result was reproved in 1960 by the famous Russian mathematician D. K. Faddeev and simplified in 1969 by the British/American mathematician L. J. Mordell. This talk discusses work to extend Aigner’s result to beyond the case $m=1$ and has applications in cryptography.

MATERIAL PROPERTIES OF COMPOSITE PATCH
Joan Yule, Shijia Zhao, Ananth Ram Mahanth Kasavajhala, and Linxia Gu, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68522

A repair method using composite patches to reinforce the cracked structure has been proven to be effective in an aging aircraft due to the patches’ high stiffness, high strength, light weight, resistance to corrosion, and directional dependence of the material properties. In this work, multiple composite
patches are tested under controlled static and fatigue cyclic loadings. The complicated strain distribution on the cracked composite patch will be recorded using two high-speed cameras. The stress-strain relationship and S-N diagram are obtained for each patch with and without crack. These data will be used for the computational modeling of cracked structure repair.

GREEN TECHNOLOGIES FOR PAVEMENT SURFACE ICING CONTROL IN COLD CLIMATES

Paul Downey, Department of Electrical Engineering, University of Nebraska–Lincoln, NE 68588

With this project, I hope to develop a robust, safe, and green technology that employs electrical power and conductive concrete for deicing surface pavement in cold climate regions. Electrical currents through conductive concrete generate the heat that would melt the ice and snow on top of the concrete pavement. Traditionally, removing ice from pavement with the use of road salts and deicing chemicals is cost effective but causes environmental pollution in waterways, damage to concrete and corrosion of reinforcing steel and motor vehicles. The damage to concrete and rebar has become a major concern to transportation and public works officials due to rapid degradation of existing concrete infrastructures. Applying electrical power to conductive concrete for pavement deicing is a green approach, as this technology not only is energy efficient but also environmentally friendly.

I believe that the development of safe conductive concrete could be very useful in many aspects for NASA or the aerospace and aviation industries. The immediate and important application will be to clear snow from the airport runways and taxiways. This would help reduce the need of heavy equipment and chemicals for snow removal. Tragedy due to an icy airfield runway such as recent one at the Midway Airport in Chicago could have been prevented. Similarly, the economic cost to the airlines and the negative impact on traveling public due to the Denver airport shutdown in December 2006 blizzard could have been mitigated. In the farther reaches, this concrete could be used to heat foundations on planetary bases. The concrete could be used as a means to warm the structures on hostile environments, reducing the need of other elements to maintain livable environments.

POLICY’S ROLE IN THE EVOLUTION OF ERROR-TOLERANCE IN NATIONAL AEROSPACE AND SCIENCE ADMINISTRATION (NASA)

Patrick O’Neil and Neil Gabrielson, Department of Aviation, University of Nebraska at Omaha, NE 68182

High reliability organizations (HROs) have shown the ability to operate complex technology in performance of critical public services with little error. O’Neil (2008) analyzed how the FAA’s air traffic function evolved into a highly reliable, low error organization. As part of this research attributes and associated characteristics that identified high reliability policy practices were developed. This project uses the attributes and characteristics developed in O’Neil (2008) to evaluate legislative policy that is currently responsible for directing NASA programs and operations. Use of these attributes and associated identifying characteristics to evaluate NASA policy serve two functions. The first is to evaluate the level of reliability and error-intolerance contained within Legislative NASA policy. Identifying the presence or absence of these attributes characteristics may identify actions that can be taken to improve NASA legislation. The function of this research is to further validate and further refine HRO policy attributes and characteristics to improve the analysis of policy guiding other critical public agencies.
THE EFFECT OF ISCHEMIA ON MUSCULAR STRENGTH
Sara Myers and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Dramatic reductions in muscle strength and mass have been noted during space flights. The development of countermeasures to minimize such losses is essential for astronaut health. However, it is necessary to first understand all potential contributors to muscle strength and mass changes due to weightlessness. Muscle atrophy and strength losses could result from biochemical and structural changes that occur with unloading, however other factors such as decreased blood flow to lower extremity muscles and pooling of fluids in the legs could also be contributing to changes in strength. Thus, the objective of this study was to investigate potential effects of decreased blood flow to the lower extremity muscles on muscular strength. Identifying this relationship will allow us to further understand how changes in muscle function occur during space flight, providing an essential catalyst for developing in-flight and post-flight interventions to counterbalance physiological changes that accompany spaceflight.

BALANCE TRAINING FOR MULTIPLE SCLEROSIS PATIENTS
Jessie Huisinga and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182; and Shane Wurdeman, Department of Environmental, Agricultural and Occupational Health, University of Nebraska Medical Center, Omaha, NE 68198

Previous research has shown that when astronauts and cosmonauts return from space flight, both the peripheral and central neural processes are physiologically and functionally altered leading to postural control deficits. The purpose of this project is to develop a unique training protocol to provide sensory feedback training and improve postural responses to external perturbations. In order to determine whether a sensory feedback training system is successful in improving response to external perturbation, a balance training intervention was designed for MS patients. This clinical population with diagnosed postural control deficits can serve as a model for determining the efficacy of the proposed sensory feedback training protocol. For baseline postural control assessment, the subjects will undergo two balance tests: the Sensory Organization Test (SOT) and the Motor Control Test (MCT). The training protocol involves 3 modules: Sway training, Ramp training, and Waveform training. The training modules were designed to help increase the degrees of freedom utilized by patients to maintain postural control and to allow the patients to respond appropriate to external perturbations.

DIFFERENTIAL GENE REGULATION OF THE icaADBC OPERON IN STAPHYLOCOCCUS EPIDERMIDIS UNDER MICROAEROBIC AND AEROBIC GROWTH CONDITIONS
Erica Colbert and W.P. Jamison, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

Staphylococcus epidermidis is a commensal microorganism found on human skin that is capable of becoming a pathogen under specific conditions. Together, S. epidermidis and its relative, Staphylococcus aureus are the leading cause of nosocomial infections. S. epidermidis, itself, is the number one cause of infections on indwelling medical devices such as catheters. These infections are difficult to treat because of the biofilms the bacteria form that contribute to their resistance to antibiotics. S. epidermidis forms the biofilm by initially attaching to the polymer surface of the medical device. Then, intracellular aggregation begins. S. epidermidis produces a poly-N acetylglucosamine (PNAG) homopolymer that aids in this intracellular aggregation by surrounding and connecting the bacterial cells. This homopolymer is produced via the ica (intracellular adhesion) gene locus. The gene locus
consists of four genes: IcaA, IcaD, IcaB, and IcaC. The current understanding of the icaADBC operon regulation is that it is either regulated by the icaA promoter or indirectly through expression of icaR, a gene located immediately upstream of the icaADBC operon. New preliminary evidence, however, indicates that other promoters may be present within the operon that allow for differential regulation of the genes included in the operon. This differential regulation is of interest because S. epidermidis is exposed to different environmental conditions throughout the course of its lifecycle in association with biofilm formation on indwelling medical devices. During the biofilm stage, the amount of oxygen available to the bacterial cells decreases, creating a microaerobic environment. The biofilm, however, is transient, and the bacteria eventually detach from the biofilm, returning to an aerobic environment. A better understanding of the differential regulation of the icaADBC operon will lead to a better understanding of the regulation involved in the creation of the biofilm and the detachment of S. epidermidis from the biofilm. With this understanding, measures can be developed to prevent S. epidermidis colonization of indwelling medical devices.

DOES EXPOSURE TO HEAVY METALS CORRELATE WITH ANTIBIOTIC RESISTANCE IN BACTERIA?

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Some bacteria are resistant to heavy metals and the resistance gene is typically carried on a plasmid. That plasmid may also carry a gene conferring resistance to antibiotics and antibiotic resistant bacteria are becoming a serious health problem. In the presence of heavy metals or antibiotics the bacterium will need the plasmid to survive and therefore the presence of heavy metals in the environment may provide a selective pressure for the bacterial population to retain the plasmid that also carries antibiotic resistance. This study focuses on microorganisms that were gathered from soil collected in Omaha, NE, where lead contamination has been documented. Bacteria resistant to lead were then tested for resistance to multiple antibiotics.

AERONAUTICS AND SPACE SCIENCE

SESSION B

ENHANCING INTRODUCTORY COURSES WITH HANDS-ON PROJECTS

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

The “Enhancing Introductory Courses with Hands-on Projects” grant is utilizing robot kits to give students hands-on experiences with building and programming robots. These kits were purchased from UNL’s Computer and Electronics Engineering Department, which is located at the Peter Kiewit Institute in Omaha. Students learn how to solder (and de-solder) components to circuit boards and assemble robots. Once a robot is built, they may have an opportunity to learn basic troubleshooting skills if the robot had been improperly soldered or poorly assembled. Students learn how to identify hardware and electronic components. The robot comes with a control program, written in C, which contains essential code for basic operations. Students can modify the code to extend the capabilities of the robot. Lesson plans will be developed to help engineering students measure and understand basic energy principles.
COMMUNITY ACTION PARTNERSHIP OF WESTERN NEBRASKA INFORMATION TECHNOLOGY INTERNSHIP

Jason Hamilton, Division of Business and Information Technology, Western Nebraska Community College, Scottsbluff, NE 69361

I gained knowledge of the infrastructure of an information technology department in a non-profit world. Being non-profit, there is a great limitation on the funding of technologies. I knew that their computer technologies would be aging and tougher to work on. CAPWN has a server infrastructure, including an email server, file server and various security devices. I worked with firewall and spam filtering technologies. CAPWN has a health clinic and has programs such as dentistry, day care, food pantry, assisted housing, youth services and financial assistance. Working with the technologies through these programs gave me experience with being a personable individual while working on their problem. The majority of projects that occurred involved printers. Almost half of the work requests are printer related making me realize how important it is to troubleshoot a printer problem. Other requests consist of network issues, office programs, computer maintenance and long-term projects such as server installations.

COMPUTERIZED RANKING TASKS FOR INTRODUCTORY ASTRONOMY

Renee Augustyn and Kevin M. Lee, Center for Science, Mathematics, and Computer Education, University of Nebraska–Lincoln, NE 68588

Ranking tasks require students to place graphical icons into some ranked order and have been widely used for several years in physics. Ranking tasks are valued for their capacity to elicit students’ natural ideas regarding physical behaviors which often helps students recognize any misconceptions that they may have. This presentation will describe the development of computer-based ranking tasks in Flash for introductory astronomy focusing on the seasons and gravity concepts. These ranking tasks can conveniently be incorporated into web pages, PowerPoint presentations, and Flash-based delivery. Computer-based delivery offers many advantages over pencil and paper versions such as assigning scores, providing feedback, incorporating instructional materials, and using color and animation in the icons. The capability to randomize the question, ranking criteria, and icons used encourages students to repeat a task until they master the concepts involved.

INTRODUCTORY ASTRONOMY ASTROPHOTOGRAPHY PROJECT

Tom Robinson, Division of Business and Information Technology, Western Nebraska Community College, Scottsbluff, NE 69361

The intent of this project was to get students hands on experience operating computer controlled telescopes and to capture images of deep space objects. The Introductory Astronomy course is offered in the fall each year and usually has a dozen students. This fall was particularly challenging due to weather. The lab time is two hours once each week and the focus of the early labs was to become familiar with the night sky and constellations. The students had learned how to set up, align and observe through the telescope by the end of September but October and most of November was spent indoors. In the end, we were able to capture some images and these along with images captured by the instructor are the focus of a sponsored Fellowship.
SPACE IMAGING RESEARCH
Jonathan Spurgeon, Division of Math and Science, Western Nebraska Community College, Scottsbluff, NE 69361

This astrophotography project uses deep sky imagers to capture celestial objects. Our Bahtinov masks are hand-made and used to aid the telescopes in focusing. Images are then taken in the form of a Flexible Image Transport System (.fts) which contains multi-dimensional arrays of data generated by the photons. These files are stacked and processed using the computer program autostar envisage in order to create original photographs.

DETECTING EXTENDED COSMIC RAY AIR SHOWERS WITH THE CROP NETWORK
Thomas S. McShane, Bjorn Nilsen, Alejandro Echeverri, and Yury Gorbunov, Department of Physics, Creighton University, Omaha, NE 68178; and Lyle A. Sass, Consultant, Mount Michael Academy, Elkhorn, NE 68022

The 2009 Creighton Project was a continuing effort to collect data from the CosmicRay Observatory Project (CROP) Network to show that a school-operated network can provide significant data to detect the interaction of ultra high energy cosmic rays with solar photons. Extensive trips were undertaken to transport equipment and to train high school teachers and students in its use. A one-day workshop was mounted to generate knowledge and enthusiasm for the Fall ’09 data-gathering run. A website was set up and a server was installed so students could enter their data, analyze it and compare their records of events with those of other schools. The 2009 March Run yielded 37 extended showers that were detected by two or more schools.

ELECTRON OPTICAL EXCITATION FUNCTIONS IN METHANE
Riley Howsden, Eric Rybacki, and Kenneth Trantham, Department of Physics and Physical Science, University of Nebraska at Kearney, NE 68845

Spin polarized electron collisions with organic molecules are of interest in understanding the origins of biological homo-chirality. This work will look for spin dependent electron interactions with methane, a common gas in pre-biotic atmospheres. A low energy, spin polarized electron scattering apparatus is presently being constructed and tested. This will examine the correlation between the polarization of emitted fluorescence, due to collisional excitation, and spin of the incident electron. As an initial and early measurement for the apparatus we will present optical excitation functions in methane; that is, looking at fluorescence intensity of visible hydrogen wavelengths as a function of incident electron kinetic energy.

INVESTIGATING MASS OUTFLOWS OF BAL QUASARS WITH CIII* ABSORPTION
David C. Austerberry, Department of Physics, Creighton University, Omaha, NE 68178

It has been postulated that galaxy formation can be significantly affected by gas outflows from a quasar in the nucleus of a nascent galaxy (Di Matteo et al 2005). Mass flows with high radial velocities are indicated by broad absorption lines (BALs) in the spectral energy distribution of quasars. The Sloan Digital Sky Survey catalogued over 5,000 quasars with BAL features identified by Shen et al (2008). Quasars were selected from this set for possible absorption by Carbon III*, a meta-stable species of doubly ionized carbon. The strength of this ion’s absorption is an indication of the density of the gas surrounding the AGN since the abundance of C III* relative to other carbon ions is highly sensitive to gas density (Gabel et al 2005). Power law and Gaussian fitting techniques were used to estimate limits on the column densities of C III* and Si IV in the spectra of these quasars. Photo-ionization simulations
in CLOUDY (Ferland 2004) were used to produce a set of models with varying quasar parameters. Applying the upper limit on the \( \text{C III}^* \) to Si IV column density ratio obtained from the spectra of several quasars to models varying in hydrogen density, hydrogen column density, and ionization parameter constrained these parameters by eliminating models that did not fit this criterion. Upper limits as low as \( 3 \times 10^{-7} \, \text{cm}^{-3} \) were placed on the total hydrogen density of the gas surrounding several BAL quasars.

**SIMULATION OF TRANSIENT ETHANOL DROPLET COMBUSTION IN CONVECTIVE ENVIRONMENT**

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

A numerical investigation has been conducted for gasification and combustion of liquid ethanol droplets, in zero gravity, atmospheric pressure, and convective environment. Ambient has been assumed to be nearly quiescent with Reynolds number of 0.01. Solution of the axi-symmetric Navier-Stokes equations has been obtained, with single step chemical kinetics for combustion. Simulations include numerically enabling/disabling surface tension, and radiation, to see their relative effects on droplet gasification and extinction behavior. Results have been compared with experimental data available in the literature and it is found that although, the model captures the rate of gasification reasonably accurately, however, the predicted extinction diameters are smaller. Numerically predicted value for extinction diameter of a 0.93 mm droplet is 0.25 mm with inclusion of surface tension and radiation. It is expected that single step kinetics assumption is mostly responsible for predicted extinction diameters to be approximately one-half of the experimental value of 0.48 mm.

**CRYOCOOLER VALIDATION FOR THE VASIMIR ISS DEMONSTRATOR MISSION**

Eldon Summerson and Kyrik Weidman, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

The Variable Specific Impulse Magnetoplasma Rocket (VASIMR) is the next breakthrough in faster and more efficient spaceflight. The VF-200 is a high-power plasma rocket prototype that will demonstrate and validate key VASIMR rocket technologies. The plasma exhaust plume is controlled by a set of High Temperature Superconducting magnets that utilize the plasma’s high conductivity to funnel the exhaust stream and give the rocket competitive efficiency levels. These HTS magnets must operate at or below 40 Kelvin and will require several cryocoolers. The proposed unit is to be tested in micro (~0g) and super (~1.8g) gravity conditions to determine the effect of gravitational forces on the cryocooler’s efficiency and performance. Our team will design a frame and data acquisition system that will record pressures and temperatures from several locations in the system. Analysis of this data will help determine the validity of the proposed unit for the eventual rocket system.

**ANALYSIS OF CRACKS IN AGING AIRCRAFT STRUCTURES WITH BONDED COMPOSITE-PATCH REPAIR**

Ananth Ram Mahanth Kasavajhala, and Linxia Gu, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

One of the challenging aspects of bonded composite repair technology is to predict the fatigue behavior of the repaired structure, and the subsequent derivation of stress intensity factors K. In this study, the crack behavior of a single edge v-notch AL7075T6 plate repaired with a 1-, 2- and 4-ply boron/epoxy prepreg patch was investigated through finite element method. Contour integral method and XFEM were used to define and evaluate the stress intensity factors at the crack and crack growth profile. The effect of the adhesive shear modulus, the adhesive thickness, the patch geometry, patch materials,
number of plies, and ply orientations on the evolution of the stress intensity factor of repaired skin were examined through numerical models. The results showed 6–17 times reduction in the $K_1$ and 80-83% reduction in the crack mouth opening displacement with composite patches.

**A CULTURAL APPROACH TO CONSERVATION UTILIZING MODERN SCIENCE**

Hank Miller, Department of Natural Resources, Nebraska Indian Community College, Niobrara, NE 68760; and Troy Munhofen and Carly DeBilzan, Department of Natural Resources, Nebraska Indian Community College, South Sioux City, NE 68776

This research will take water and soil samples at select locations along the Missouri river. After analysis, the soil and water conditions at these selected sites will be determined. GIS/GPS technologies will be used for establishing project site locations and imagery to document locations. Presently, water quality on both the Santee and Macy reservations is very poor. This project would establish a data set to work off of with hopes of determining where and why contamination is so prevalent. This project is simple. Select key spots along the Missouri, taking samples from both sides of the river, and establish a water and soil data set; testing for composition and contaminants. With this information, collectively, we will be able to identify some of the soil and water quality issues that exist on the Omaha and Isantee reservations. We feel that the information gained through this project will help us to improve the health and quality of our reservation people and their resources.

**REGIONAL EVAPOTRANSPIRATION ESTIMATION USING LAND SURFACE MODELING, DATA ASSIMILATION, AND SATELLITE REMOTE SENSING**

Ayse Irmak, School of Natural Resources and Department of Engineering, and Baburao Kamble, Department of Engineering, and Ian Ratcliffe, Center for Advanced Land Management Information Technologies, University of Nebraska–Lincoln, NE 68853

The first objective of this paper was to quantify crop evapotranspiration (ET) by utilizing METRIC (Mapping Evapotranspiration at high Resolution using Internalized Calibration) model in key vegetation surfaces in Nebraska (NE) and improve our understanding of relevant processes that control ET in these settings. METRIC was run with the inputs (weather, soil properties, water balance, etc.) for individual Landsat Path and Row (Path 29, Row 32) in NE. Six Landsat TM/ETM satellite images were obtained for the 2006 growing season (May -October). The application of METRIC model gave insight into quantifying flux distribution and its progression on a field scale as a consequence of utilizing the high resolution of Landsat imagery and in-situ meteorological measurements. Model predictions of the surface energy fluxes were correlated well with the measurements. For instance, the model predicted ET extremely well with RMSE less than 0.3 mm on a daily basis. Second, we expanded one-dimensional land data assimilation scheme, based on genetic algorithm, Soil Water Atmosphere and Plant (SWAP) model to improve the estimation of soil moisture profile. The ET in SWAP model was updated dynamically by satellite observed ET (METRIC ET). The SWAP hydraulic parameters were optimized by minimizing the residuals between METRIC ET and simulated SWAP model ET. The optimized parameters were inserted as inputs to SWAP to provide reliable estimates of the soil water balance used for estimating subsurface soil water status. The results show that the selected parameters (i.e. sowing date, harvesting date, irrigation scheduling date, Level of impervious layer, horizontal hydraulic conductivity, vertical hydraulic conductivity, maximum rooting depth allowed by the soil) were successfully estimated with the data assimilation methodology. The scheme was tested and validated by two different dataset for same field in South Central Nebraska for year 2006 and 2007. Data assimilation improved the estimation of soil moisture profile about 20% for the study area.
THE POLARIZING EFFICIENCY OF LYOTROPIC CHROMONIC LIQUID CRYSTALS
Jeremy Stromer, Bobbi Arnold, Josh Beck, Liubov Kreminska, and Michael Larsen, Department of Physics and Physical Science, University of Nebraska at Kearney, NE 68845

While in the liquid crystal phase, the unique molecular arrangements allow a material to exhibit properties that would not be demonstrated otherwise. One of these properties that has become of interest is the use of lyotropic chromonic liquids as polarizers. It has been shown that the production of liquid crystal thin film polarizers can perform on a level similar to that of conventional polarizers. In particular, our research is concerned the near infrared dye IR-806, and determining its ability to function as a polarizer. Characterization of the dye was conducted by producing various solutions of differing concentrations (wt%) and measuring the absorbance spectra for each at different temperatures. Construction of the thin films was done by the shearing of the dye solutions on a glass substrate by either hand or pneumatic methods. The films were measured for their effectiveness by use of a polarizing microscope and also additional absorbance spectra were taken. Results have shown that IR-806 shows capability to act as a polarizer.

NEBRASKA 7-9 DECEMBER 2009 SNOW STORM: NASA’S SATELLITE VIEW AND NCEP’S WEATHER REANALYSIS
Amy Gehring and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln, NE 68588

The Nebraska snow storm of 7-9 December 2009 resulted in record breaking snowfall totals in many locations throughout the state. While many methods are available to forecasters to predict a snow storm such as this, there is still a demand for an increasingly accurate method to forecast snowfall totals. What were the main atmospheric ingredients that led to the Nebraska snow storm of 7-9 December 2009, and how can this information be used to develop a better forecasting technique in this region? Images and soundings from NASA’s Moderate Resolution Imaging Spectroradiometer (MODIS) coupled with data and soundings from the National Weather Service are used to reconstruct the atmospheric conditions of the winter storm. From there, analysis of the atmospheric conditions favorable for the record breaking snowfall event on 7-9 December 2009 is conducted.

USING PHOTOGRAMMETRY AND GIS METHODS TO STUDY AND DIGITALLY PRESERVE FLUVIAL ICHNOFOSSIL ASSEMBLAGES AT TOADSTOOL PARK, NORTHWEST NEBRASKA
Jesse Zwiebel and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337; and Hannan LaGary, Department of Sciences, Oglala Lakota College, Kyle, SD 57752; and Neffra Matthew, Bureau of Land Management, Denver, CO 80215; and Brent Breithaupt, Department of Geology and Geophysics, University of Wyoming, Laramie, WY 82072

Toadstool Park, near Crawford, Nebraska, is the site of one of the world’s best preserved vertebrate trackways of Oligocene age. Systematic comparison of photogrammetric images of latex peels created at outcrops in 1995, with similar datasets made from the same outcrops in 2007 is yielding a wealth of information about ichnology as well as information about how this important data is being lost. Many vertebrate trackways from the outcrops offer evidence about the geologic environment in which the tracks were created. Track morphology is an exceptional indicator of substrate and environmental conditions. This information can also support interpretation of the general behavior of the trackmakers. Since Toadstool Park is currently undergoing rapid erosion, these trackways are threatened by the natural processes that are occurring and from other threats including vandalism and
public use. The method of digital documentation we are using ensures that the trackways will not be lost and will be available for study in a form of resembling their current state even long after they have succumbed to erosion at the park.

WIND ENERGY IN THE MIDWEST: PAST, PRESENT AND FUTURE
Eric Holt and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln, NE 68588

The Midwest region of the United States is generally believed to be an ideal location for wind farms because its population density is far less than that in the coastal regions and its uniform topography results in a consistent wind direction and sometimes seasonally large wind speed. Yet, how sustainable these wind farms would be, if we are going to build them? This project, now a part of my Master’s Thesis research, is designed to answer this question by studying the past, current, and future changes of wind energy in the Midwest. Past and current changes of wind energy are analyzed from the 3-hourly North American Regional Reanalysis (NARR) dataset, and NASA’s 6-hourly Modern Era Retrospective-analysis for Research and Applications (MERRA) dataset. Uncertainty in my analysis is estimated through the cross-validation between NARR and MERRA. Future changes of wind energy are revealed through similar analysis from the ensemble means from more than 10 global climate model outputs collected by the Coupled Model Intercomparison Project (CMIP3). CMIP3 dataset includes the prediction of wind for the next 50-100 years under the different greenhouse emission scenarios proposed by the IPCC for its fourth comprehensive report on climate change (AR4). Four steps are to be carried out in the analysis of each dataset: (i) estimate the wind speed at 80m hub height level; (ii) compute the wind energy harvest potential using results from (i); (iii) statistical analysis of wind energy climatology and trend with such techniques as Empirical Orthogonal Function (EOF), Harmonic time series decomposition, and hypothesis testing. These techniques allow me to discern the space and time variations of the meteorological parameters and energy trends throughout multiple time scales. Interactive Data Language (IDL) has built in functions for these techniques, and aids this project for data interpretation and visualization.

SATELLITE REMOTE SENSING OF AEROSOLS: FACTORS THAT AFFECT SMOKE PLUME INJECTION HEIGHTS
Catherine May, Department of Meteorology, and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln, NE 68588; and Charles Ichoku, Department of Physics, University of Maryland and Baltimore County, Baltimore, MD 21250

Concerns among the scientific community are rapidly growing with the increased studies of aerosols and their effects on climate change. Wildland fires in North America contribute a great amount of carbon monoxide, nitrous oxides, and particulate matter into the atmosphere. This study uses fire events previously observed by satellite remote sensing instruments aboard NASA’s Terra and Aqua satellites to address the issue of predicting smoke plume injection heights. Many factors contribute to this height: fire radiative power, atmospheric instability, elevation, and a vegetated area supplying fuel. Different regions in North America are affected by a unique combination of these factors. For example, in the western region of the United States the Haines instability index and topographical elevation are the major contributors to determining smoke plume height. Once the effects of various factors on smoke plume injection heights can be accurately resolved the precision of smoke plume models will significantly increase.
CORRELATING MODIS OBSERVATIONS AND CORRESPONDING AERONET STATIONS
Nicole Pothier and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln, NE 68588

Validating the accuracy of an instrument is essential for research; without the accuracy of measurements, there is little purpose for study. This study acts to find the correlation between two specific products that measure aerosols in the same location, in order to validate the precision of each. The data being used in this study come from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument and corresponding AErosol RObotic NETwork (AERONET) stations in Eastern Asia and North America.

REMOTE SENSING AS A MEANS OF ENHANCING NEBRASKA’S EMERGING WINE INDUSTRY
Trisha Larson, Donald Rundquist, and Brenton Willoughby, School of Natural Resources, University of Nebraska–Lincoln, NE 68588

There are approximately 250 vineyards statewide with 25 bonded wineries in business. Further expansion is expected. Remote sensing is a potential tool for improving not only monitoring existing vineyard operations but also vineyard management as well as elements of wine production, thereby assisting in economic development. The objective of the presentation is to assess the utility of AISA-Eagle airborne hyperspectral data (over James Arthur Vineyards near Raymond, NE) for: 1) identifying and spectrally distinguishing blocks of specific grape cultivars; 2) separating spectral signatures of inter-row (grass) target backgrounds from the vines themselves; and 3) quantifying differences in vine phenology among selected cultivars, during one growing season. Results indicate that multi-temporal imagery is required for spectral separation of cultivars, vines can be distinguished from the grass background by means of vegetation indices, and the quantification of image phenology reveals differences in integrated NDVI. Remote sensing seems to be a viable tool for monitoring vineyard operation.

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

MULTI-FUNCTIONAL IN VIVO ROBOTIC PLATFORM FOR LONG-TERM SPACEFLIGHT
Tyler D. Wortman, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

The objective of this study is to demonstrate the effectiveness of using an in vivo multi-functional miniature robot platform to perform surgery during long-term spaceflight. A miniature robotic platform that is completely inserted into the peritoneal cavity through a single incision provides a method to perform surgery during emergency medical situations in space where a surgeon is not accessible. The robotic platform consists of a multi-functional robot and a remote surgeon interface. The robot has two arms with two-degree of freedom elbow joints and specialized end effectors. The end effectors can be interchanged with different surgical tools to perform specific surgical tasks. During the current work, new kinematic arrangements and a camera system were added. This robot has been demonstrated in multiple non-survival procedures in a porcine model, including four cholecystectomies. The robot provides a completely insertable platform that improves triangulation and better enables the performance of complex surgical tasks.
THE USE OF MULTIVARIATE FACTOR ANALYSIS IN THE DEVELOPMENT OF HAND SIZES
Trevor McLain and R.R. Bishu, Department of Industrial Engineering, University of Nebraska–Lincoln, NE 68588

The aim of this project is to use Multivariate Factor Analysis to develop a more accurate description of the human hand to be used in the creation of glove sizes; currently gloves sizes are small, medium, and large. By using Multivariate Factor Analysis we hope to provide a wide variety of hand sizes. It is the aim of this project to create male and female groups of sizes. These sizes will provide glove designers with the ability to create a glove design that can provide fit to the majority of hand variations in the human population. The project will use the U.S. Army Anthropometric data that was collected in 1988. This data contains approximately ninety measurements of the human hand for one thousand male subjects and thirteen hundred female subjects. Eliminating redundant measurements will narrow the variables down to around forty-six measurements. Once the variables have been narrowed down, Multivariate Factor Analysis will be performed. Factor analysis will group the variables together to form factors. These factors will then be used to generate hand sizes. The current measurements for glove sizes will be compared to the newly created sizes. From this it will be determined if factor analysis will be a valuable addition to glove design.

BEARING DRAG TORQUE AND STIFFNESS ESTIMATIONS
Justin Green, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

Bearings are widely used to enable mechanisms to achieve a desired range of motion. However, bearings also introduce disturbances into the system, which can have unfavorable effects. Two of the most critical are the drag torque and stiffness. These are the cause of some concern because they can affect the precision and reliability of a device. It is projected that a two-axis gimbal will be used to meet the large field of regard needed for the reflected solar instrument suite for CLARREO to obtain nadir and off-nadir views of the Earth, Sun and Moon. It will be essential for the instruments to point and follow in two-axes to enable intercalibration of other instruments on other satellites. The focus of this project is to provide a deliverable that will be able to take in parameters of bearings as input, and then be able to determine the drag torque and stiffness of the bearing. With these two properties, engineers and scientist will be better informed when developing designs of the motors and reaction wheels used in the CLARREO satellite(s).

TWO ONLINE ENVIRONMENTS TO SUPPORT STEM EDUCATION
Neal Grandgenett, Department of Teacher Education, and Robert Shuster, Department of Geography/Geology, University of Nebraska at Omaha, NE 68182

Online learning can be an important catalyst to a deeper involvement of teachers and students in science, technology, engineering, and mathematics (STEM) concepts. The use of the Internet and the resultant access to the many resources available from organizations such as NASA can help make learning more realistic and engaging for both students and teachers alike. We will overview two successful online learning environments in which UNO is an important partner and facilitator. The first online environment is associated with the Earth System Science Education Alliance (ESSEA), in which a total of 40 universities around the country, including UNO, are offering ESSEA-related graduate credit coursework for teachers. The second online environment will be that of the Silicon Prairie Initiative for Robotics in Information Technology (SPIRIT). This project is developing a national online educational robotics curriculum for middle school students.
DESIGN OF A GPS-BASED COSMIC RAY DETECTOR USING THE BERKELEY DAQ

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

The detection and recording of cosmic ray events with readily available and inexpensive instrumentation is a priority for the Cosmic Ray Observatory Project (CROP). Observing extended showers of cosmic rays requires the implementation of many detectors across a wide geographic range. CROP utilizes detectors in 16 Midwest high schools and colleges. Thus, the operation and data collection of a detector must be straightforward and accessible to participating teachers and students. Since the hardware necessary to support and expand the array of detectors currently in use is no longer readily available, a cosmic ray detector system has been designed to meet these requirements. This system uses commercially offered components, including a Berkeley Cosmic Ray Detector Board and GPS device. The Berkeley detector uses coincident signals from two photomultiplier tubes to identify cosmic ray events, while event times are obtained from the GPS. This design uses a National Instruments data acquisition device programmed in the Python language to record cosmic ray event data to a personal computer.

GEOMORPHOLOGICAL ANALYSIS OF STREAM IN THE PINE RIDGE, NORTHWESTERN NEBRASKA

Kodi Young and Michael Leite, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

The Pine Ridge is a southwest-northeast trending escarpment in northwestern Nebraska. Numerous groundwater-fed streams flowing to the north off the escarpment are tributaries to the White River. Analysis of these streams’ gradients, discharge and watershed topography can be used as a tool for understanding the interaction between surface water and ground water as well as the geomorphic evolution of the Pine Ridge region. Streams are sensitive to tectonic events, and analyzing their profiles can help identify tectonic features. They are also an important source of water for the vegetation, wildlife and culture of the region. Discharge measurements in several Pine Ridge streams made in the summer of 2009 indicate a complex interaction between surface water, ground water and bedrock geology. Each stream has a unique discharge trend, with the only common trend being a gaining stream toward the head. Discharge data from one stream, shows a highly varied change in discharge toward the head and therefore does not fit the trend. Further analysis of discharge data, longitudinal profiles and lineament/stream coincidence will be needed to determine their interrelation.

USE OF SPECTRAL REFLECTANCE AND SATELLITE IMAGERY TO IDENTIFY AMERICAN BURYING BEETLE NICROPHORUS AMERICANUS HABITAT IN NEBRASKA

Michelle McPherron, Vijendra Boken, and W.Wyatt Hoback, Department of Sociology, Geography and Earth Sciences, University of Nebraska at Kearney, NE 68849

Burying beetles, Nicrophorus sp. inhabit limited geographical areas and have specific habitat requirements. Many of these species are in decline including the American burying beetle (ABB), Nicrophorus americanus. Reasons for decline include habitat fragmentation, environmental change, and use of pesticides. Because carrion beetles are highly susceptible to death from desiccation, there may be a general relationship between aridity and habitat associations. We investigated the spectral reflectance of smooth brome grass, Bromis inermis, to examine the relationship between the water stress of the grass and ABB habitat. Data was collected using a spectroradiometer in combination with satellite imagery at four carrion beetle trap locations in Nebraska. The mean reflectance of smooth brome from June to August was 36% and ranged from 21% to 49%. Because burying beetles are highly mobile, collecting reflectance data as a measure of moisture stress may allow critical refuges to be identified, especially under drought conditions.
USING REMOTE SENSING DATA FOR PALEONTOLOGICAL EXPLORATION IN MADAGASCAR

Timothy J. Stoebner and Christina Etzrodt, Department of Geography; and Todd Widhelm and Lisa D. Boucher, Department of Biology, University of Nebraska at Omaha, NE 68182

The purpose of this project was to explore the use of remote sensing data to locate potential fossil sites and plan paleobotanical field research in western Madagascar. At least six known sites from published reports, first-hand field data, and museum specimen data were located using available geospatial data. All possible current roadways and access points to sites were found and enhanced to create maps for future field research. Data will be presented to illustrate the resolution of these maps. These regions were then examined using remote sensing processes to detect geologic signatures in exposures that indicate potentially favorable sites. The ENVI ratio algorithm was used to locate specific exposures. Ratios that were used in the algorithm were 5/7 for clay, 3/2 for iron-oxide and 4/3 for vegetation. Spectral data was processed to find potential fossil sites for future field research. In summary, existing satellite data was applied for the logistics and planning of paleontological exploration in remote regions. This is the first application of these techniques in this type of paleobotanical exploration.

CENTRAL AMERICAN SMOKE TRANSPORT TO TEXAS: METEOROLOGICAL CAUSES AND SOCIETAL EFFECTS

Melissa Huffman and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln, NE 68588

With the annual biomass burning performed every spring by Central American farmers, large volumes of aerosols are placed into the atmosphere. If winds are southerly in Central America, the smoke from biomass burning can penetrate the Gulf states of the United States. How does this smoke affect the quality of life for Americans in these coastal states? To narrow this study, the sample area was limited to Texas. Images from NASA’s Moderate Resolution Imaging Spectroradiometer (MODIS) as well as the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite were used to detect the geographic locations and their populations impacted in the study region. From there, MODIS and CALIPSO helped determine which months are most affected by this smoke and what the transport time is. This research will be coupled with air quality reports by the National Weather Service to determine the societal impact of these events.

THE EFFECT OF AUDITORY STIMULATION ON HUMAN MOVEMENT VARIABILITY

Jeffery P. Kaipust and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Locomotor patterns in humans must be flexible in order to meet the demands of the environment. Such flexibility in gait patterns is demonstrated by variability measures and has been shown to be altered for certain populations such as the elderly and Parkinson’s patients. These populations may need external cues to facilitate normal flexibility and variability during walking. Such external cues can be provided by auditory stimulation. However, it is not clear what kind of auditory stimulation provides the best results. Human gait variability has been shown to be deterministic in nature and exhibit properties explained with the chaos theory. Pathology tends to deteriorate these properties. Auditory stimulation delivered in the form of music that exhibits such properties may restore this normal pattern of gait variability. Our purpose is to investigate this hypothesis in healthy young and elderly subjects who will walk under different auditory stimuli, while gait data are acquired.
LINEAR AND NONLINEAR ASSESSMENT OF POSTURAL CONTROL IN MULTIPLE SCLEROSIS PATIENTS
Jessie Huisinga and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182; and Mary Filipi, Department of Adult Health and Illness, University of Nebraska Medical Center, Omaha, NE 68198

Disturbances in balance are some of the first reported symptoms of Multiple Sclerosis (MS). Therefore a precise tool to define balance deficit in MS is necessary. Center of Pressure (COP) measures were used to evaluate balance through sway variability in 19 MS patients and 15 healthy. Variability was quantified with Root Mean Squared (RMS) (a linear measure of amount of sway), Lyapunov Exponent (LyE) and Approximate Entropy (ApEn) (nonlinear measures of the temporal structure of the sway patterns). MS patients had a significantly higher RMS value compared to controls. MS patients also had a significantly lower LyE value compared to controls. Lastly, MS patients had a significantly lower ApEn value compared to controls. Overall, there is a decrease in complexity due to identified pathology that corresponds well with the optimality of variability hypothesis. These results can provide the foundation for the development of the protocol needed to assess onset and severity of MS as well the effect of therapeutic interventions for these patients.

UNDERSTANDING AND DEVELOPING HPLC METHODS
Chelsea Dean, Ganesh Naik, and Jeremy Karr, Department of Arts and Sciences, College of Saint Mary, Omaha, NE 68106

This project involves the investigation, development and implementation of the following HPLC experimental procedures:
1) Qualitative and quantitative analysis of vitamin C in fruit juices and food products.
2) Qualitative and quantitative analysis of products formed during lipid peroxidation.
These experimental procedures will be introduced into the analytical chemistry laboratory curriculum and may be considered for other laboratory courses at College of Saint Mary such as general and fundamental chemistry. This project will increase the depth of instrumental methods, particularly separation methods that are taught in the undergraduate curriculum at College of Saint Mary.

WORK TOWARD THE DEVELOPMENT OF A MICROFLUIDIC BIOSENSOR
Erin M. Gross, Sarah E. Roszhart, Nicholas R. Stukel, and Laura R. Anderson, Department of Chemistry, Creighton University, Omaha, NE 68178; and Charles S. Henry, Department of Chemistry, Colorado State University, Fort Collins, CO 80523

Microfluidic devices offer the possibility of fast, portable, and automated analytical tests with small amounts of sample and reagent consumption. As microfluidic devices find more applications, new instrumentation and detection methodologies must be developed. These detection methodologies must be sufficiently sensitive for the small amounts of analytes present, but also be easily miniaturized to integrate onto a microchip device. This research focused on the development of a biosensor on a small “microchip”. We used a novel type of microelectrode, a micromolded carbon paste electrode, as a template for the biosensor. We also performed some basic studies on the electrochemical characteristics of these electrodes. Enzyme immobilization of glucose oxidase within the carbon paste mixture was investigated and optimized. When luminol is oxidized at the biosensor in the presence of glucose, we observed an electrochemiluminescent signal, and the analytical figures of merit for the sensor were determined.
THE ASSOCIATIONS BETWEEN COGNITIVE AND PHYSICAL FUNCTION DURING DUAL TASK PARADIGMS

Sara Myers, Leslie Decker, and Nick Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Recent research has shown changes in proprioception, sensory perception, psychological disturbances and cognitive changes during and after spaceflight, but the impact of these changes on human performance is not known. For astronauts to complete space missions, it is important to understand the effects of space travel on cognitive and physical function; however this association is not well understood. Therefore, this project sought to determine the relationship between physical function and cognitive performance by examining whether cognitive performance could be predicted using gait variability. Our findings showed that cognitive performance was strongly associated with gait variability measurements and that certain cognitive performance measures were strongly predicted by gait variability. The relationships indicated that as amount of variability increased and structure of variability became more complex, cognitive performance declined. In conclusion, gait variability assessments could be developed as indicators cognitive health status before, during and after space flights.

SURFACE HABITAT 1/6g SUITLOCK EVALUATION

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One of the major challenges of exploring the lunar surface is ensuring safe crewmember entry and exit of the lunar habitat. Initial airlock concepts provided an area large enough for crewmembers to prepare for extravehicular activities (EVAs), maintain space suit hardware when not in use, and don and doff the EVA suits. However, the size of this design is prohibitive due to its large volume and the loss of gases during depressurization. The suitlock concept combines the aspects of a suit donning stand with a smaller airlock design. It limits exposure of the crew and habitat to lunar dust and other contaminants brought in after an EVA. While a smaller size is advantageous, a major concern of the design is providing safe return to the habitat for an incapacitated crewmember. This project analyzes in a lunar gravity environment the operational procedures required to assist an incapacitated crewmember safely into the habitat.

THE REAL WORLD EXPERIENCE

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Too often students lack motivation and excitement with their learning. Students also struggle to make a connection with what they are learning and how it applies to their lives. It is often times a struggle for my eighth grade web design and graphic design students to connect with the curriculum because they do not know what it is like to be an actual graphic designer. Throughout this project, I hope to help my students make that connection by providing an opportunity for them to act like real world web and graphic designers. They will be working together to create a website and logos for NASA that are directed towards a student aged audience.
ANTHROPOLOGY

EVALUATING THE EFFECTS OF MICROWAVABLE MEALS ON HEALTH AND CULTURE IN THE U.S

Bailey Armstrong, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Niche construction explores how modifications made by organisms to their environment effect their evolution. In humans, the introduction of tools and processing techniques created dietary niches that allowed for adaptation to varying environments. However, use of this model need not be limited to our evolutionary past. This paper evaluates the effects of microwave oven use and ready made meals on diet and health in the U.S. using niche construction. Our fast paced, capitalist culture has shaped the acceptance and use of microwave technology, underscoring the relationship between culture and biology. With this in mind, comparisons are made between nutrient profiles and cost in a sample of ready made meals and home cooked meals, controlling for serving size. The niche created by microwave technology has clear ramifications for human health in the foreseeable future and demonstrates the utility of niche construction in a contemporary context.

EDUCATION AND PUBLIC OUTREACH IN ARCHAEOLOGY

Christine Nycz, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Archaeology is seldom a part of curriculum standards set in schools across the United States, yet it can be a valuable tool to teach a variety of topics. Education and Public Outreach programs that focus on hands-on archaeological activities, especially with school-aged children, can improve one’s understanding of the past and promote a sense of stewardship that cannot be learned in the classrooms of today. Such outreach programs provide audiences an opportunity to gain first-hand knowledge of past lifeways, and often promote a personal link to the past by examining local or national cultural heritage.

WILD POTTERY OF THE LINCOLN POTTERY WORKS: CAN ANTIQUE COLLECTIONS HELP ARCHEOLOGISTS?

Linda Dammann, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

The Lincoln Pottery Works produced domestic ceramics in Lincoln, Nebraska from the early 1880s until about 1903. The archeological assemblage obtained from excavation of the LPW site in 1986 included a large sample of domestic ware and terra cotta. A few antiques collectors have assembled groups of LPW pottery. Those collections differ in composition from the excavated sample. They also include miniatures, marked pieces, and other forms not found in the excavations. This study documents some of these “wild” forms and, using contrast and comparison analysis of the assemblages, explores possible explanations and importance for these differences.

TIMBER, TRADE, AND THE HANSEATIC LEAGUE: AN EVOLUTIONARY PERSPECTIVE ON THE DEVELOPMENT AND ADAPTATION OF SHIP CONSTRUCTION TECHNIQUES

Jillian Smith, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

From 1200-1500 CE, the Hanseatic League controlled merchant shipping in the North and Baltic Seas expanding their network from modern Germany to England, Scandinavia, Russia and the Baltic States. During this period the League predominately utilized one type of ship, the Cog: a sailing vessel with a flush-laid bottom and steep, high lap-straked sides. These vessels became larger throughout
the course of the period, requiring the consumption of greater amounts of timber for construction. At
the same time, timber resources in close proximity to hanseatic shipyards along the North and Baltic
Sea coasts were being exhausted. This necessitated pushing inland and eastward towards less densely
populated areas and more heavily forested regions in search of timber resources for the shipbuilding
industry, thereby driving up the price of these resources as they are transported from further away.
Using evidence from Cog wrecks, this paper will present an accounting of the construction adaptations
developed in response to both timber quality and economy as an examination of the evolutionary forces
driving innovation in ship construction in the Middle Ages.

THE DECIDUOUS DENTITION OF CATARRHINE PRIMATES: IMPLICATIONS FROM
MACACA NEMESTRINA (PIGTAILED MACAQUES)
Emily Hammerl, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Permanent dental development has been shown to be a useful proxy for life history. Consequently, the study of juvenile fossil hominids provides both a unique opportunity to study
growth and development in our lineage and examine the unique developmental strategy of humans in a
comparative context. Our current understanding of the complexities of growth in the mixed permanent
and deciduous dentition of extant juvenile primates limits analysis to that of the permanent dentition.
This presentation describes the first phase of a project that utilizes a stage based methodology to
examine the development of the deciduous dentition in three species of catarrhine primates. Here, a
radiographic study of the developing deciduous dentition in Macaca nemestrina serves as a first step
in understanding deciduous dental growth in living primates. Descriptive statistics and analysis of
incremental growth will be presented along with a discussion of future work planned.

HOW WOMEN ACHIEVE STATUS IN TRADITIONAL SOCIETIES
Melissa Garfield, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

There is substantial literature on the differences of ascribed status between women and men and
significant research has investigated the gender asymmetry of relative social status. However, there is
very little analysis of the behaviors that women value among themselves and the actions that warrant
higher achieved status for women remains unclear. This research is a preliminary survey of the strategies
and behaviors women employ to distinguish themselves among their contemporaries. Using the
electronic HRAF I have identified and categorized multiple avenues that women in traditional societies
exploit to differentiate status amongst themselves. Data collected on 24 traditional societies reveals
cross-cultural trends and suggests that women’s roles within the domains of motherhood, leadership,
productivity, domesticity, and spirituality are the most crucial and widespread. This research excludes
women’s relationships and involvement with men, and focuses specifically on the behaviors that women
value collectively. These findings are a synthesis of ethnographic data describing female interests, social
tactics, and ways women compete for status in traditional societies. Through systematic, cross-cultural
investigation this research provides a foundation for outlining the mechanisms of female prestige
systems and will contribute to the literature as a comparative approach to understanding women’s
achieved status.
THE PROSOCIAL DIMENSION OF STATUS IN EGALITARIAN SOCIETIES
Zach Garfield, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Egalitarian societies lack formal authority figures, yet successful individuals maintain varying degrees of social influence. Although several ideas on status in egalitarian societies have been proposed they are generally anecdotal in nature and lack cross-cultural reference. This research investigates the importance of prosocial behaviors, or behaviors that benefit the group, in determining relative social standing or prestige and evaluates theoretical conceptions of status with comparative investigation. Focusing on the actions that merit prestige in egalitarian societies in the electronic HRAF, I have identified and categorized behaviors that lead to cultural success and differential status. Collected data, on 32 societies thus far, has been classified under the domains of leadership, economics, politics, ritual participation, arts, personality traits, and physical characteristics, which together encompass a total of 27 subcategories of behaviors. Recurrent in my initial findings are the subcategories of hunting, shamanism, warfare, and generosity. These findings reveal cross-cultural patterns of societal values of egalitarian groups, suggesting a critical component of the egalitarian ethos is promoting and rewarding prosociality with differential prestige. This research synthesizes the theoretical literature with supporting quantitative data on the issue of status in egalitarian societies.

RITUALIZED AND NONRITUALIZED RELATIONS BETWEEN CAPTORS AND CAPTIVES AMONG THE COMANCHES, KIWAS AND CHEYENNES
Martha McCollough, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

The treatment and/or survival of captives by the Comanches, Kiowas and Cheyennes depended not only on age, gender and the external political situation, but also upon the captives’ ability to handle nonritualized and ritualized ordeals. These ordeals occurred at the initial moment of capture, the period of escape from pursuers, the return to the village of the captors and throughout the first year of captivity. The similarities in methods used to acculturate captives by the Comanches, Kiowas and Cheyennes illustrate the importance of both the nonritualized and ritualized ordeals.

READING IMAGES OF GENDER AND EMPIRE: PHOTOGRAPHS OF THE OJIBWE OF NORTHERN MINNESOTA
Ashley J. Barnett, Department of Geography, University of Nebraska–Lincoln, NE 68588

It is tempting to interpret photographs as depictions of reality, but photographs are manipulated by photographers and subjects. By ‘reading’ images intently, observers can gain insight into the photographer’s intentions, the lives of individuals in the photographs, and the political and cultural situations in which the photograph was created. Photographs taken in a colonial context may illuminate aspects of the relationships that existed between the colonizers and the colonized. Images from the Minnesota Historical Society’s Visual Resource Database which depict Ojibwe persons offer examples of colonial depictions of colonized persons. This paper provides analysis of several different genres of photographs of the Ojibwe of northern Minnesota, with the intention of illuminating constructions of gender and colonialism depicted by the images.
EVOLUTIONARY CONSERVATION OF A POTENTIAL ANIMAL/MAMMALIAN RIBOSWITCH

Andrew Kavan, Molly McDevitt, and Julie Soukup, Department of Chemistry, Creighton University, Omaha, NE 68178

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

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ANTIBIOTIC DEVELOPMENT BY INVESTIGATION OF THE GLMS RIBOSWITCH

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Although bacterial infections have always been of significant interest to researchers and physicians, the drug-resistant bacterial strains that have recently developed are causing new concerns and are much more difficult to combat. Our current methods for treating bacterial infections include broad-spectrum antibiotics, which target only a small number of bacterial processes. However, with the discovery of riboswitches, we are developing new ways to fight bacterial infections which make use of their own natural metabolic pathways, essentially causing bacteria to destroy themselves. Riboswitches are found in non-coding regions of messenger RNAs and these RNA elements bind to ligands to control the expression of nearby genes. The glucosamine-6-phosphate (glmS) riboswitch is unique in that upon binding its ligand, glucosamine-6-phosphate (GlcN6P), it undergoes self-cleavage and is therefore also a catalytic RNA. The cleavage event targets the RNA for subsequent degradation, thereby repressing further gene expression. To study the glmS riboswitch, initial experiments were performed to determine the mechanism followed upon binding of the natural ligand. Since then, analogs of the natural ligand have been obtained and are being tested for their catalytic capabilities through kinetic analyses and rate constant calculations. Once successful candidates have been determined, these non-natural ligands will be introduced into live bacterial cultures, hopefully disrupting normal cell metabolism and reproduction. If successful, these analogs could be used as novel antibiotics, offering a more specific mode of targeting a wide variety of bacterial species.
Riboswitches are small sequences of RNA found in the untranslated regions of mRNAs that bind to specific cellular metabolites and consequently undergo a conformational change, which modifies expression of a nearby coding region of the mRNA. This coding region is involved in the synthesis of the same metabolite, thereby providing an efficient feedback mechanism of genetic control. To date, various riboswitches have been described as effective controls of genetic expression in bacterial cells, but none have been discovered in mammals. 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 frequently surround DNA to stabilize the DNA’s negative charge making control of polyamine levels in the cell crucial to cell proliferation. In order to classify the small RNA as a true riboswitch, it must bind a specific ligand and undergo a conformational change resulting in modulation of gene expression. We hypothesize the RNA binds specifically to a polyamine and induces a conformational change upon binding resulting in a feedback loop to control polyamine levels in the cell. To validate this small RNA as a riboswitch, we have employed in-line probing and equilibrium dialysis experiments. The data from in-line probing experiments indicate a conformational change occurs upon binding of the metabolite. Equilibrium dialysis experiments indicate the specificity of the RNA for its polyamine metabolite.

Currently, we are working to elucidate the 3-dimensional structure of the small RNA bound to its metabolite using X-ray crystallography techniques. Results will render a better understanding of the binding properties of the metabolite to the RNA and clarification of the mechanism through which binding induces a conformational change. Cancer cells require a higher concentration of polyamine due to their increased replication rate. Therefore, a combination of structural and functional studies of this RNA may prove useful in the development of novel cancer therapies.

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

Riboswitches are mRNA sequences that can regulate the expression of their own gene by binding to a metabolite. The discovery of riboswitches is important as they demonstrate that RNA can bind small molecules specifically, a capability that was once believed to be only possible by proteins. Several programs have been written to search for DNA sequences that may code for riboswitches, the most recent being RiboSW (http://ribosw.mbc.nctu.edu.tw). Unfortunately, the web version of this program limits the size of search sequences to 10 kbp, a size that makes searching entire genomes impractical. Although the command-line version has no such limit, it creates a massive amount of output that is difficult to interpret. In order to making searching large parts of genomes for riboswitches more practical, we have modified RiboSW so that the amount of output is reduced and the results are easier to understand. Specifically, we have modified the program to show only the most relevant hits, unless the user specifies otherwise. In addition, the use of search parameters has been made more flexible. Our presentation will describe riboswitches and their importance as we as give an explanation of RiboSW and the enhancements we have made in the program.
MIMICKING THE TARGETING OF RNA: REACTION OF DNA STEM-LOOP MOTIFS WITH PARTIAL COMPLEMENTARY STRANDS

Hollie Siebler, Department of Biology, Dana College, Blair, NE 68008; and Carolyn Carr, University of Nevada, Reno, NV; and Hui-Ting Lee, Irine Khutsishvili, and Luis A. Marky, Department of Pharmaceutical Sciences, University of Nebraska Medical Center, Omaha, NE 68198-6025

Antisense drug strategies are used to control the expression of genes, such as to block the expression of oncogenes. To this end, our laboratory is mimicking the targeting of complex structures of mRNA, by reacting DNA hairpin loops with partial complementary strands. This forms duplex products with dangling ends, nicks, or a displaced strand. We use a combination of differential scanning calorimetry (DSC) and UV melting techniques to determine thermodynamic profiles for the unfolding of the hairpin loop and duplex product of each reaction. We also use circular dichroism (CD) to characterize the molecules.

The DSC and UV melts show that each DNA hairpin (reactant) unfolds in monophasic transitions with melting temperatures ($T_m$) independent of strand concentration. Each duplex (double stranded segment) also unfolds in a monophasic manner, but their $T_m$'s do depend on strand concentration. For each transition, favorable folding free energy terms result from the compensation of a favorable enthalpy and unfavorable entropy contributions. The data is used to create thermodynamic (Hess) cycles that correspond to each targeting reaction. All three targeting reactions yielded favorable $\Delta G^\circ$ contributions and were enthalpy driven.

Dependence of $T_m$ on Na+ ion concentration was also measured. Higher salt concentrations yielded higher $T_m$'s in all molecules but the duplexes showed a higher dependence on salt than the hairpins. Supported by Grant MCB-0616005 from the National Science Foundation, Department of Pharmaceutical Sciences, College of Pharmacy.

CHANGES IN OTK18 mRNA LEVELS USING RNAi AND qRT-PCR

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Information about the molecular mechanisms involved with Human Immunodeficiency Virus (HIV) replication and integration into the host genome is imperative. Attention has turned toward OTK18, a human transcriptional suppressor expressed in all normal human tissues that has a role in the regulation of HIV-1 infection of mononuclear phagocytes. Although OTK18 is expressed in all normal human tissues, its homeostatic function is yet to be characterized. In an effort to begin to determine the homeostatic function of OTK18, RNA interference (RNAi) experiments were performed to inhibit OTK18 gene expression in a human monocytic cell line, U937. The monocytes were subjected to RNAi with an OTK18 micro RNA (miRNA) construct. Detection of OTK18 mRNA silencing was completed using quantitative reverse transcriptase polymerase chain reaction (qRT-PCR). In the future, target immune genes hypothesized be regulated by OTK18 will be uncovered using cDNA microarrays in conjunction with RNAi. The results of this study provide information on the homeostatic function of this molecule. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.
STABILITY AND MICROMECHANICAL PROPERTIES OF MODEL ALZHEIMER’S $\alpha$-AMYLOID FIBRILS
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Protein nanofibrils are the ordered end product in the protein self-association process. Firstly recognized as linked to amyloid diseases, including Alzheimer’s, they are currently identified as remarkably stable states accessible to almost any polypeptide chain. Interestingly enough, protein nanofibrils made of the same polypeptide building blocks adopt different ordered three dimensional structures. The purpose of this study is to investigate via all-atom molecular dynamics simulations the stability and micromechanical properties of model Alzheimer’s $\alpha$(9-40)-amyloid fibrils that display different quaternary structure. These structures consisted of a three-fold symmetric mode and a striated-ribbon pattern. Both of the three fold symmetric models (full side chain and alanine mutated) show a similar RMSD pattern in progression towards a plateau; however, the three fold symmetric model that contains only mutated alanine side chains has a higher RMSD value. This indicates that the structure as a whole differs more significantly from the solid state NMR determined structure than the three fold symmetric model with all side chains included. In looking at the striated ribbon models, the structure with only alanine side chains has a larger RMSD value. The side chains appear to confer a certain amount of stability to the fibril. The higher peaks of the three fold symmetric model in the RMSF calculation with all alanine side chains shows that these C$\alpha$ atoms fluctuate in their respective locations much more than the structures with all side chains included. The atoms of the striated ribbon model with only alanine side chains and those of the model with all side chains show similar patterns of respective fluctuations, but at differing magnitudes. Both models appear to follow the pattern of having a highly dynamic atom followed by several less fluctuating atoms. However, on average, the striated ribbon model with only alanine side chains has atoms that fluctuate more than the model with all side chains considered. The contribution of the side chains might be more relevant to the three fold symmetric model. The fluctuations in the residues in the three fold symmetric model seem to differ more so than the striated ribbon models. The three fold symmetric model also has more peaks of fluctuations than the striated ribbon model. Estimations of the Young’s modulus value of the model fibril structures fall in the range of $10^8$ Pa, consistent with values found in the literature. We propose possible relationships between the geometry of the fibril and the interactions that govern structure stability.

EVALUATING POTENTIAL MODIFIERS OF PARKINSON’S DISEASE USING A DROSOPHILA MODEL OF PD
Lokeshchandra Kalekar, Kevin Barton, and Bruce Chase, Department of Biology, University of Nebraska at Omaha, NE 68182; and Katerina Markopoulou, Department of Neurology, University of Thessaly, Larissa Greece

Sporadic Parkinson’s disease (PD) affects 1 to 2 percent of adults over age 50, but its etiological basis is largely not understood. Substantial insights into the disease have come from the analysis of rare forms of familial Parkinson’s disease (FPD). FPD has been associated with mutations in over a dozen loci and genes. It is striking that even in monogenic forms of FPD that arise due to the same genetic lesion, the severity of disease and the age of onset can be highly variable even within one kindred. This phenotypic variation may arise from unknown environmental contributions or genetic modifiers. Since many of the genes in which mutations cause FPD have products that function in the pathogenesis of PD, understanding the environmental and/or genetic factors that contribute to disease severity in FPD is likely to offer insight into the development of therapeutic interventions that can delay or prevent the onset of PD.
Earlier work (Markopoulou et al. (2008) *Acta Neuropathologica*, 116:25-35) demonstrated that the most severely affected member in a large kindred where FPD is caused by a dominant mutation in SNCA (the G209A mutation producing A53T alpha-synuclein) also is homozygous for a rare genetic variant at PARK2 (*parkin* 167N). Though dominant and recessive alleles at PARK2 can lead to FPD, individuals homozygous for 167N parkin do not exhibit a FPD phenotype. However, in some genome-wide association studies, S167N heterozygotes appear to have an increased risk of PD. Both 167N parkin homozygotes and A53T alpha-synuclein heterozygotes are rare, making it unlikely that multiple individuals with both A53T alpha-synuclein and 167N parkin will be identified. Thus, it is difficult to evaluate the hypothesis that 167N parkin exacerbates the phenotype associated with A53T alpha-synuclein by studying parkinsonian individuals. Therefore, we are evaluating this hypothesis using a *Drosophila* model for PD. Transgenic *Drosophila* expressing human A53T alpha-synuclein exhibit death of dopaminergic neurons and motor deficits. To assess whether parkin N167 affects the severity of the A53T-alpha-synuclein associated neurodegenerative phenotype, we are constructing doubly transgenic animals that express both A53T alpha-synuclein and N167 parkin, and evaluating the severity of dopaminergic cell death and motor deficits in these animals compared to controls with S167 parkin and animals with no parkin transgene.

We suggest that this is a useful experimental paradigm to evaluate the importance of rare genetic modifiers of dominant mutations associated with neurodegenerative disease.

A NEW COMPUTATIONAL APPROACH FOR ASSEMBLING SHORT READS
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Next-generation sequencing is quickly becoming a major platform for accelerated, in-depth research of genome features, structures, and functions through the high throughput production of short read sequences. Like a genomic puzzle, these short reads need to be assembled together before any clear insight into the original genomes features can be obtained. The sequence reads produced by next generation sequencing are short but plentiful; enough so that each region of the genome corresponds to multiple reads. Relationships between overlapping sequence reads assist the identification of fragments which are consecutive within the genome, allowing the recursive merging of these overlapping sequences until long stretches of contiguous genetic data, known as contigs, are recovered. Quite often this is a difficult task due to multiple issues that include overlap ambiguities, sequencing errors, and repeat regions within the original genome. To address the challenges of short read assembly, we developed a computational model that employs graph theoretic techniques for sequence reconstruction. The model determines overlap relationships between reads and then maps the reads and overlap relationships, respectively, to nodes and edges in an overlap graph. Once an overlap graph is established, the algorithm finds a solution to the sequence reconstruction problem by first merging highly overlapping nodes into super nodes and then traversing the reduced overlap graph. However, the presence of read errors in next generation sequencing datasets creates spurious and missing edges in the parameter that allows for inexact overlap relationships. As this parameter is relaxed, more mismatches are allowed in the overlap relationships. To test the new version of our assembler, we apply the algorithm on a number datasets that include various levels of read errors.
CCR4-NOT COMPLEX IN THE POST-TRANSCRIPTIONAL CONTROL OF Gcn4p TARGETED GENES’ mRNAs

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Gcn4p in *Saccharomyces cerevisiae* controls the gene expression of about 500 genes, including the genes encoding the amino acid biosynthetic enzymes. During amino acid starvation in *S. cerevisiae*, the expression of Gcn4p is up regulated, and it is repressed back when the cell returns back to normal conditions. The CCR4-NOT complex is one of several co-activators required by Gcn4p. Along with regulation of transcription, the CCR4-NOT complex also plays a role in the degradation of mRNAs. Ccr4p, one of the subunits of CCR4-NOT is a catalytic component of the major cytoplasmic deadynelase, and Dhh1p is involved in mRNA 5’ cap removal. The overall goal of this project is to understand the activity of the CCR4-NOT complex for the regulation of Gcn4p activated genes. We are studying how the cell returns to its normal state, i.e. how the Gcn4p activated genes are repressed after overcoming starvation. Also, we are determining how the ribosome distinguishes between the Gcn4p activated gene mRNAs and other mRNAs of the cell. We will try to determine whether the CCR4-NOT complex interacts with the Gcn4p target gene mRNAs. Recent work in the lab has shown that CCR4-NOT interacts with the ribosome. The project mainly involves determining the exact nature of the CCR4-NOT complex in the post-transcriptional control of Gcn4p targeted genes’ mRNAs. Towards this end, we are in the process of cloning the *SNO1* and *SNZ1* genes, which are Gcn4p regulated genes, for epitope tagging in order to monitor the mRNA and protein levels simultaneously in the cell. We will use these reporters in various induction experiments to see how these genes are regulated by CCR4-NOT under various conditions.

**BIOLOGICAL AND MEDICAL SCIENCES**

**SESSION B**

**POPULATION GENETICS OF SICKLEFIN AND STURGEON CHUBS IN THE MISSOURI RIVER BASIN**

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Dams within the Missouri River basin have dampened the natural oscillations of water temperature, turbidity, and flows in addition to restricting access to spawning and nursery grounds. As a result, many native fishes adapted to this variability have experienced declines in population sizes. Theory predicts that smaller populations are more prone to the vagaries of genetic drift, which may act antagonistically to localized selection. In conjunction with habitat alteration and loss of spawning habitat, the isolation of populations may potentially expose them to greater risks of extirpation. Within the Missouri River basin, populations of both sicklefin (*Macrhybopsis meeki*) and sturgeon chubs (*M. gelida*) have declined prompting the Nebraska Game and Parks Commission (NGPC) to list them as “Tier 1”, a category highlighting their imperiled and threatened status. Our primary objective is to assess the genetic health of sicklefin and sturgeon chub populations by quantifying genetic diversity, identifying population structure, and estimating effective population sizes. With the cooperation of NGPC, Montana Fish, Wildlife, and Parks, Missouri Department of Conservation, Open Rivers and Wetlands Field Station and United States Fish and Wildlife Service offices in ND and MO, chubs were collected during 2008 and 2009. A portion of the control region (mitochondrial DNA) failed to reveal
population structure as individuals distributed from Montana to Missouri had identical haplotypes. Thus we isolated microsatellite loci from nuclear DNA and genotyped more than 100 individuals of each chub species. We present early results of this research and plans for future work.

IDENTIFICATION OF ALKALIPHILIC BACTERIA FROM WESTERN NEBRASKA

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

INVESTIGATION INTO THE EFFECTS OF ECODYSTEROIDS ON SCHIZOCOSA WOLF SPIDERS

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Ecdysteroids, in particular 20-hydroxyecdysone (20E), are a group of hormones that are found in insects and other arthropods and are typically implicated in developmental processes, primarily molting. Previous experiments with the spider Tegenaria atrica showed that females injected with ecdysteroids would significantly alter reproductive behaviors and physiology. These spiders would initiate vitellogenesis without mating, had increased levels of reproductive-specific hormones in their ovaries (Pourié, et al., 2003), were completely sexually receptive, and would not cannibalize their mates (Pourié, et al., 2005). However, these studies failed to quantify the level of 20E in the experimentally treated spiders. We collected samples of a variety of Schizocosa wolf spiders from the field and quantified 20E levels by use of radioimmunoassay (RIA) of hemolymph samples collected after mating trials in order to assess a possible relationship between mating behaviors and physiology with 20E levels. Additionally, in order to confirm if 20E is acting as a molting hormone in Schizocosa species, hemolymph samples will be taken over the course of the penultimate molt cycle and measured by RIA.

THE EFFECTS OF FLY CLEANING BEHAVIOR ON BACTERIAL TRANSMISSION

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For many years flies have been known to be mechanical vectors of disease causing microorganisms. Flies have been shown to harbor over 100 different pathogens and are known to transmit more than 65 infectious diseases. Although it is known that flies clean themselves, no studies have been done to identify the effects of cleaning behavior on disease transmission. The objective
of this study was to determine if fly cleaning behavior affects the vectoring ability of three species of flies: *Sarcophaga bullata*, *Musca domestica*, and *Drosophila virilis*. These flies vary in size and in contribution to disease transmission and come in direct contact with humans and human habitats. Flies were exposed to *Escherichia coli* or *Pseudomonas aeruginosa* and were allowed to clean themselves for 0, 5, or 10 minutes. After cleaning, flies were washed in saline, and bacteria quantified by standard dilution and plating on Luria Broth Agar. For all three flies, cleaning does reduce the bacteria present on their bodies. The *D. virilis* can reduce the bacteria to the lowest levels, and this may explain why *D. virilis* is not known to transmit disease. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

THE EFFECTS OF pH FLUCTUATION ON BACTERIOPHAGE ISOLATED FROM EPHEMERAL, ALKALINE LAKES

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The pH and salinity in the hyper alkaline-saline lakes in Western Nebraska fluctuates throughout the year. It is known that bacteriophage rely on ions for attachment and infection of bacteria. Therefore, this change in ion concentration could have a profound effect on bacteriophage replication and population. Our hypothesis is that bacteria with a wide pH growth range will also have bacteriophage that have wide pH infection capabilities. We isolated phage from ten Sandhills lakes using seven host strains of bacteria that were isolated and identified by partial 16S rDNA sequencing during earlier experiments. Strains were selected because they were able to grow at a wide range of pHs. Phage enrichments were done at pH 8 and 10, and plaques isolated based on morphology and subsequently purified. We have isolated 30 different phage from five host species. We have isolated mostly lytic phage (29), but we also isolated one lysogenic phage. We have isolated more phage at pH 8 (25) than at pH 10 (5). The one phage we have tested for its pH infection range has been able to infect from pH 6 to 11 supporting our hypothesis. We have isolated other phage but have not been able find the pH infection range due to instability in both the bacteria and phage. Although incomplete, these results will help us to have a more realistic model of how bacteriophage replication changes throughout the year. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

ATRAZINE: WATER AND SOIL SAMPLES IN WESTERN NEBRASKA

Callan Driscoll, Environmental Sciences Program, and J. E. Platz and Megan Konz, Department of Biological Sciences, and E. J. Haas and Charles Cohlmia, Department of Chemistry, Creighton University, Omaha, NE 68178

Atrazine is a commonly used broad leaf herbicide applied on corn, grain and sorghum crops in the mid-western states. It is also the most widespread endocrine disrupter contaminate in soil, ground, and surface water in the United States. Hayes et al. (2001) found that exposure to 0.1 ppb atrazine resulted in sexual abnormalities including gonadal dysgenesis and testicular oogenesis in the common Leopard frog, *Rana pipiens*. More recent studies suggest that exposure to atrazine is linked to higher risks of prostate and breast cancer, hormonal, cardiovascular, lung and kidney problems in humans (Sanderson et al. 2002; MacLennan et al. 2002). During the fall of 2009, we obtained water samples from the South Platte River and surrounding waterways from Ogallala, Nebraska in Keith County to Cozad, Nebraska in Dawson County. Soil samples were also taken in the areas near known breeding sites of *Spea bombifrons*. We used an ELISA kit to determine atrazine levels. Water samples contained traces of atrazine ranging from below 0.05 ppb to 0.11 ppb. Atrazine soil concentrations were higher in general and at one site (2.4 ppb) 21 times that of our highest water sample. We are currently
validating the ELISA estimates with gas chromatography-mass spectrometry techniques. Documenting the concentrations of atrazine in western Nebraska will provide a base line for our survey of local amphibians for teratogenic effects.

IDENTIFICATION OF SIDEROPHORE PRODUCTION BY BACTERIA FROM HYPER ALKALINE-SALINE LAKES
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The hyper alkaline-saline lakes found in the Sandhills of western Nebraska are of great importance to the Nebraskan farmers and wildlife. Some of these lakes provide drinking water for cows, while others are used by waterfowl for feeding and nesting. The lakes ranges in pH from 7 to above 12, are iron poor, and are shallow. Little is known about the microbial communities of these lakes, so the purpose of this study is to investigate the oxic microbial communities of the lakes. Many of these bacteria have acquired unique structures to help them survive in these harsh environments. This study focuses on how the bacteria gather iron. Siderophores are iron-chelating molecules which aide the bacteria in the uptake of iron (III). In this study, standard siderophore assays were used to quantify siderophore production. This assay is determined by a color change from blue to orange, meaning that the siderophores chelated iron(III) and stripped it from azurol S hexahecyltrimethylammonium bromide, which is blue when complexed with iron(III). Distinctive isolates have been purified to axenic cultures, and from this the phylotype has been determined using 16S rRNA gene sequencing methods. Once sequenced, the siderophores were classified as potentially catecholate-type or hydtoxamate-type by standard chromogenic assays. By understanding these organisms and the siderophores secreted by them, we will be able to hopefully determine the processes by which bacteria obtain iron in the iron poor, hyper alkaline-saline lakes of western Nebraska. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

FUNCTIONAL DIVERSITY OF MITOCHONDRIAL β-HYDROXYACYL-COA HYDROLASES IN A. THALINA
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In plants, the classical pathway for valine catabolism likely has multiple metabolic functions for disposal of valine and of isobutyryl-CoA from diverse sources such as valine, other amino acids, branched-chain fatty acids, and phytanic acid derived from chlorophyll. These functions appear to be matched by the presence of diverse β-hydroxyacyl-CoA hydrolase isoforms. Eight distinct β-hydroxyacyl-CoA hydrolase homologs are present in the Arabidopsis thaliana genome. The functional importance of three putative mitochondrial β-hydroxyacyl-CoA hydrolase genes of A. thaliana have been examined by characterization of sequence homology, T-DNA insertion mutations, enzyme activity, and mRNA expression profiles during growth and development. The isoforms are designated as CHY4 (At4g31810), CHY5 (At3g60510) and CHY6 (At3g24360). CHY4 and CHY5 display a higher level of amino acid sequence homology and display very characteristic mitochondrial targeting sequences. The genes coding for these three proteins differ with respect to both expression profiles and effects of T-DNA insertion mutations.
D-LOOP MITOCHONDRIAL AMPLIFICATION: THREE SPECIES OF ARIZONA RANID FROGS

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Systematic studies of the Leopard frogs (genus *Rana*) of North America, currently recognize either six or seven species depending upon interpretation. The more inclusive list includes: *R. pipiens*, *R. berlandieri, R. blairi, R. sphenoecephala, R. chiricahuensis, R. yavapaiensis* and *R. subaquavocalis*. Goldberg et al. (2004) questioned the validity of *R. subaquavocalis* based on mtDNA analyses of the D-loop region and concluded that the latter species represented populations of *R. chiricahuensis*. Limited interpopulation sequence variation and lack of intrapopulation variation in presumed samples of *R. subaquavocalis* led us to wonder if pseudogene copies of the D-Loop had inadvertently been amplified. In preparation to test this explanation we used published primer sets from Goldberg et al. (2004) to carry out PCR assays of *Rana pipiens, Rana chiricahuensis*, and three individuals of *Rana subaquavocalis*. With these primers we successfully amplified *R. pipiens*, however the other two species could not be amplified under these conditions. We modified the PCR protocol to include a “hotstart” profile. This approach, combined with a touchdown PCR profile resulted in successful amplification of *R. chiricahuensis* and *R. subaquavocalis* D-loop mtDNA. Sequence comparisons among the three species, and the relative difficulty of amplification of the three, will be used a basis for a discussion of their taxonomic status.

EVOLUTIONARY DEVELOPMENT OF pH TOLERANCE IN EXPERIMENTAL *ESCHERICHIA COLI* LINEAGES

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Evolutionary changes may shift environmental tolerance ranges in organisms exposed to changing environments. This project uses lines of *Escherichia coli* propagated for 2000 generations under different pH conditions, and we are looking for changes in the lethal limits of pH for these evolved lines. As an initial part of this project, we need to determine whether faster methods are available for assessing population densities in liquid mediums than plating samples and counting colonies. We are thus investigating whether optical density (OD) readings, also known as spectrophotometric absorbance readings, can be accurately substituted for plate counts. In testing this hypothesis, we have used two ancestral lines of *E. coli* (A- and A+) and grown them in a variety of supplemented environments. We have used a combination of two solutions that create the varied environments necessary for evaluating the plates. Davis Dilute Medium 25 (DM25) and Davis Dilute Media 0 (DM0) are used in proportion such that DM25 is representative of the actual percentage of supplement within each flask. These two solutions are identical in composition, however, DM25 is further enhanced with 25 micrograms of glucose per liter while DM0 has no glucose. When the bacteria are transferred to their respective flasks containing 0%-100% DM25, the bacteria will grow to whatever density that amount of sugar allows; i.e. a 50:50 ratio of the two DM solutions should allow growth to about half the expected density of pure DM25, and the DM0 should allow no growth. We are currently generating samples of different population densities using this approach, and then taking both plate counts and OD measurements from these samples to test the generality of this OD approach.
BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

ANTIBIOTICS USAGE AND ITS EFFECT ON THE DEVELOPMENT OF ANTIBIOTIC RESISTANCE IN MEDICALLY IMPORTANT BACTERIA; A CORRELATION STUDY
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Identification of antibiotics was one of the major achievements of the previous century. However, over use (or misuse) of antibiotics have often been reported as a leading cause for the emergence of new strains of antibiotics resistance bacteria. We are interested in the antibiotic resistant bacteria in Nebraska because agriculture is such a mainstay of the economy. Literature review show that there are twenty antibiotics commonly being used in farm animals and mutation associated with 15 of bacterial genes have been reported in bacterial resistance. We are currently investigating antibiotic resistant bacteria identified in Nebraska. Our goal is to catalog the antibiotics usage in the state and collect and maintain and database of resistant bacteria.

DROSOPHILA MELANOGASTER NORA VIRUS ORF-1 PROTEIN: ANTIBODY CHARACTERIZATION OF VIRUS REPLICATION IN VIVO
Brandon Mizner, Ethan Cordes, Darby J. Carlson, Brad L. Ericson, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney, NE 68849

Nora virus is a novel picorna-like virus that infects Drosophila melanogaster and is implicated in affecting longevity in this organism. This virus has a single stranded, positive-sense RNA genome that encodes four open reading frames (ORFs). Preliminary studies using two populations of D. melanogaster show that a high viral titer exists in one population and the other population has a low viral titer. This suggests that D. melanogaster has the ability to clear the Nora virus or that the virus exhibits differential replication abilities in a strain-dependent manner. To begin to elucidate an answer to these two questions, protein studies employing a monospecific antiserum need to be initiated. The purpose of this study was to generate a monospecific antisera to Nora virus by expressing the ORF in E. coli using the pET28a protein expression vector followed by purification of the His-tagged recombinant protein. The results of this project will provide a tool to characterize a novel D. melanogaster virus and eventually provide insight into its possible role in life span regulation. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

INVESTIGATION OF THE EFFICACY OF NANOPARTICLE ANTIRETROVIRAL DRUG DELIVERY SYSTEMS
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Antiretroviral drug therapy (ART) has significantly reduced HIV-1 morbidity and improved life expectancy. However, drug expenses, treatment failures, dosing complexities, and limited global access have prevented the full utility of ART. Previous work has shown that nanoparticles (NPs) coated with a single antiretroviral drug promote sustained local drug release and deliver drug concentrations
exceeding what is reported to be necessary to inhibit HIV-1 strain replication. This project is designed to investigate the ability of nanoparticle drug carrier systems to deliver a combination of three clinically relevant ART drugs to immune cells targeted by HIV-1. Initial experiments involve the development of cellular assays to test uninfected immune cell viability and function following ART-NP loading. MTT assays, cell counts, and Cell-Titer-Glo® assays were used to assess cell viability, HPLC to assess the amount of drug in cells and media over time, and immunocytochemistry combined with confocal microscopy to observe cellular structure and ART-NP localization. Cell media was analyzed for cytokine production. The results of the controls and ART-NP treated cells were comparable. Pharmacodynamics of ART-NPs will be investigated using a hollow-fiber drug dosing system, which will simulate a central and peripheral compartment of the central nervous system and assess the ability of ART-NP to diffuse across a membrane and be phagocytosed by immune cells.

Future work will utilize bioreactor data to determine the effectiveness ART-NP to induce rapid and sustained attenuation of viral replication in HIV-1 infected immune cells. Information gathered from this project will help to determine whether nanoparticle drug carrier systems will help to overcome pharmacokinetic obstacles of ART and provide successful universal therapy for HIV-1 infected individuals world wide.

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

IDENTIFICATION OF HUMAN HERPESVIRUS TRANSMISSION SOURCE IN ZAMBIAN HOUSEHOLDS

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Human herpesvirus-eight (HHV-8) also known as Kaposi’s Sarcoma associated herpesvirus (KSHV) is the etiologic agent linked to multicentric Castleman’s disease, primary effusion lymphoma, and multiple forms of Kaposi Sarcoma (KS), including human immunodeficiency virus- (HIV) associated KS. HHV-8 is a gamma herpesvirus and its worldwide distribution is uneven, with endemic regions in sub-Saharan Africa. Previous studies have shown the prevalence of HHV-8 infected individuals in Zambia can be up to 40% and multiple routes of transmission have been observed. Blood borne and sexual transmission have both been documented but vertical transmission is not a major contributor.

In Zambia, we have found that the majority of HHV-8 infection occurs by the age of four based on a cohort study with whole households, suggesting that household contact via saliva could be the source of infection. In this study we have further determined the source of infection within the same household, based on the genotyping of the viruses from the recipients and potential donor sources. We have used the K1 gene as an indicator of relatedness of the virus, because it is the most variable gene of HHV-8 and is therefore used for subtyping. Genomic DNA is extracted from buccal swabs of patients and is tested for HHV-8 by nested PCR for the K1 gene (a 600 base-pair fragment). Genomic sequencing of K1 is performed for individuals who are PCR positive for K1, with matching sequences between individuals suggesting transmission between them.

Thus far the study has concentrated on testing 70 of the HHV-8 seropositive children, all of which are under the age of four years. Buccal swabs at 248 time points have been tested for these index cases, with 53 (75.7%) testing PCR negative for HHV-8 at all time points, and 17 (24.3%) testing positive in at least one time point. Eight (11.4%) of these cases have tested positive for K1 at least once, with HHV-8 positive results for six of these households. Of these six, potential horizontal transmission pairs have
been identified by sequence of the K1 gene from four households. We have found that the source of infection could come from both within or outside the households. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources, and grant number NIH CA-75903 and P20 RR15635 supporting the research of Zambia in the Wood lab.

RESPONSES OF SALICYLIC ACID METABOLISM RELATED TRANSCRIPTS IN THE SOYBEAN-SOYBEAN APHID INTERACTION

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Aphids are amongst the most damaging agricultural pests worldwide. In addition to withdrawing food from the host plant, aphids transmit viral disease and can cause severe responses. The soybean aphid (*Aphis glycines*) has been introduced to the Midwest, and represents a growing risk to soybean production. The development of insecticide resistance is common, and plant resistance based on antibiotic factors is often short-lived. In our study, we attempt to address this problem by examining soybeans tolerant to aphid infestation. Tolerance has a much broader genetic basis than resistance and is therefore more durable. In a previous study, subtractive hybridization was used to produce libraries that represented genes expressed uniquely or at increased levels in infested tolerant plants. Amongst the transcripts identified were a number encoding proteins involved in salicylic acid (SA) metabolism raising the possibility that SA signaling could be involved in the response of tolerant plants. In this study, we selected two genes (*npr1* and *pad4*) that are well-characterized components of SA metabolism to examine using qPCR. We will present our expression data for these genes over a time course in both tolerant and susceptible plants. Funding for this project was provided by the North Central Soybean Research Program.

SOYBEAN GENETIC RESPONSE TO SOYBEAN APHIDS AT ADVANCED DAMAGE TIME POINTS

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Aphids are perhaps the most damaging group of agricultural pests worldwide. They transmit diseases, withdraw phloem sap, and can elicit drastic responses in the plant. Recently, the soybean aphid (*Aphis glycines*) has been introduced the to Midwest, and represents a growing risk to soybean production. The development of insecticide resistance is common, and plant resistance based on antibiotic factors is often short-lived. In our study, we attempt to address this problem by examining soybeans tolerant to aphid infestation. Tolerance has a much broader genetic basis than resistance and is therefore more durable. We infested soybean plants tolerant to soybean aphid and in parallel another variety that was susceptible. We previously presented data from a 7-day post-infestation subtraction library for each type of plant. In this study, we present the data from further subtractive libraries at the more advanced damage time points of 14 and 21 days post-infestation. Putative identities and functions will be assigned to each using GenBank searches and GO ontology to allow classification of the transcripts into functional categories. This project was supported by a grant from North Central Soybean Research Project.
SEX-SPECIFIC SPLICING OF THE PEA APHID DOUBLESEX GENE
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Sex-determination mechanisms vary greatly among taxa. It has been proposed that genetic sex-determination pathways evolve in reverse order from the final step in the pathway up to the first. Consistent with this hypothesis, doublesex (dsx), the most downstream gene in the Drosophila sex-determination cascade that determines most sexual phenotypes, also determines sex in other holometabolite insects by producing sex-specific proteins through alternative splicing of the pre-mRNA. However, it is unknown whether dsx plays a role in sex-determination process in hemimetabolite insects, which take more basal positions in insect phylogeny. As a first step to address this issue, we determined the dsx mRNA sequences of the pea aphid, Acyrthosiphon pisum, which is the most immediate sister taxa to the holometabolites, in both males and females. Using the rapid amplification of cDNA ends (RACE) technique, we identified sex-specific splicing variants of the dsx mRNA, just like in holometabolites, which suggests that the mode of sex determination using sex-specifically produced Dsx proteins is ancient and predates the origin of homometabolism.

EXON-INTRON STRUCTURE OF THE IMMULECTIN-1 GENE OF MANDUCA SEXTA
Brittany Brown and Brad Ericson, Department of Biology, University of Nebraska at Kearney, NE 68849

Insect innate immunity is concentrated around two responses, the humoral and the cell-mediated immune response. Some components of the humoral immune response system are proteins that function as pattern recognition receptors. Immulectins are a specific type of receptor found in Manduca sexta. Immulectins perform a variety of tasks when challenged by microbial pathogenic agents, including recognition of lipopolysaccharide, melanization and the activation of the prophenol oxidase cascade. Our research is concerned with immulectin-1 and its sequential organization. To investigate the gene organization, we designed DNA primers from the previously published mRNA sequence, and then used the primers to amplify our DNA regions of interest via polymerase chain reaction. Products from these reactions are subsequently ligated into PCR4-Topo vector (Invitrogen) and sent to the University of Nebraska-Medical Center DNA sequencing center to determine the DNA sequence. Analysis and comparison of immulectin-1 gene structure with those of immulectins 2, 3 and 4 suggests a novel gene organization for immulectin-1. The determination of the exon-intron sequence of the immulectin-1 gene will be beneficial to the progression of understanding immunity processes in insects, as well as to support the establishment of evolutionary relatedness between the immulectins of M. sexta and other lepidopteran insects.

EFFECT OF FOOD AVAILABILITY ON IMMUNE FUNCTION
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Trade-offs exist between life-history traits such as physical activity, reproduction, and maintenance of the immune system. It has been suggested that organisms adjust immunological ability based upon a variety of factors including the amount of energy available over time. Utilizing this hypothesis, we investigated changes in immune response in the burying beetle Nicrophorus orbicollis when different food amounts were encountered. We predicted that immune function would be decreased as each beetle responded to reduced energy availability. Immunity was tested by measuring
phenoloxidase activity levels in insect hemolymph. After controlling for loss of mass due reduced energy intake, males and females showed a similar significant decrease in protein concentration and phenoloxidase activity per milligram of protein in hemolymph as their food intake was reduced. Our results support general life history trade-off theory as immune system function was down regulated due to decreasing energy availability. This would imply that in order to maintain a certain level of overall fitness, burying beetles adjust components of their physiology accordingly, including their levels of immune activity.

**Pseudomonas syringae induces changes in host plant chromatin in a type III secretion dependent manner**

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The gram-negative plant pathogen *Pseudomonas syringae* requires a type III secretion system (T3SS) and the type III effector proteins (T3Es) it injects into plant cells to be pathogenic. Although the molecular function of many effectors is still unclear, it now appears that many T3Es contribute to disease development in plants by suppressing plant innate immunity. Several recent studies have shown that a subset of effectors from various human pathogens contribute to disease development by either directly or indirectly modifying host chromatin. We think it is highly likely that T3Es of *P. syringae* are involved in modulating host chromatin and thereby gene expression of innate-immunity related genes to favor plant pathogenesis. To evaluate whether *P. syringae* induces chromatin modifications in *Arabidopsis* in a T3SS dependent manner we vacuum-infiltrated plant leaves with the wildtype strain, a TTSS mutant, several poly T3E mutants, and a buffer control. Immunoblot analysis of chromatin extracted from infected plant leaves was used to detect specific histone modifications and determine if the treatments caused changes in global chromatin modifications. We found a T3SS dependent decrease in histone H3 K9 acetylation after a 20 hour infection period. As this histone modification is typically associated with expressed genes, we are investigating the possibility that the reduced H3K9 acetylation is along innate immunity related genes. Reduced H3K9 acetylation along these genes would likely result in reduced gene expression and an associated reduced ability of the plant to resist a pathogen attack. We have determined optimal conditions for Chromatin Immunoprecipitation (ChIP) Assays and preliminary data using semi-quantitative PCR show a change of H3K9 acetylation along a subset of innate immunity and PAMP related genes in plants challenged with wildtype *P. syringae* compared to those challenged with the secretion defective mutant. We are in the process of confirming these results using real-time PCR. Together, our results suggest that during the interaction of *P. syringae* with its host plant there is a T3SS dependent change in chromatin structure of innate immunity genes.

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IDENTIFICATION OF THE RESIDUES IN THE TYPE III SECRETED TOXIN EXOU REQUIRED FOR CHAPERONE BINDING

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*Pseudomonas aeruginosa* is an opportunistic pathogen. One of the chief virulence factors of this Gram-negative bacterium is a Type III secretion system (TTSS). The TTSSs mediate the secretion of specific bacterial-encoded toxins into the cytoplasm of eukaryotic host cells. Chaperones are required for the effective secretion of some toxins, but the exact role of chaperones is still undefined. To try to further define the role of chaperones in secretion, we are examining the role of the *P. aeruginosa* chaperone SpcU in the secretion of ExoU. For this project, we are determining the residues in ExoU required for SpcU binding. Using a yeast two-hybrid procedure, we observed that deletion of either portion of the amino terminus of ExoU or its C-terminal membrane localization domain caused a loss of interaction with SpcU. These results suggest that the C-terminal MLD is required for SpcU to bind to ExoU. To confirm that the MLD is required for SpcU binding, we are performing a co-purification experiment. For this experiment, we are tagging SpcU with multiple histidine residues on its carboxy terminus. The His tag will allow easy purification of SpcU. In this report, we will report our progress in testing whether the MLD of ExoU is required for ExoU to co-purify with His-tagged SpcU.

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HOST CELL RESPONSES TO N\textsuperscript{PRO} MUTANT BVDV2 INFECTION

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Bovine viral diarrhea virus (BVDV) is a member of the genus *Pestivirus*, family *flaviviridae*. It infects many types of animals of order *Artiodactyla*. The non-cytopathic (ncp) BVDV genome has the N\textsuperscript{PRO} segment that degrades IRF-3 (Interferon Regulatory Factor-3) to reduce interferon (IFN) production from host cells. The hypothesis here is that N\textsuperscript{PRO} modulates the innate immune responses to BVDV infection and enhances virulence. A ncp-BVDV2 mutant with dysfunctional N\textsuperscript{PRO} fused with enhanced green fluorescent protein (EGFP) generated from NY93 infectious clone, NY93/clone BVDV2, and wild-type NY93-BVDV2 have been used in this research. The objectives are to characterize the replication kinetics of these viruses using MDBK (Madin-Darby Bovine Kidney) cells, and their influences on IFN-1 induction in MDBK using the NCL1-ISRE-Luc-Hygro (Modified bovine uterus) cells. Wild-type BVDV2 replicated 0.8 – 1.1 TCID\textsuperscript{50} logs higher than EGFP-BVDV2 in MDBK cells. EGFP-NY93/clone-infected MDBK cells synthesized IFN-1 significantly higher than NY93/clone-infected and wild-type-infected MDBK cells. This increase in IFN-1 synthesis may lead to a safe, effective attenuated BVDV2 vaccine.

ASSESSING PEROXIDASE GENE EXPRESSION IN BUFFALOGRASS CULTIVARS INFESTED WITH CHINCH BUGS

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Buffalograss (*Buchloe dactyloides*) is a low-growing warm season grass native to the central U.S. It is low growing and quite drought resistant. These characteristics make buffalograss appealing for home use. It however has problems, which make wide adoption difficult. The color and texture
of buffalograss are not quite the same as bluegrass, which most homeowners prefer. The other more significant problem is that most varieties are susceptible to chinch bug infestation. Susceptible cultivars will quickly turn brown when infested. Breeding efforts have largely focused on the appearance of the grass without directly considering insect susceptibility. In a previous study, we identified a peroxidase from a subtraction library of the tolerant cultivar infested with chinch bugs. In this study, we used a TaqMan gene expression assay designed from the peroxidase that we identified to determine the levels of transcript accumulation in infested and uninfested tolerant and susceptible plants. We will present our data from this study assessed over a time course. This research was supported by grants from the Nebraska Research Initiative and the United States Golf Association.

A NEW APPROACH FOR FINDING PROTEIN SORTING MOTIFS
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Translocation of proteins to their proper cellular destinations is important for the survival of any organism. Examples of known signal peptide systems include the LPXTG/sortase system and the PEP-CTERM/EpsH system. Due to the high conservation in these domains, it has been conjectured that similar sorting domains exist in other genomes. Thus, we can use motif-finding tools and multiple sequence alignment to search for such signals. Since a genome-wide search is unfeasible, we propose a Hidden Markov Model (HMM) based approach that uses properties of known sorting motifs to limit the search space. Genomes are searched using the domain profile HMM compiled from LPXTG and PEP-CTERM-containing proteins after removing the motif from the sequences. The resulting sequences have high sequence similarity to the profile, and are used in a motif finding tool and/or multiple sequence alignment to discover any motifs that may be present in the resulting sequences. We also use a reduced alphabet search option to find more sequences that contain a domain with hydrophobic amino acids followed by positive amino acids. The reduced alphabet search reduces the protein alphabet in the sequences to a subset of the original characters based on their properties, such as hydrophobicity. Using this approach, we were able to find sequences containing the LPXTG and PEP-CTERM domains in the genomes of Staphylococcus aureus and Colwellia psychrerythraea respectively, and to discover an LPXTG sorting domain in the genome of Streptococcus agalactiae. In addition, a full genome search of all bacterial genomes was performed using genomes obtained from NCBI’s Bacterial Genome Database. The search revealed many new instances of the LPXTG and PEP-CTERM domains, and discovered occurrences of additional conserved motifs, which we are currently evaluating.

SYSTEMATIC EVALUATION OF SEQUENCE COMPARISON METHODS
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Different sequence comparison methods use different algorithms, with different assumptions, which may generate very different results. Here we evaluate three sequence comparison methods, including one alignment-based method and two alignment-free methods (compression-based and vector-based) using multiple datasets, with different levels of sequence similarity. The alignment-based method relies on dynamic programming to find the optimal alignment score (e.g., similarity) between sequences. The compression-based method is built on information theory and uses compression to estimate the Kolmogorov complexity for sequence comparison. The vector-based method uses the frequencies of “words” or k-mers to represent sequences, and compares the frequencies to estimate sequence similarity. The pros and cons of each method in sequence comparison will be discussed.
BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

ANALYSIS OF NEUROGENESIS AND NEURODEGENERATION IN ATOH1-CRE DICER NULL MUTANT MICE

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Small regulatory RNAs such as microRNAs (miRNAs) and short-interfering RNAs (siRNAs) are non-coding RNAs that play a fundamental role in expression of genes and formation of protein effector complexes. Small regulatory RNAs have been implicated in neurogenesis, neuronal differentiation, neuroplasticity, neurodegeneration, and stress responses. To explore the functions of small regulatory RNAs in the nervous system, we hypothesized that Dicer, a RNase III endonuclease that regulates miRNA and siRNA function, is required for proper development, differentiation, and survival of neurons and non-neuronal cells in the central nervous system. To test this hypothesis, conditional Dicer null mutants under the control of a developmentally regulated promoter, Atoh1, were generated. Atonal/Atoh1 encodes the basic helix-loop-helix (bHLH) protein Atoh1, and is expressed in and contributes to neurogenesis in the cerebellum. Atoh1-Cre Dicer null animals begin to demonstrate tremors and ataxic behavior by ~2 weeks of age and severe seizures and death by ~4 weeks of age. To more thoroughly investigate Dicer-dependent developmental deficits, behavioral and immunohistochemical analyses were used to compare cerebellar structure and function between control and mutant mice. CatWalk-assisted gait analysis was used to assess behavioral effects of Dicer loss. Specifically, swing speed, paw angle and stand index were important in characterizing motor function. Swing speed of the paws was significantly slower in mutant mice (0.131 pixels/sec) than in wild type mice (0.416 pixels/second, p<0.0002). Paw angle, an estimate of paw axis relative to the horizontal plane, was significantly increased in mutant mice (39.4 degrees outward relative to the horizontal plane) than in wild type mice (17.7 degrees outwards relative to the horizontal plane, p<0.0198). Stand index, a measure of the speed at which the paw loses contact with the floor is significantly slower in mutant mice (0.130 pixels/sec) than in wild type mice (0.416 pixels/second, p<0.0001). Behavioral data suggests severe impairment in motor function, loss of coordination and balance in mutant mice. Immunohistochemical analysis of cerebellar structure demonstrated that granule cell layers in mutant mice are significantly narrower than those of wild type mice possibly due to compaction or loss of granular and/or Purkinje cell layer neurons. Loss of cerebellar folia or merging of folia was evident. Future goals of this study include further characterization of neurodegeneration and how it correlates with behavioral abnormalities in Atoh1-Cre Dicer null mice. Results are expected to enhance our understanding of the role of Dicer and small regulatory RNA in regulation of protein translation during neuronal development and neurodegeneration.

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NEUROTROPIC FUNCTION OF MICROGLIAL AND UNDERLYING EPIGENETIC MECHANISMS

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Previous research indicates that neuron survival, axonal sprouting, and recovery from central nervous system injury may be enhanced by soluble signaling molecules secreted by immune cells. Secretory immune cells of the brain include mononuclear phagocytes (MP) called microglia and a growing body of work suggests that activated microglia can play a role in promoting neuronal survival and neurogenesis. The potential link between the neurotrophic properties of microglial secretory cues, epigenetic changes underlying their secretion has yet to be determined. To address the neurotropic role of microglial secreted cues, conditioned media from co-cultures in which microglia were suspended above damaged or undamaged neurons were analyzed for microglial-derived cytokines using ELISA. Microglia activated by neuronal damage displayed significant increases in MCP-1, RANTES and MIP-1α and significant decreases in IFNγ, TNFα and IL-6. RT-PCR is currently being used to verify ELISA data. Western blot data were used to evaluate epigenetic changes in microglia based on modification of histone proteins. Histone modifications of interest include serine phosphorylation, lysine methylation and lysine acetylation. Preliminary western blot results show differences in monomethylation of H3 and undetectable levels of histone phosphorylation or acetylation. ChIP analysis will be used to further investigate H3 methylation and DNA interaction. Increasing our understanding of the neurotropic properties of activated microglia and the epigenetic mechanisms by which these processes occur may help improve our understanding of neuroimmune interaction during neurodegenerative diseases and traumatic brain injury.

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CELL PROLIFERATION OF PERITONEAL TISSUE BY PEROXIDE CONTAINING WHITENING PRODUCTS

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Hydrogen peroxide, the active agent found in whitening agents, whitens by decomposing into hydroxyl radicals that break down chromophore molecules into colorless molecules. Consumers can purchase whitening agents that contain hydrogen peroxide over the counter. Studies have shown that teeth whiteners containing hydrogen peroxide, if not administered correctly or according to package instructions, can increase tissue irritation and cell proliferation. This study will attempt to replicate and expand upon previous findings by examining the effects of hydrogen peroxide in the time and concentration combinations outlined for home application on peritoneal tissue of neonatal rats. Hydrogen peroxide in the form of carbamide peroxide was applied to the tissue in concentrations of 10%, 15%, and 20%; after the applications, tissue irritation and cell proliferation were assessed using the rat peritoneal explant test. It was hypothesized that at higher concentrations, cell proliferation would increase.
THE EFFECT OF THREE ESSENTIAL OILS ON CELL PROLIFERATION IN CELL CULTURE
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Bacterial resistance is an increasing problem in both hospital and community settings. There is a need for alternative antimicrobials to combat these resistant organisms. Essential oils, a secondary compound of plants, may be that alternative. There is a lot of data to support the antimicrobial properties of essential oils. Alternatively, there is very little clinical or in vivo data to support the use of essential oils in wound dressings or other clinical applications. The purpose of this study was to look at the effect of essential oils on a tissue culture taken from the peritoneum of neonatal rats. Three oils were studied: tea tree oil, oregano oil, and thyme oil. The MIC concentrations for MRSA were used since MRSA is a well known, problematic, and wide spread resistant pathogen. It was hypothesized that such low concentrations of essential oil would not have an adverse effect on the tissue cultures or on cell proliferation when compared to the controls. The results showed that two of the three essential oils studied may be safe to use in wound dressings or other clinical applications.

IN VITRO ELONGATION OF PORCINE EMBRYOS USING ALGINATE HYDROGELS AS A THREE-DIMENSIONAL EXTRACELLULAR MATRIX
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In the pig, the pre-implantation period of pregnancy is highly influential on sow productivity and therefore the profitability of swine production. Between Day 11 and 12 of gestation, the embryo undergoes a significant morphological change, during which it transforms from an ovoid structure of about 1 cm in length to a long, thin filament that can grow to greater than 10 cm in length. This transformation process is known as elongation and is critical for maternal recognition of pregnancy. It has been found that about 20% of embryonic loss is associated with the elongation process that occurs before implantation. An effective in vitro culture system could help us develop a clear understanding of the pre-implantation period of porcine embryos, in particular elongation, which in turn can allow us to identify physiological components that could be manipulated to improve pregnancy outcomes. So far, attempts to elongate porcine embryos in vitro have been unsuccessful. We hypothesize that this failure to elongate is, at least in part, caused by an inadequate culture system which lacks three-dimensional structure. Therefore, our objective is to use tissue engineering principles (i.e. scaffolds) to provide a 3D matrix in which to culture the embryos, in an attempt to establish an effective culture system that can support pig embryo elongation in vitro. In particular, we have been using alginate hydrogels as a three-dimensional scaffold. Alginate, a polysaccharide derived from brown algae that gels in the presence of a divalent cation, is an inert material that allows for gentle encapsulation of cells and tissue without any specific interaction between the cells/tissue and the surrounding hydrogel. We have investigated different hydrogel formation and encapsulation techniques with live embryos, including a bead method using alginate and calcium chloride solution, a slurry method using alginate and calcium sulfate solution, and a method of boring into pre-made alginate hydrogels. We have obtained promising data indicating embryo survival as well as evidence of elongation in vitro within the alginate hydrogels.
TERATOGENIC EFFECTS OF LOW DOSES OF NICOTINE ON EARLY AVIAN DEVELOPMENT
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Nicotine is one of the major teratogenic chemicals that cross the placenta in smoking pregnant women. Previous teratogenic studies in animals used nicotine levels exceeding those measured in human amniotic fluid of smoking mothers (100-300 nM) and were conducted at relatively late stages of embryonic development. Here, we injected physiologically relevant amounts of nicotine (10 or 100 nM) into the air sac of chicken eggs after 24 hours of development to determine its teratogenic effects in younger embryos. Specimens were collected and examined 4 days after a single nicotine injection. Embryos exposed to 100 nM nicotine were significantly smaller, as evidenced by a decrease in wet weight and crown rump length, and exhibited a higher frequency of gross morphological abnormalities. Embryos treated with 10 nM nicotine were unaffected. We also used immunohistochemistry to analyze the expression of nicotinic acetylcholine receptors (nAChRs) in very early embryos. We found expression of the $\alpha_{1/5}$ nAChR subunits in developing myotome as early as embryonic day (ED) 3, and expression of the $\beta_2$ nAChR subunit in pharyngeal arch tissue at ED 2 and in neural tissue by ED 3. Our data show that very young embryos express nAChRs and that a single exposure to a low dose of nicotine increases the risk of congenital defects and causes a significant decrease in embryonic growth rate. This project was supported by NIH grant number P20RR016469 from the INBRE Program of the National Center for Research Resources, also supported by the Nebraska Health and Human Services (LB506). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NIH.

THE CORRELATION BETWEEN MATERNAL ANDROSTENEDIONE LEVELS AND NEONATAL MORPHOLOGY OF GEOFFROY’S MARMOSETS, CALLITHRIX GEOFFROYI
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A critical period in mammalian development occurs as the offspring are exposed to a variety of chemicals in utero. This study sought to determine the correlation between maternal androstenedione levels during gestation and the postnatal growth of thirty offspring from eighteen pregnancies in Geoffroy’s Marmosets, Callithrix geoffroyi. Androstenedione levels in the mother’s urine were measured throughout pregnancy and immediately post partum using an adapted radioimmunoassay. Nine somatic measurements including mass, torso length, and various limb circumferences of the resulting viable offspring were taken throughout development and correlated with androstenedione measures. We observed significant relationships between these adrostenedione levels in utero and morphological development of the offspring. Research was supported by Grant HD 42882 from the National Institutes of Health to Jeffrey A. French.

OLFACTORY SOCIAL BUFFERING IN MARMOSETS (CALLITHRIX GEOFFROYI)
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In humans and nonhuman primates, cortisol levels increase in response to stress through the hypothalamic-pituitary-adrenal (HPA) pathway. In some situations these biological responses are advantageous, but if cortisol is elevated over long periods of time the effects can be harmful, even
neurotoxic. In humans high levels of cortisol have been associated with heart disease, depression, and greater risk for infection. In many social animals, the presence of a social partner can reduce levels of cortisol in response to a stressor, a phenomenon termed ‘social buffering’. Marmosets form strong bonds with their mates and can be used as a model to study the effects of social buffering. Previous work has shown marmosets express lower levels of excreted cortisol in response to a stressor when a pair mate is present. The behavioral cues necessary to produce this effect are those that are specific to the individual. Marmosets produce signature vocal and scent patterns. Hearing the specific vocal patterns of a pair mate is sufficient to induce a significant buffering effect. To determine if olfactory cues can also induce buffering, marmosets were exposed to a stressor in the presence of a pair-mate’s scent or that of an opposite-sex stranger. The levels of urinary cortisol in response to the stressor were measured and used to determine the presence or absence of olfactory buffering of the stress response. Supported in part by funds from the NIH (HD 42882) to JAF and an INBRE fellowship to EBH, NIH (P20 RR016469).

CENTRAL ANGIOTENSIN-(1-7) ENHANCES BAROREFLEX GAIN IN RABBITS WITH CHRONIC HEART FAILURE

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Arterial baroreflex function is impaired by over-activation of the renin-angiotensin system and elevated Angiotensin (Ang) II and has been associated with sympahto-excitation of chronic heart failure (CHF). A metabolite of Ang II, Ang-(1-7), has been shown to exhibit cardiovascular effects that are in opposition to that of Ang II. However, the action of Ang-(1-7) on sympathetic outflow and baroreflex function is not well understood. The aim of this study was to determine the effect of intracerebroventricular (ICV) infusion of Ang-(1-7) on baroreflex control of heart rate (HR) and baseline mean arterial pressure (MAP) and HR in rabbits with CHF. We hypothesized that central Ang-(1-7) would improve baroreflex control in CHF. ICV cannulas were implanted and Ang-(1-7) (2 nmol/1 µl/hour) or artificial cerebrospinal fluid (1 µl/hour) infusion was initiated by osmotic mini-pumps for 4 days in sham and pacing induced CHF rabbits (n=5-6/group). Continuous recordings of baseline HR and MAP and measurement of reflex changes in HR elicited by phenylephrine and sodium nitroprusside were then made in conscious rabbits. CHF rabbits showed elevated HR (252.2±8.9 bpm vs. 193.2±6.6 bpm, P<.05) and depressed baroreflex gain (2.5±0.4 bpm/mm Hg vs. 5.4±0.5 bpm/mm Hg, P<.05). Ang-(1-7) reduced HR in CHF rabbits (216.4±7.6 bpm vs. 252.2±8.9 bpm, P<.05) and increased baroreflex gain (7.4±1.5 bpm/mm Hg vs. 2.5±0.4 bpm/mm Hg, P<.05). The results show that central Ang-(1-7) modulates baroreflex control in CHF by lowering minimum heart rate. This suggests the modulation of baroreflex by Ang-(1-7) may be due to increased vagal tone.

EFFECT OF ANTIOXIDANTS ON DEPLETED URANIUM INDUCED LIPID PEROXIDATION

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Depleted uranium (DU) munitions are used to destroy enemy armor. However, when used these weapons leave DU fragments and dust behind in the environment where they may enter the biosphere and be ingested by humans. A number of studies have shown that DU exposure induces lipid peroxidation of the brain, kidneys, and liver and accompanying changes in behavior. This pilot study set out to determine if the co-administration of the anti-oxidants vitamin C and E during DU exposure would affect the amount of lipid peroxidation. Swiss-Webster mice were exposed to DU in drinking water (75mg/L) with one group receiving standard lab chow and another receiving the same lab chow
fortified with vitamin C (3g/Kg chow) and E (700IU/Kg chow) for two weeks. Animals were then tested in the open field maze, the elevated plus maze and water maze test of working memory. After testing the animals were sacrificed and the brains, kidneys and liver collected. The tissues were then tested for the amount of lipid peroxidation present. Compared to DU exposed animals, the mice that received anti-oxidant supplements demonstrated less lipid peroxidation in all the tissues studied. Additionally, the anti-oxidant treated animals demonstrated significant differences in their behavioral measures. These data further support the theory that lipid peroxidation is an important mechanism by which DU effects behavior and that anti-oxidant therapies may be important in treating those exposed to DU. A more detailed experiment is underway.

THE EFFECTS OF 5-HOUR ENERGY DRINK ON HUMAN MOOD, CONCENTRATION, AND ENDURANCE
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The increasing demand for students to get higher grades and for athletes to increase their athletic performance leaves many individuals exhausted. Thus, more college students and athletes rely on the assistance of an energy drink to get them through the day. The manufacturer of 5-Hour Energy Shot® claims its product will increase a person’s energy, mood, and concentration. One of the problems is that it is hard to rationalize buying an energy drink for a lot of money (i.e., $3.00 for 2 oz.) if it will not deliver results. The objective of this study was to test the claim that 5-Hour Energy Shot® increases endurance, mood, and concentration. The null hypothesis was 5-Hour Energy Shot® will not have an effect on the subjects’ energy, mood, and concentration. Five healthy volunteers, over the age of 19, served as subjects. They completed two tests measuring mood and concentration after the ingestion of either the energy drink or a placebo. Mood and concentration were tested by using a Visual Analogue Mood Scale and a Digit Cancellation Test, respectively. The subjects’ endurance was tested by timing how long they pedaled a stationary bicycle within their maximum effort range. Results of this study will be presented and discussed.

DISCARDED BOTTLES ENTRAP AND KILL SMALL MAMMALS ALONG ROADSIDES IN NEBRASKA
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Littered bottles along roadways have been known to trap and kill small mammals for nearly 50 years. In Nebraska, at least 20 species of small mammals have the potential to be trapped and killed in discarded bottles based on their small body size. The objectives of our study were to quantify the number of bottles containing vertebrate remains and to gather information about the types and position of bottles that kill small mammals in the state. We observed 548 bottles along 17.4 km of roadsides, and these bottles contained 37 individuals representing 7 species of mammals. Harvest mice (Reithrodontomys spp.) were the most commonly observed taxa trapped in glass bottles. In our study, we observed a slightly greater percentage (5.5%) of small mammals killed in bottles than in a similar study conducted in eastern Virginia (4%). Bottles positioned in an upward direction with the bottle opening higher than base had proportionally more vertebrates than bottles in other positions. Numbers of littered bottles along roads in Nebraska (31 bottles/km) were much lower than those observed in Virginia (>500 bottles/km) suggesting that the density of humans indirectly affects the quantity of vertebrates trapped in these roadside hazards. Reduction of littering or removal of litter from along roadsides would not only be more aesthetically pleasing but reduce mortality of mammals and other small animals.
LEAD CONTAMINATION IN VENISON: ENVIRONMENTAL AND RIFLE HUNTING CONTRIBUTIONS
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Lead contamination in deer venison has been documented extensively throughout the past decade as a result of the use of lead ammunition in deer hunting. Bullets have been consistently documented to disintegrate into a cloud of fragments and contaminate venison. Many studies have shown that the consumption of lead-contaminated meat is directly correlated to increased blood lead concentrations that pose several human health risks; most of them are associated with neurological and renal disorders. In this experiment, meat samples from rifle-harvested deer and archery-harvested deer will be analyzed for lead quantities. Samples from rifle and archery harvested animals will be used to respectively analyze both lead ammunition and environmental contributions to venison lead contamination. Random samples will be collected from local meat lockers as donations to this experiment. Samples will be homogenized, treated with a series of nitric acid, and sent to an outside laboratory to quantify lead concentration for each sample. It was hypothesized that the use of lead ammunition in harvesting deer would increase the level of lead contamination in venison compared to environmental levels found in archery harvested deer. Results of this study are to come later as this experiment is still ongoing.

BUTTERFLIES AND THEIR NECTAR PLANTS AT SPRING CREEK PRAIRIE AUDUBON CENTER
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We conducted ten fortnightly Pollard Transect population censuses of the butterfly community at Spring Creek Prairie Audubon Center between early June and mid October from 2005 to 2009. Spring Creek Prairie Audubon Center is a 327-hectare tallgrass prairie nature preserve near Denton in southeastern Nebraska. Its biological community includes 51 species of butterflies and over 350 species of flowering plants. Our transect included areas of native tallgrass prairie, restored prairie, deciduous forest, disturbed areas, and a butterfly garden. In addition to the butterfly counts, we also collected data on visits by butterflies to nectar plants. Data will be presented on annual variations in butterfly numbers, seasonal phenology of individual species, habitat preferences of different butterfly species, the butterfly community of the different habitats, and the nectar plants visited. Emphasis will be placed on species of particular public or conservation interest, including the Monarch and the Regal Fritillary. Our transect census information will be compared to data from annual North American Butterfly Association Fourth of July Butterfly Counts conducted at Spring Creek Prairie in July of each year from 2002 to 2009.

A FLORISTIC ANALYSIS AND COMPARISON OF PLANT COMMUNITIES IN HARLAN COUNTY, NEBRASKA
Naomi D. Hastings and Steven J. Rothenberger, Department of Biology, University of Nebraska at Kearney, NE 68849

Since the 1830’s when Thomas Nuttall first began to document the region’s flora, the Republican River Valley in Harlan County, Nebraska, has been extensively studied. However, the county flora has continually been under-represented and has been found to lack records for plants that are considered common. During the 2009 growing season, a taxonomic study and comparison of 3 different sites in Harlan County was made. Site #1 was pastureland while Sites #2 and #3 were both riparian, located on the north side of the Republican River. Collections were pressed, dried, identified, and submitted to the University of Nebraska at Kearney Herbarium (NEBK). Seventy-one new county records were verified,
including *Cyclanthera dissecta* (cutleaf-cucumber), a rare species as listed by the Nebraska Natural Heritage Program. The three sites were compared using an index of similarity (ISJ), which is based on the species in common to two given sites and species that are exclusive to each site. The two riparian sites (Sites #2 and #3) had the highest ISJ value (47.4%), Sites #1 and #2, ISJ = 43.3%; and Sites #1 and #3, ISJ = 36.7%. This study helps to document the current plant diversity of the area and updates the known flora of Harlan County, which now totals 458 species.

**THE EFFECTS OF STANOZOLOL ON MURINE THYROID FUNCTION AND ITS ABILITY TO PRODUCE THYROID HORMONE**

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There has been an increase of the use of a specific class of steroids known as the anabolic-androgenic steroids in the past three decades. The most common use is to enhance athletic performance abilities while taking multiple steroids at the same time or stacking. Research of how this class of steroids affects different aspects of both human and animal organisms has also increased. There have been many convincing studies that have shown the negative implications they can have upon the different systems within the body but there have been very few that have focused on the thyroid gland. Here, a very commonly used steroid within the anabolic-androgen class known as stanozolol, trade name Winstrol, was injected into mature male and female Sprague/Dawley rats. The objective was to determine the effects that stanozolol had upon the thyroid glands ability to produce functional thyroxine hormone (T4). TSH levels were also measured to determine if the effects were upon the thyroid itself, or upon the anterior pituitary gland. ELISA assay results concluded a significant depression of T4 levels within the treatment group and a lack of TSH depression. Ultimately this suggests stanozolol directly affected the thyroid gland in its ability to produce T4 hormone and did not affect anterior pituitary function.

**THE EFFECTIVENESS OF ESSENTIAL OILS WITH ANTI-MICROBIAL CLAIMS ON INHIBITING GROWTH OF BACTERIA COLLECTED FROM THE SURFACE OF HANDS AND ARMS**

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Essential oils have been used for a variety of purposes for many years. There have been claims that these essential oils have antimicrobial activity. The antimicrobial activity of these oils has become the basis of many pharmaceuticals and alternative medicines. The purpose of this study aims to determine if three essential oils, tea tree, thyme and oregano oil, are effective as antimicrobials against bacteria collected from the surface of hands and arms. Skin of human subjects was swabbed using Culture Swab plus and then the bacteria was grown on Tryptic Soy Agar (TSA) plates. The bacteria were then isolated and identified using a variety of agars and staining procedures. The cultures were then exposed to the essential oils. Samples were taken every six hours to determine the time-kill cultures of each species and essential oil. By looking at the percent of relative viable counts, the bactericidal effect of the essential oils was determined. The essential oil was considered bactericidal if 99.9% of the bacteria were killed within a 6 hour period.
CHEMISTRY AND PHYSICS

CHEMISTRY

APPLICATION OF VIRTUAL SCREENING TOWARDS THE FUNCTIONAL ANNOTATION OF YNDB, AN AHSA1 PROTEIN

Jaime L. Stark, Kelly A. Mercier, and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln, NE 68588; and Geoffrey A. Mueller, Laboratory of Structural Biology, National Institute of Environmental Health Sciences, Durham, NC 27709; and Thomas B. Acton, Rong Xiao, and Gaetano T. Montelione, Center for Advanced Biotechnology and Medicine, Department of Molecular Biology and Biochemistry Northeast Structural Genomics Consortium, Rutgers University, Piscataway, NJ 08854

The solution structure of the Bacillus subtilis protein, YndB has been solved using NMR in order to investigate its proposed enzymatic function. The YndB structure exhibits the helix-grip fold, which consists of a β-sheet with two small and one long α-helix, forming a hydrophobic cavity that preferentially binds lipid-like molecules. Sequence and structure comparisons to proteins from eukaryotes, prokaryotes, and archaea suggest that YndB is very similar to the eukaryote protein, Aha1, which binds to the middle domain of Hsp90 and induces ATPase activity. Based on these similarities, YndB has been classified as a member of the Activator of Hsp90 ATPase homolog-like protein (AHSA1) family with a function that appears to be related to stress response. An in silico screen of a compound library of ~18,000 lipids was used to identify classes of lipids that preferentially bind YndB. The in silico screen identified the chalcone/hydroxychalcone and flavanone classes of lipids, which was further verified by 2D $^1$H-$^{15}$N HSQC NMR titration experiments with trans-chalcone and flavanone. Both chalcone and flavanone molecules are typically found in plants as precursors to flavanoid antibiotics and signaling molecules. The symbiotic relationship between B. subtilis and plant roots suggests YndB is involved in a stress response process that senses chalcone-like molecules released by plants due to pathogen infection.

DIRECTING THE SELF-ASSEMBLY OF PORPHYRIN-PADDLEWHEEL FRAMEWORKS

Paul M. Barron, H. Chung, and W. Choe, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

The topological control of metal-organic frameworks (MOFs) has been of particular interest in materials research due to the potentially exciting applications in hydrogen storage and catalysis. These applications can be enhanced by the incorporation of open metal sites into the framework. As a result, development of methodologies for the inclusion of various metal centers into MOFs is important. Toward this end our group has been particularly interested in using the porphyrin metalloligand in conjunction with a paddle-wheel building unit to create Porphyrin Paddle-wheel Frameworks (PPFs). The metal coordination geometry and ligand functionalization are critical to controlling the framework topology and pore functionalization in PPFs. This presentation will focus on current design strategies to control the self-assembly and resulting topology of PPF structures. The result is a series of PPFs frameworks, characterized by single crystal, that contain Zn, Co, Mn, Fe, Pt, Pd, V, and Ni porphyrin metal centers.
USE OF ENZYME ACTIVE-SITE COMPARISONS TO STUDY EVOLUTIONARY RELATIONSHIPS
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Global sequence comparisons are often used for determining protein evolution, but this can be a limiting approach for distantly related proteins, especially when global sequence similarities are not readily apparent. A similar problem arises when using global structural similarity to determine these phylogenies. Proteins, as well as distinct regions of proteins, evolve at different rates. Correspondingly, it is generally accepted that active sites, or functional epitopes, evolve at a slower rate than other, non-critical residues. This provides an alternative means to identify potential functional similarities between proteins. Our Comparison of Protein Active Site Structures (CPASS) program uses only the structure and amino acid composition of active-site residues to infer a functional association through active-site similarities. CPASS uses a database of ~35,000 ligand-defined binding sites for proteins of known function. The value of using CPASS to determine evolutionary relationships between proteins based strictly on the sequence and structure similarity of ligand binding sites was investigated. This was demonstrated by comparing CPASS active-site similarities with global protein sequence and structure homologies for two different enzyme classes, PLP-dependent enzymes and ATP-bound kinases. The resulting phylogenetic trees imply that CPASS is a valuable approach to analyze the evolutionary relationship of distantly related proteins.

COMPARISON OF THE COMPUTED UV/VIS SPECTRUM OF A RUTHENIUM COMPLEX UTILIZING VARIOUS MODEL CHEMISTRIES
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Complexes of ruthenium are one of the most widely studied classes of complexes. The present DFT study examines the computed UV/VIS spectrum of a Ru$^{2+}$ low-spin complex utilizing the B3LYP method coupled with six different basis sets (LanL2DZ, SDD, DGDZVP, CEP4G, CEP31G, and CEP121G) as implemented in the Gaussian 03 software suite. The selected complex was first optimized to a stationary point on the Born-Oppenheimer potential energy surface utilizing each of the six model chemistries. Next, a TD-DFT computation of the first 30 singlet-singlet transitions was run on the optimized structures utilizing the same six model chemistries. The six spectra computed with the various model chemistries were then graphed using an in-house developed method.

HIGH-EFFICIENCY MICROPHOTOXIDATION USING MILLIWATT LED SOURCES
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Use of photochemical reactions in the organic laboratory is limited by economical light sources and need for specialty equipment. Inexpensive milliwatt light emitting diode (LED) sources allow energy- and atom-efficient, economical photochemical reactions, and are especially appropriate for microphotochemical applications. Thus, using as few as three 120 mW 627 nm LED’s for 20-30 min, methylene blue-sensitized singlet oxygen photooxidations of 30 μmol - 1.5 mmol of various arenes and 3-oxo-1,4-cyclopentadienes with a 3-5 molar excess of oxygen provides endoperoxides and (Z)-2-buten-1,4-diones in 89-98% yields.
TOPOLOGY CONTROL OF METAL-ORGANIC FRAMEWORKS THROUGH MULTISTEP SYNTHESIS
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Traditionally, metal organic frameworks (MOFs) are constructed in a one-pot synthesis. This synthetic strategy limits the control over and complexity of the product. To gain better control and to achieve more complex frameworks, multistep syntheses are being explored. In this presentation, a series of two-dimensional (2D) bilayer porphyrin paddlewheel frameworks (PPFs), including a previously unattainable structure in single phase, have been synthesized by a pillar insertion between the layers of the 2D porphyrin sheets without destroying 2D grid pattern structure. Kinetics of the transformations have been studied using UV/Visible spectroscopy.

ONE POT SYNTHESIS OF AMINES FROM HYDROPEROXY ACETALS
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Hydroperoxy acetals are generated in high yield via alkene ozonolysis in the presence of an alcohol nucleophile. The reduction of hydroperoxy acetals to alcohols can be accomplished with sodium borohydride. Herein we report the ability of a less reactive borohydride, sodium triacetoxyborohydride, to efficiently reduce hydroperoxy acetals to aldehydes. The application of this methodology as a one-pot procedure for the reductive amination of aldehydes will be discussed.

OPTIMIZATION OF POLYMERIZATION CONDITIONS FOR AFFINITY MONOLITH COLUMNS CONTAINING IMMOBILIZED PROTEINS
Erika Pfaunmiller, Rangan Mallik, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Monolithic supports in chromatography consist of a single block of a porous polymer or porous silica. Monoliths have been of great recent interest in HPLC as supports that allow fast separations and minimal operating pressures. One area of interest in which monolith columns have been used is with affinity ligands, giving a method known as affinity monolith chromatography (AMC). Much of this work has used a co-polymer mixture of glycidyl methacrylate and ethylene dimethacrylate, which has been shown to be highly effective in the immobilization of proteins such as human serum albumin (HSA). This study uses a combinatorial approach to optimize and improve upon the organic monoliths that can be used for the immobilization of HSA or other similar proteins for use in AMC. Both the co-polymer and the porogen ratios were varied in this work. Co-polymers based on glycidyl methacrylate (GMA) and ethylene dimethacrylate (EDMA) as well as glycidyl methacrylate (GMA) and
trimethylolpropane trimethacrylate (TRIM) were evaluated. The porogens cyclohexanol and dodecanol were used as co-solvents and their ratio was varied to generate a library of monoliths. These monoliths were evaluated utilizing various immobilization techniques and examined for their final protein content. Preliminary results for the GMA/EDMA monoliths indicated that a high content of cyclohexanol (48% v/v) versus dodecanol (12% v/v) leads to an increase in immobilized HSA. Results for the GMA/TRIM monolith indicated that high content of dodecanol (20% v/v) versus cyclohexanol (40% v/v) gave larger amounts of immobilized HSA. Future work will involve the use of multiple immobilization methods as well as the immobilization of other proteins to these monoliths.

DEVELOPMENT AND APPLICATIONS OF MULTI-STEP ONE-POT TANDEM CLICK TRANSFORMATIONS
James T. Fletcher, Megan J. Lewandowski, David J. Jung, and Matthew E. Keeney, Department of Chemistry, Creighton University, Omaha, NE 68178

The high chemoselectivity of the copper-catalyzed Huisgen 1,3-dipolar cycloaddition towards azide and alkyne reactants makes it highly tolerant to participation in multi-step one-pot tandem reactions. Such transformations are advantageous due to their providing a route to circumvent the isolation of intermediate products. Examples of successful incorporation of in situ azide formation from alkyl halide precursors with click reaction conditions have recently been reported in the literature. In addition to affording synthetic efficiency, in situ azide formation precludes the need to isolate potentially shock-sensitive intermediate products and provides practical access to new 1,4-disubstituted-1,2,3-triazole products. This goal of this investigation was to survey a range of electrophile reactants compatible with room temperature multi-step one-pot tandem click transformations performed in aqueous solvent mixtures. Targeted applications for this approach include the gram-scale preparation of ionic liquids and the rapid synthesis of metal-chelating units amenable to bioconjugation via solid-phase peptide synthesis. Electrophiles surveyed include allyl, benzyl and alpha-carbonyl halides with varying substitution and steric bulk. The success of such electrophiles participating in two-step and three-step one-pot transformations with terminal alkyne and trimethylsilyl-protected alkyne reactants will be presented, along with applied examples of this methodology.

ENERGY DECOMPOSITION ANALYSIS FOR OPEN-SHELL AND EXCITED MOLECULES
Nandun M. Thellamurege and Hui Li, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

A new energy decomposition analysis method is implemented to study intermolecular interactions involving open shell and electronically excited state molecules. In this method, the closed shell and ground state molecule is described by single determinant Hartree-Fock wavefunction while the excited or open shell molecule is described by multi-configuration self-consistent field (MCSCF) wavefunction. The interaction energy between the two molecules is decomposed into electrostatic, exchange, repulsion, polarization and dispersion terms. This method is used to study the interactions of a variety of excited chromophors.

CLONING AND EXPRESSION OF THE PATRIDGE PEA ENOLASE GENE
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The purpose of this research is to clone and express a gene from partridge pea, (Chamaecrista fasciculata (Michx.) Greene), which codes for the glycolysis enzyme, enolase, which catalyzes the conversion of 2-phosphoglycerate to phosphoenolpyruvate via a dehydration reaction. The full length
The gene for this enzyme has been obtained from a cDNA library. The first goal has been to fully sequence the gene for submission to Genebank. Next we worked to clone the partridge pea enolase gene using polymerase chain reaction (PCR) to add restriction cut sites to the very ends of the gene. We then inserted the PCR’d gene into pTrcHis TOPO TA plasmid and transformed into *E. coli* (DH5α). This new plasmid contains a purification tag (6xHis) that gets added to the enolase gene, which we have used for chromatographic purification. The gene was then expressed in *E. coli* and purified using Ni-NTA chromatography. The expressed recombinant enolase was then characterized for size and purity using SDS-PAGE and size exclusion chromatography. Concentration and yield were characterized using the BCA assay. The purified protein was further characterized for enzyme activity via enzyme assay and its activity compared to enolases from other organisms.

### DOCKING STUDIES AND PHARMACOPHORE MODELING OF MATRIX METALLOPROTEINASE (MMP) INHIBITORS

Theresa D. Faure, Melissa A. Wees, and Haizhen Zhong, Department of Chemistry, University of Nebraska at Omaha, NE 68182

Matrix metalloproteinases (MMPs) are members of a large family of zinc-containing, calcium-dependent enzymes involved in a variety of diseases, including cancers and arthritis. Gelatinase B (MMP-9) has been observed in a variety of pathological processes, such as inflammatory, autoimmune diseases and the metastasis of cancer cells. The vast majorities of the MMP inhibitors are hydroxamate (marimastat, and prinomastat) or reverse hydroxamate (ABT-518). The effect of the ionization state of the hydroxamates or reverse hydroxamates on the MMP binding, however, has not been elucidated. With the aim of determining the effect of ionization of hydroxamates and the effect of an active mutation (E402Q) on the ligand binding, we carried out dockings studies of 164 MMP-9 inhibitors and drug-like molecules against MMP-9 proteins. Our docking results show that the ionization state of the hydroxamates does have significant effect in determining the binding affinities between hydroxamates and MMP-9. The continuing investigation of pharmacophore modeling, database search, and biological screening for novel MMP-9 inhibitors showed that we were able to identify molecules with novel antiproliferative activity based on pharmacophore modeling generated from the hydroxamate-based inhibitors.

### DETECHIP AND WILDPLUM

Andrea Holmes, Department of Chemistry, Doane College, Crete, NE 68333

The design of a novel sensor for drugs of abuse, DETECHIP®, is described. Combining both colorimetric and fluorimetric assays, DETECHIP® is suitable for lab and field use. More than a simple “yes or no” spot test, DETECHIP® provides twenty responses for a more complete characterization of suspect material. DETECHIP® is applicable to both plant-derived and synthetic drugs, such as cocaine or Rohypnol™, being selective and easy to use. A novel compound named “Wild Plum” fluoresces blue, and has been synthesized to camouflage skin imperfections, addressing the market demand for an anti-aging product. Wild Plum imparts optical brightness, color purity, and fluorescence. It can be prepared in several shades of color and used as an ingredient in cosmetic formulations. Skin appearance before and after application of Wild Plum compounds demonstrated an improved appearance of skin including a decreased number of wrinkles. When added to make-up, lotions, creams, and powders, Wild Plum conveys the glow of healthy youthful skin, thus replacing other costly or invasive alternatives such as cosmetic surgery.
SCREENING OF CHEMICAL LIBRARIES USING ELECTROSPRAY IONIZATION MASS SPECTROMETRY
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As pathogens continue to evolve antibiotic resistance, there is a growing need to identify novel therapeutic targets. Furthermore, new techniques are required to improve the efficiency and success rate of drug discovery. Our efforts to identify novel drugs and therapeutic targets have focused on the development of nuclear magnetic resonance (NMR) based ligand-affinity techniques. The increase in sensitivity and throughput of mass spectrometry may complement these efforts. Incorporating liquid chromatography and mass spectrometry within an NMR ligand affinity screen may reduce both sample usage and cost while allowing for an increase in the size of the chemical library. A major obstacle with an MS-base drug screening assay is library design. Essentially, it is difficult to predict a priori which compounds will generate a detectable molecular-ion peak. To address this issue, a library of biologically relevant chemicals was dissolved in various buffers and analyzed using electrospray ionization mass spectrometry. This library was found to have only a 64% ionization rate. To ascertain which, if any, physiochemical factors are correlated with the ability to form a molecular ion, eDragon (http://www.vcclab.org/lab/edragon/) software was used to categorize each compound using ~1,600 molecular descriptors. These molecular descriptors were then compared to experimental ionization rates. Thus, designing a library for analysis by mass spectrometry can then use these molecular descriptors as a predictor of detectable molecular ions.

SECOND-ORDER MØLLER-PLESSET GRADIENT FOR THE POLARIZABLE CONTINUUM MODEL
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The second order Møller-Plesset (MP2) method is one of the most popular quantum chemical methods, and the conductorlike polarizable continuum model (CPCM) is one of the most popular solvation models. We implemented the energy gradient for the MP2/CPCM method that uses variationally determined Hartree-Fock orbitals and energies in the presence of the CPCM reaction field to perform second order perturbation calculations. Using our fixed points with variable areas (FIXPVA) surface tessellation scheme, continuous and smooth potential energy surfaces, as well as analytic gradients, are obtained for MP2/CPCM. This method has been implemented for a variety of MP2 programs. The MP2/CPCM method was used to study the structures of DNA/RNA base pairs in aqueous solution.

BIOSYNTHETIC MECHANISM FOR A TETRAMIC ACID-CONTAINING ANTIFUNGAL MACROLACTAM ISOLATED FROM THE BIOCONTROL AGENT LYSOBACTER ENZYMOGENES C3
Lili Lou, Yunxuan Xie, and Liangcheng Du, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Fungal infections are an important cause for mortality and morbidity in humans. With the constant emergence of drug resistant pathogens, it is an imperative task to continually develop antifungal agents with new modes of action. HSAF (dihydromaltophilin) is an antifungal compound recently isolated from the biocontrol agent Lysobacter enzymogenes, which is a bacterium effective in protecting crops from fungal diseases. HSAF exhibits activity against a wide range of fungi and shows a novel mode of action through disrupting the polarized growth of filamentous fungi. It belongs to a group of
tetramic acid-containing macrolactams, including marine natural products discodermide, cylindramide, aburatubolactam, geodin, and alteramide. This group of metabolites has unique structural features and diverse biological activities. The biosynthesis of these products has not been investigated due to the difficulties in access to these marine products and their invertebrate/microbial producers. HSAF is an ideal system to dissect the biosynthetic mechanism because it is produced by a fast-growing terrestrial bacterium that is user-friendly for genetic manipulations. We have identified the HSAF biosynthetic gene cluster and studied a hybrid PKS-NRPS gene. Using heterologously expressed enzymes, we are elucidating the molecular mechanism for the biosynthesis of tetramic acid-containing macrolactams. In addition, we have genetically manipulated the HSAF biosynthetic genes in L. enzymogenes. Our final goal is to generate new antifungal agents using rational engineering of the biosynthetic genes of HSAF.

MOLECULAR DYNAMICS SIMULATIONS OF THE ZIF268/DNA COMPLEX
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Sequence-specific DNA-binding proteins play a central role in gene regulation. The ability to accurately predict the binding of DNA-protein interactions, therefore, is extremely useful in biomedical research. ZIF268 is a Cys²His² zinc finger DNA binding domain with three independent finger motifs bound to a Guanine-rich (G-rich) sequence of DNA. To evaluate the influence of residues in the ZIF268 active site upon DNA binding, we carried out MD simulations of the ZIF268/DNA complex. The MD-based molecular mechanics generalized Born surface area (MM-GBSA) method was used to calculate the binding free energy. Our data suggested that arginines 12, 16, 22, 44, 68, and 78 are critical residues for DNA binding. The details of ZIF268/DNA interactions will be discussed.

CONFORMATIONAL CHANGES OBSERVED FOR MINERAL-BINDING PEPTIDES UPON ADSORPTION TO HYDROXYAPATITE MINERAL SURFACE
Crystal Vander Zanden, Mark V. Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Regulation of bone mineral growth during bone formation is accomplished via the interactions of noncollagenous bone matrix proteins (NCPs) with the hydroxyapatite mineral surface. NCPs regulate the size and morphology of mineral crystals, and probably also play some role in their location and orientation as well. While all NCPs have highly acidic mineral-binding sequences, some NCPs primarily play an inhibitory role while others nucleate and promote mineral growth. NCPs are intrinsically disordered proteins in solution, and little is known about the interaction of NCPs with the mineral surface. Peptide comprising mineral binding sequences from osteopontin, an NCP that primarily inhibits bond mineral growth, were synthesized, and their interactions with hydroxyapatite mineral characterized by circular dichroism and FTIR. Circular dichroism spectra confirmed that these peptides are disordered in solution. FTIR analysis suggests that osteopontin mineral-binding peptides undergo a distinct conformational change to a more ordered structure upon binding with the mineral surface. The shift in conformation occurred in the presence or absence of excess solution calcium. These results provide insight into mechanisms of crystal growth regulation at a molecular level.
COMPETITIVE TRANSITION STATES AND ACTIVATION ENERGIES EXPLAIN C-1 VS C-4 PHOTODISPLACEMENTS BY HYDROXIDE ION ON 4-NITROANISOLE

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Photosubstitutions by aqueous hydroxide ion on 4-nitroanisole have long been known to produce about 80% nitro and 20% methoxy displacement, giving, respectively, 4-methoxyphenol and 4-nitrophenol as products. A recent report claims an extraordinary temperature effect on this regioselectivity of photodisplacement by hydroxide ion in various alcohol solvents, ranging from 99:1 nitro vs. methoxy at -20 °C to 0.6:1 at 196 °C. We question these conclusions. The photoreactions reported do not appear to give mainly the products claimed. We find for aqueous solutions between 0 and 70 °C, the product ratio varies slightly near the 80:20 ratio in accord with a simple Arrhenius model for competing transition states (from the 4-nitroanisole triplet) having activation energies of 2.2 and 3.0 kcal/mol, respectively.

HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY STUDIES OF SULFONYLUREA BINDING TO HUMAN SERUM ALBUMIN IN DIABETES

Jeanethe A. Anguizola and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

The International Diabetes Federation estimates that by 2010, 285 million people around the world will have developed some type of diabetes. The number of people with diabetes has been increasing over the last 20 years, making this disease a worldwide concern. Under physiological conditions, non-reducing sugars such as glucose can react non-enzymatically with free amino groups on proteins through a process called glycation. The abnormally high concentration of glucose usually seen in diabetics has been correlated to a higher protein glycation level in these persons when compared to healthy adults. Of the numerous proteins that can undergo glycation, human serum albumin (HSA) was chosen because of its importance in the binding, transport and metabolism of different solutes and due to its implications in the pharmacological response of numerous drugs. The goal of this study was to use high-performance affinity chromatography (HPAC) to examine the binding of in vivo glycated HSA to tolbutamide, a first generation sulfonylurea drug often use in the treatment of type II (non-insulin dependent) diabetes. For this purpose, glycated HSA was isolated from the serum of diabetic patients using a commercial resin containing anti-HSA antibodies and recovered using a low pH buffer without major changes in the activity of the protein. The supports were prepared by covalently attaching the isolated glycated HSA to diol-bonded silica through the Schiff method. These glycated HSA columns were used in frontal analysis studies to determine the association equilibrium constants and binding capacity of each column for tolbutamide, while competition studies based on zonal elution provided information on the location of these binding sites. The results of this study were used to provide information on how binding to in vivo glycated HSA compares to normal or in vitro glycated HSA.

INVESTIGATIONS OF THE ROLE OF PYRIDINE ON ALKENE OZONOLYSES

Brad M. Johnson and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

The ability of ozone to cleave carbon-carbon double bonds to create various classes of carbonyl groups has made alkene ozonolysis an important reaction in organic synthesis. Added pyridine has been reported as sometimes exerting a significant influence on ozonolysis reactions. Our talk will describe our research into the influence of pyridine and related organic additives on the nucleophilic trapping of ozonolysis-derived carbonyl oxides.
Zr-DOPED CeO₂ NANO-TUBES AND NANO-WIRES AS CATALYSTS FOR CO OXIDATION
Gonghua Wang, Neil Lawrence, Joseph R. Brewer, Barry Chin, and Li Cheung, Department of Chemistry, University of Nebraska– Lincoln, NE 68588-0304

Ceria, as a strong oxygen storage promoter, has been intensively studied in the catalytic field because of its high oxidation capability. However, during catalytic oxidation reactions, its oxygen storage capacity decreases due to the reduction of surface area. Therefore we introduce a heat-resistant zirconium dopant into ceria nanostructure to increase the overall thermal stability. The smaller Zr⁴⁺ ions (0.84 Å in diameter) compared to Ce⁴⁺ (0.97 Å) and Ce³⁺ (1.1 Å) lead to the distortion of the O²⁻ sublattice in the doped oxide and hence a higher mobility of the lattice oxygen, or a higher reducibility. In this report, zirconium-doped ceria nanotubes and nanowires (ZrₓCe₁₋ₓO₂) are prepared using a hydrothermal method in a solution of NaOH with Ce₂(SO₄)₃ and various Zr salts. The mechanism for the formation of Zr-doped ceria nanotubes is based on the Kirkendall effect, in which Zr⁴⁺ ions play an important role as catalysts for the formation of the tubular nanostructures. The morphology and crystalline structure of the samples are characterized using X-ray diffraction and electron microscopy. The results reveal the distortion effect of zirconium dopant on the cubic lattice of ceria as a function of dopant concentration. The temperature-programmed reduction study suggests a facile reduction of the doped ceria samples. The catalytic measurements also confirm a higher reducibility and activity of the Zr-doped ceria nanotubes for CO oxidation, compared to the non-doped samples.

CHEMISTRY AND PHYSICS

FIRST RESULTS FROM THE ALICE DETECTOR
Bjorn S. Nilsen, on behalf of the ALICE Collaboration, Department of Physics, Creighton University, Omaha, NE 68178

In November 2009 the LHC had its first proton-proton collisions at a center of mass energy of 900 GeV and by December at 2.36 TeV. The first results from the ALICE collaboration on particle multiplicities and their distributions in 900 GeV proton-proton collision will be presented and compared to similar energy proton-antiproton collision. In addition the present status of the detector and some of its capabilities will be covered.

FIRST RESULTS FROM THE LARGE HADRON COLLIDER
Maxwell D. Gregoire, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68588-0118

With the long-awaited startup of the Large Hadron Collider at CERN comes new data that will let us explore physics at the highest energy scales ever studied in the laboratory. The proton-proton collisions in the LHC have a center-of-mass energy of 7 TeV during 2010, which is considerably higher than the center-of-mass energy of 1.96 TeV previously explored using the Tevatron at Fermilab. In this first year of data-taking, we will test particle physics theories that have been extensively tested at lower energies at these higher energies, and then start searching for new phenomena that are only expected to occur at the LHC. I will discuss the latest status of the LHC and Compact Muon Solenoid experiment, including the first physics measurements that the experiment has made, and I will also describe studies that will lead to the first observation of the top quark at the LHC. With these new energy scales we must examine the data to verify our theory regarding particle interactions at these energy scales. This new data, however, also gives us the possibility to discover
new, unpredicted physics. We are interested in a particular class of event that occurs more often at high energies in which (SOME PARTICLES) decay into a high-energy photon and a collection of quarks. We are interested in photon plus jets events because we are looking for a method of predicting the rate at which jets are incorrectly tagged as b-quarks. We hypothesize that the method in which b-quarks in photon plus jets events created is similar to said method in another type of event, W plus jets events.

COLOR MATCHING FUNCTIONS AND CONE FUNDAMENTALS
Nakul Padalkar and Chuck Blatchley, Department of Physics, Pittsburg State University, Pittsburg, KS 66762

Industrial use of color measurement and analysis has increased in the last few decades, almost all still based on color matching functions (CMFs) from the Commission Internationale de l’Éclairage (CIE), established in 1931 based on an amalgamation of two data sets by Wright and Guild. We compare the accuracy of the resulting CMFs against five more recent systems to determine whether alternative CMFs are truly better, or statistically indistinguishable: (1) CIE 1964, (2) Stiles and Burch, (3) Demarco, Smith, and Pokorny, (4) Stockman, MacLeod, and Johnson, and (5) Vos and Walraven. Computational analysis will test different CMFs and cone fundamentals using existing measurements of metameric pairs to determine which set best approximates average human visual perception. This comparison will enable a computer simulation of color differences between different sets of responsivity functions, which will display the tristimulus match predicted by each set for a given spectral radiance or reflectance data set.

OBSERVATION OF $\phi$ MESON PHOTOPRODUCTION AT RHIC THROUGH $\phi \rightarrow K^+K^-$
Jonathan Bruckman, Creighton University, Omaha, NE 68178

Ultra-peripheral collisions are collisions of nuclei with no overlap of the nucleons. The large electromagnetic fields present are treated as a flux of photons. The flux from one nucleus can interact with the other nucleus, producing a wide range of particles. At RHIC, these collisions are done with heavy ions (e.g. Gold, Copper, etc.) accelerated to relativistic speeds ($v > 0.99c$). This talk will focus primarily on the underlying physics of these types of reactions, and the techniques used for analyzing the data. The possibility of measuring the production of $\phi$ mesons through the $\phi \rightarrow K^+K^-$ decay channel will also be discussed.

DARK MATTER AND DETECTION METHODS
T. J. Torpin, Aruna P. Wanninayake, and G. Duda, Department of Physics, Creighton University, Omaha, NE 68178

Detection of dark matter is one of the most challenging and important problems in both astro and particle physics. This talk will introduce possible dark matter particle candidates and will examine the major methods used in the both the indirect and direct detection of dark matter. Direct detection methods rely on measuring the nuclear recoil when dark matter particles collide with a target nucleus within the detector. Indirect methods attempt to detect the by-products of a dark matter particle collision such as gamma-rays, neutrinos, and anti-matter. The latest results from the CDMS direct detection experiment and the Fermi gamma ray telescope will be discussed.
A METHOD FOR IDENTIFYING BOTTOM AND CHARm QUARK JETS USING THE ALICE ELECTROMAGNETIC CALORIMETER

Andrew J. Turvey and M. G. Cherney, Department of Physics, Creighton University, Omaha NE 68178

ALICE (A Large Ion Collider Experiment) is one of three major detector experiments at the Large Hadron Collider at CERN. The electromagnetic calorimeter (EMCAL), a component of the ALICE detector, is used to determine the energy deposited by particles from the collisions. Electrons and positrons can be identified because they are the only charged particles that will dissipate all of their energy in the EMCAL. Nearly all of the produced $e^+$ and $e^-$ are found in the “jets” of particles from bottom or charm quarks. The electron and positron velocities are studied in terms of their perpendicular and parallel components, with respect to the jet axis. Bottom quarks will have, on average, a greater perpendicular velocity than charm quarks. The component of the velocity parallel to the jet axis can be used to approximate the rest frame for the jet. Study of the decay of the heavy quarks in their rest frame provides a second method for distinguishing bottom quark jets from charm quark jets.

THEORETICAL DETERMINATION OF FORM FACTORS USED IN DARK MATTER STUDIES

Aruna P. Wanninayake, T. J. Torpin, and G. Duda, Department of Physics, Creighton University, Omaha, NE 68178

In direct detection experiments which search for WIMP-like dark matter, limits are placed on the WIMP-proton cross section by comparing theoretical detection rates to the actual number of observed WIMP-nucleon scattering events. However, the theoretical rate depends on several factors which are not completely well understood, such as the WIMP velocity distribution and nuclear mass form factors. This talk will discuss the calculation of the nuclear form factor for several models for the charge density. Model independent schemes will be introduced which allow for a better determination of the nuclear form factor. Finally, data from pion scattering experiments will be used to determine the degree of error introduced into WIMP-proton cross sections by assuming that nuclear charge densities track nuclear mass distributions.

ULTRA PERIPHERAL COLLISIONS AND THE TIME OF FLIGHT DETECTOR AT RHIC

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

At RHIC (Relativistic Heavy Ion Collider) two atomic nuclei are stripped of their surrounding electrons and accelerated to near the speed of light. Creighton is a member of a collaboration that studies ultra peripheral collisions through STAR (Solenoidal Tracker At RHIC), one of four detectors at RHIC. UPC’s (Ultra Peripheral Collisions) occur when two nuclei pass each other at a very short distance yet still interact with one another only through electromagnetic means. While the nuclei continue along the beam line, only altered slightly if at all, particles are produced from the interaction. Trigger detectors enable the STAR detector to select the events of interest that will go to storage. Over the past couple of years, the CTB (Central Trigger Barrel) has been replaced by the TOF (Time of Flight) trigger detector. We will discuss the impact the TOF detector has on the STAR collaboration’s study of the UPC’s.
TURN THE HEAT DOWN OR DON'T
Jacob Mathieson, Wayne State College, Wayne, NE 68787

The purpose of this study is to help determine whether or not more energy is used by a residence if the internal temperature is held constant or if energy is saved by lowering the temperature at times. A simple theoretical calculation determined that energy will be saved. This neglects several variables that could influence a residence’s energy consumption. So I measured the energy consumption of three domiciles; an apartment, a 50 year old house, and a brand new house. I compared the energy use when the temperature was held constant and when it was varied. The energy consumption vs. average external temperature was plotted and compared to the theoretical calculation.

OLBERS’ PARADOX IN AN EXPANDING UNIVERSE
Adam N. Davis, Wayne State College, Wayne, NE 68787

Olbers’ Paradox is a statement about why the night sky is dark even though in an infinite and static universe, the night sky would not be. I present a complete mathematical derivation of the paradox and extend the derivation to include universes which expand. I show that while an expanding universe worsens the problem of the paradox no observational conflicts arise because the energy density of our universe is insufficient to create a bright night sky in time frames consistent with the age of our universe.

PHOTOPRODUCTION OF PHI-MESONS IN 200-GEV AU-AU COLLISIONS AT RHIC
Olamide I. Osinkolu and Janet Seger, Department of Physics, Creighton University, Omaha NE 68178

In ultra peripheral collisions, heavy ions pass by each other at large impact parameters and do not interact through the strong interaction. The long-range electromagnetic interaction has a large cross section for the photoproduction of vector mesons. At the Relativistic Heavy Ion Collider (RHIC), collisions occur at energies high enough to produce vector mesons as heavy as the J/psi mesons in Ultra Peripheral Collisions (UPC’s). The photoproduction of the light vector meson, such as $\rho$, has been extensively studied using data obtained from the Solenoidal Tracker (STAR) at RHIC. In our presentation, we will discuss the possibility of observing the photoproduction of the $\Phi$ meson in UPC’s at RHIC through the $\Phi$ to $K_S^0K_L^0$ decay channel.

STATIC AND DYNAMIC LIGHT SCATTERING STUDY OF AQUEOUS SUCROSE SOLUTIONS
Victor Ogunjimi, Department of Physics, Creighton University, Omaha, NE 68131

I report static and dynamic light scattering study of aqueous sucrose solutions at concentrations ranging from 10%wt to 50% wt. This will include the determination of diffusive or visco-elastic states; gunnier analysis and Stoke-Einstein treatment. The adjustment made to the explanation of previous data in light of new observations will also be discussed. Measurements were taken at temperatures ranging from -10 degree Celsius to 50 degree Celsius.
DEVELOPMENT OF A DIGITAL HOLOGRAPHIC MICROSCOPE
Robert Thomen, Department of Physics, Creighton University, Omaha, NE 68178

In order to accurately and precisely measure the refractive index of living, biological cells used in the biophysical optics research, a digital holographic microscope has been constructed within Creighton University’s Biophysical Optics research group. It must scan samples, produce an interferrogram of the object, then using their respective wrapped phase data, unwrap and plot its (refractive index) x (depth). These images are then processed in order to decouple the refractive index and depth using documented decoupling methods. An exposition on data acquisition technique will be presented along with analysis methods and goals. This research was supported by grant number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institute of Health.

CORRELATION BETWEEN BIAS FIELDS AND MAGNETORESISTANCE IN CoPt BIASED NiFe/Ta/NiFe HETEROSYSTEMS
Yi Wang, Xi He, S. Sahoo*, and Ch. Binek, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68588-0111
*Seagate Technology

Exchange coupled magnetic hard layer / soft layer (SL) thin films show SL biasing in close analogy to exchange bias systems with antiferromagnetic pinning. I Here we study CoPt(35nm)/NiFe(450nm)/Ta(d)/NiFe(450nm) heterostructures with d between 0.7 and 5nm. We use AGFM and SQUID to measure the overall magnetization reversal and minor loop behavior of the top NiFe layer followed by reversal of the CoPt-pinned NiFe layer. Magnetoresistance (MR) is measured by four-point methodology and modeled using magnetization data thus confirming the assumptions of uniform rotation of the top layer and exchange spring behavior of the pinned NiFe layer. In the absence of vector magnetometry, MR provides evidence for the distinct reversal mechanisms.

Financial support by NSF, MRSEC and the NRI.

ROBUST ISOTHERMAL ELECTRIC SWITCHING OF INTERFACE MAGNETIZATION: A ROUTE TO VOLTAGE-CONTROLLED SPIN ELECTRONICS
Xi He, Yi Wang, N. Wu, K. D. Belashchenko, P. Dowben, Ch. Binek, Department of Physics & Astronomy, NCMN, University of Nebraska–Lincoln, NE 68588; and A. Caruso, Department of Physics, University of Missouri, Kansas City KS 64110; and E. Vescovo, Brookhaven National Laboratory, Nat. Synchrotron Light Source, Upton, NY 11973; and Siqi Shi, Department of Physics & Astronomy, NCMN, University of Nebraska–Lincoln, NE 68588; and Department of Physics, Zhejiang Sci-Tech University, Hangzhou, China

Promising spintronic device concepts utilize the electric control of magnetic interfaces. We present compelling evidence of a roughness-insensitive and electrically controllable ferromagnetic state at the (0001) surface of antiferromagnetic chromia. If this ferromagnetic surface is placed in close proximity with a ferromagnetic Co/Pd multilayer film, exchange coupling across a Pd interlayer induces an electrically controllable unidirectional anisotropy in the Co/Pd film. This electrically controlled exchange bias effect allows for reversible isothermal shifting of the global hysteresis loop of the Co/Pd film along the magnetic field axis from negative to positive values.
Supported by NSF through Career DMR-0547887, by NRI, by NSF MRSEC, and by the NRC/NRI supplement. K.D.B. is a Cottrell Scholar of Research Corporation.
NON-COVALENT FUNCTIONALIZATION OF BORON NITRIDE NANOTUBES WITH SIMPLE AROMATIC RINGS
Yu Zhao, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

The properties of chemically modified boron nitride nanotubes (BNNTs) with simple aromatic rings have been studied by first-principles calculations. Considering the large ionicity of BN bond, the equilibrium configuration of these complex were found to be different from the case of carbon nanotubes (CNTs): the center of the aromatic rings prefer the nitrogen site on the BNNTs surface, which would contribute to the wrapping behavior of single strand DNA (ss-DNA) on BNNTs. The qualitative trend of binding energy, which bears the signature of weak $\pi-\pi$ stacking interactions, indicates that besides dispersion effect (area of the $\pi$ orbital) and dipole-dipole interaction (polarization), electrostatic repulsion (lone pair electrons) should also be taken account when modifying BNNTs with aromatic rings.

LASER-DRIVEN ELECTRON AND X-RAY BEAMS FOR IMAGING OF DENSE STRUCTURES RELEVANT TO BIOMEDICAL APPLICATIONS
Laila Gharzai, S. Banerjee, and D. Umstadter, Department of Physics, University of Nebraska–Lincoln, NE 68588

X-rays have been the method of choice for medical imaging since they can penetrate deep into the body and also resolve small structures. The ideal x-ray device would produce photons with energy ~100 KeV with high spectral and spatial brightness, a small source size, and be compact and relatively expensive. High-power laser systems offer the possibility of producing such x-ray sources. The Diocles laser system produces electron beams with energy 10-400 MeV over an acceleration distance of 1-4 mm. These electrons can produce x-rays by Thomson scattering or betatron oscillations. These x-rays are extremely bright (109 photons/sec at 10-500 keV) and a source size of a few microns. Both electrons and x-rays from this source can be used for imaging purposes. I will use these sources to image objects of medical interest including lesions in a breast phantom of interest in cancer diagnosis. The experiments will be preceded by a survey of the requirements for effective imaging in particular the requirements to obtain the highest possible contrast and resolution for specific configurations. The imaging measurements will be performed with calibrated image plates and dose requirements for optimal imaging will be determined.

STRAIN- AND DEFECT-ENHANCED CAVITY FORMATION AND GOLD PRECIPITATION AT THE INTERFACES OF AN Au IRRADIATED ZrO$_2$/SiO$_2$/Si HETEROSTRUCTURE
Philip D. Edmondson, Chongmin Wang, Zihua Zhu, William J. Weber, and Yanwen Zhang, Pacific Northwest National Laboratory, PO Box 999, Richland, WA 99352; and Fereydoon Namavar, University of Nebraska Medical Center, Omaha, NE 68198

Zirconia (ZrO$_2$) is an important ceramic material with a wide range of potential applications in industry. In particular, it has been proposed to use zirconia as a high-k gate dielectric in the fabrication of complementary-metal-oxide-semiconductor (CMOS) devices to aid in the continued reduction in the scale of devices in accordance with Moore’s law. Recently, nanostructured materials with grain sizes <100 nm have been attracting great interest due to the ability to tailor the physical, chemical, electrical and optical properties by varying the grain size. With a view to this, we have studied the effect of 2-MeV Au$^+$ irradiation (at temperatures of 160 and 400 K) on a nano-crystalline-ZrO$_2$/SiO$_2$/Si heterostructure.
paying particular attention to the interfacial regions. During the irradiation, defect- and strain-enhanced cavity formation and Au precipitation were observed to occur at the interfaces, in addition to the loss of oxygen and a growth in the grain size of the nanocrystalline-ZrO$_2$ layer. The morphology of the cavities was observed to be dependent on the damage state of the underlying Si lattice, with elongated cavities forming when crystallinity is retained in the damaged Si substrate, and spherical cavities forming when the substrate is fully amorphised. As the ion fluence increases, the cavities appear to stabilise and begin to act as gettering sites for the Au. As the cavities become fully saturated with Au, the ZrO$_2$/SiO$_2$ interface then acts as a gettering site for further Au precipitation. We will discuss these results in terms of the diffusion of oxygen vacancies in the ZrO$_2$ film being trapped at the ZrO$_2$/SiO$_2$ interface, forming and limiting the growth of the cavities, the role of lattice strain on the morphology of the cavities, and the effect of the binding free energy of the cavities on the Au precipitation.

**RADIATION RESPONSE OF NANOCRYSTALLINE RUTILE (TiO$_2$)**

Jiaming Zhang and Rodney C Ewing, Departments of Geological Sciences and Materials Science & Engineering, University of Michigan, Ann Arbor, MI 48109-1005; and Jie Lian, Department of Mechanical, Aerospace & Nuclear Engineering, Rensselaer Polytechnic Institute, Troy, NY 12180; and Fereydoon Namavar, University of Nebraska Medical Center, Omaha, NE 68198

The radiation response of nanocrystalline materials is of importance because of its potential application to design advanced nuclear materials with mitigation of radiation damage. We report, for the first time, the results of high energy ion irradiation of nanocrystalline rutile (TiO$_2$) in dense thin-film synthesized on Si substrate by ion beam assisted deposition (IBAD). Cross-sectional transmission electron microscopy (TEM) reveals a crystal-to-amorphous transformation in the nanocrystalline rutile at room temperature under 1 MeV Kr$^{2+}$ bombardment at a fluence of $1.25 \times 10^{15}$ ions/cm$^2$, similar to the behavior of the bulk counterpart. The rutile phase remains stable upon irradiation at elevated temperature (575 K). The amorphous phase in the interfacial area between rutile and Si substrate, produced during the IBAD process, recrystallized as nanocrystals with rutile structure, which cannot be induced by only thermal annealing at 575 K. The complex interplay among irradiation-induced defect formation and crystallization, defects annealing activated by thermal energy and irradiation is discussed.

**EXPERIMENTAL STUDIES OF THE GIANT DIELECTRIC CONSTANT MATERIALS CaCu$_3$Ti$_4$O$_{12}$**

Jianjun Liu and W. N. Mei, Department of Physics, and R. W. Smith, Department of Chemistry, University of Nebraska at Omaha, NE 68182-0266

We present results of four different experimental studies, namely (1) scanning electron microscopy, (2) dielectric measurements, (3) *in-situ* high-pressure and X-ray and (4) low-temperature specific heat, on the insulating giant dielectric constant material CaCu$_3$Ti$_4$O$_{12}$. From analyzing the results, we first deduce the electronic and mechanical properties of the samples and conclude that the mechanism for high-dielectric constant phenomena is mostly extrinsic. In addition we propose a phenomenological model to explain the high dielectric constant behaviors at both low and high frequency regions.
NEGATIVE MAGNETORESISTANCE IN CHROMIUM CONTAINING DIAMOND LIKE CARBON BASED HETEROSTRUCTURES

J.A. Colón Santana, A. Sokolov, I. Ketsman and P.A. Dowben, Department of Physics and Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln, NE 68588-0111; and V. Singh, V. Palshin, and Y.B. Losovyj, Center for Advanced Microstructures and Devices, Louisiana State University, Baton Rouge, LA 70806; and E.M. Handberg and A.G. Petukhov, Department of Physics, South Dakota School of Mines and Technology, Rapid City, SD 57701

The local structure around the Cr atom, as a function of Cr content, in films of chromium-doped hydrogenated amorphous diamond-like carbon (Cr-DLC) synthesized by plasma-enhanced chemical vapor deposition (PECVD) has been characterized. The composition appears to be related to the structure and forward bias magnetoresistance in heterojunction devices. Chromium in diamond-like carbon (DLC) has a chemical state much like chromium carbide and, at low Cr content, the Cr is dissolved in an amorphous DLC matrix forming an atomic-scale composite. At higher Cr content, Cr is present as nano-composite and chromium carbide precipitates preferentially form at the surface of the film. In these films of higher chromium concentration, a large coefficient of negative magnetoresistance is observed in heterojunction devices with n-type silicon.

PIEZOELECTRIC TUNING OF EXCHANGE BIAS FROM NEGATIVE TO POSITIVE BIAS FIELDS

Srinivas Polisetty and Christian Binek, Department of Physics and Astronomy and Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln, NE 68588; and Sarbeswar Sahoo, Seagate Technology, Minneapolis, MN 55435

Tuning of the exchange bias has been attempted using magnetoelectric and multiferroic antiferromagnetic systems. Alternatively, we here propose tuning of the exchange bias shift via the piezoelectric property of ferroelectric material. A ferromagnetic Co thin film is deposited on top of a ferroelectric single crystalline tetragonal BaTiO$_3$ (001) with the help of MBE at a base pressure of 1.5×10^{-10} m bar. An ex-situ antiferromagnetic CoO thin film is naturally formed on top of the Co thin film. The piezoelectricity of BaTiO$_3$ allows to induce electrically tunable stress in the adjacent ferromagnetic Co thin film. The stress induced strain alters the magnetic anisotropy of the Co film and by that the magnetization at the Co/CoO-interface modifying the exchange bias field. This includes sign change of the exchange bias from negative to positive bias fields at different temperatures by increasing the electric field applied on BaTiO$_3$. The observed complex electric field dependence of the exchange bias field is interpreted through competition between ferromagnetic and antiferromagnetic exchange at the rough Co/CoO interface. The competition involves weakening of the negative exchange bias through deviations from collineraities of the Co and CoO interface magnetization and simultaneous activation of antiferromagnetic exchange giving rise to a crossover into positive exchange bias. Financial support by NSF through CAREER DMR-0547887, NRI and Nebraska MRSEC.
AGING IN MAGNETIC SUPERLATTICES
T. Mukherjee and Ch. Binek, Department of Physics & Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln, NE 68588-0111; and M. Pleimling, Department of Physics, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0435

Aging phenomena can be observed in non-equilibrium systems with slow relaxation dynamics. Magnetic specimens with well defined interactions and dimensions can serve as model systems for universal aspects of aging. Magnetic thin films provide access to a wide range of microscopic parameters. Superlattice structures allow tuning the intra and inter-plane exchange and enable geometrical confinement of the spin fluctuations. We use Co/Cr thin film superlattices to study magnetic aging. The static and dynamic magnetic properties are affected via the Co and Cr film thicknesses. The Curie temperature of the Co films is reduced from the bulk value by geometrical confinement. Cr provides antiferromagnetic coupling between the Co films. In-plane magnetic set fields of some 10-100 mT are applied and the sample is exposed to the latter for various waiting times. After removing the field, relaxation of the magnetization is recorded via longitudinal Kerr-magnetometry and SQUID. The relaxation data are analyzed by scaling plots revealing universal aspects of aging. Financial support by NRI, and NSF through EPSCoR, Career DMR-0547887, and MRSEC.

MAGNETOCALORIC PROPERTIES OF Co/Cr SUPERLATTICES
T. Mukherjee, R. Skomski, D.J. Sellmyer, and Ch. Binek, Department of Physics & Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln, NE 68588-0111

Nanostructured materials for refrigeration applications are experimentally realized by molecular beam epitaxial (MBE) growth of Co/Cr superlattices using mean-field theoretical concepts as guiding principles. Magnetocaloric properties are deduced from measurements of the temperature and field dependence of the magnetization of our samples. More generally, the potential of artificial antiferromagnets for near room-temperature refrigeration is explored. The effects of intra-plane and inter-plane exchange interactions on the magnetic phase diagram in Ising-type model systems are revisited in mean-field considerations with special emphasis on tailoring magnetocaloric properties. The experimental results are discussed in light of our theoretical findings, and extrapolations for future improved nanostructures are provided. Financial support by NRI, and NSF through EPSCoR, Career DMR-0547887, and MRSEC.
Reference:

MAGNETO-ELASTIC PROPERTIES OF FRUSTRATED TRIANGULAR MAGNETIC STRUCTURE: FLEXOMAGNETIC EFFECT
P.Lukashev and R. Sabirianov, Department of Physics, University of Nebraska at Omaha, NE 68182

We report results of ab-initio calculations on the magneto-elastic properties of the Mn$_3$AN (A=Ga, Zn). We show that these materials exhibit rich array of magneto-elastic phenomena, i.e. change in magnetization due to the mechanical deformation of the crystal lattice, - linear piezomagnetic, non-linear magneto-elastic, and linear flexomagnetic effects. These effects are due to the complex symmetry which combines perovskite crystal and the frustrated triangular magnetic structures. We demonstrate from first-principles calculations of the Mn$_3$AN that the external strain gradient induces...
the magnetization in these systems and it depends linearly on the strain gradient. We applied a classical Heisenberg model to simulate the effect of the strain on the frustrated triangular lattice at zero temperature. We assume antiferromagnetic interactions between nearest neighbors. Using Monte Carlo simulation of the triangular lattice we observe the induction of magnetization upon application of strain gradient. Thus, we conclude that the mechanism behind flexomagnetism is the dependence of the exchange interaction on inter-atomic distances. In particular, when external strain gradient is applied these distances become inequivalent, which results in “out-of-plane” rotations of local magnetic moments and appearance of net magnetization. We estimate the flexomagnetic coefficient to be \( \sim 2 \mu_B / \AA \).

**ORDERED-DISORDERED TRANSITION FOR CORRUGATED Au LAYERS**

Keisuke Fukutani and P.A. Dowben, Department of Physics and Astronomy, Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln, NE 68588-0111; and N. Lozova and Yaroslav B. Losovyj, Center for Advanced Microstructure and Devices, Louisiana State University, Baton Rouge, LA 70806; and S.M. Zuber, Institute of Experimental Physics, University of Wroclaw, pl. M. Borna 9, Wroclaw, Poland; and P. Galiy, Electronics Department, Ivan Franko National University of Lviv, 50 Dragomanov Str., 79005 Lviv, Ukraine

Atomic-scale structure of the growth of a gold film on (112) plane of Mo single crystal were investigated by means of low energy electron diffraction (LEED) and scanning tunneling microscopy (STM) up to 2 monolayers (ML) of gold coverage. Both LEED and STM results establish that the gold grows on Mo(112) in a layer-by-layer mode, for at least the first two monolayers of gold. A number of ordered structures are formed and both the first and second layers adopt the Mo(112) 1x1 surface structure upon completion. For some gold layers on Mo(112), notably the 1.66 monolayer 3x1 and 1.75 monolayer 4x1 gold overlayers, we find evidence of a phase transition associated with increasing disorder in gold layers with structural corrugation and anisotropic band structure. The signature of this phase transition, at temperatures in the region of 400 to 500 K, is a sharp decrease in the overlayer effective Debye temperature.

**BIOCOMPATIBILITY OF ENGINEERED NANOSTRUCTURES**

Alexander Rubinstein and Ali Khoynezhad, Department of Surgery, Creighton University Medical Center, Omaha, NE 68131; and Renat F. Sabirianov, Department of Physics, University of Nebraska at Omaha, NE 68182; and John D. Jackson, Department of Pathology and Microbiology, and J. Graham Sharp, Department of Genetics, Cell Biology and Anatomy, and Fereydoon Namavar, Roxanna M. Namavar, Hani Haider, Edward V. Fehringer and Kevin L. Garvin, Department of Orthopaedic Surgery and Rehabilitation, University of Nebraska Medical Center, Omaha, NE 68198

The biocompatibility of the implant surfaces remains the significant barrier to the development and implementation of advanced implant medical devices. The modern view on the biocompatibility of the implant surfaces (depending on medical applications) is associated with the understanding the mechanisms of nonspecific adsorption (adhesion) of the extracellular adhesive proteins (osseointegration) as well as various plasma, serum and whole blood proteins on the surfaces (blood clotting problem). Despite of a large number of experimental and several theoretical works in this field, the problem of controlling interfacial protein adsorption remains a challenge. More accurate and efficient theoretical and computational approaches are required to model protein-implant interfacial processes (on the mesoscopic scale). This modeling including description of the implant surface dispersion (roughness, defects), the solvent dielectric properties at the macromolecular interface (protein, implant surface) as well as conformational properties of proteins at the interfaces are very restricted. We are proposing a phenomenological concept that may explain the enhanced adhesion of proteins to the engineered
nanostructured surfaces compared to conventional smooth surfaces. This concept considers steric and electrostatic fit (complementarity) between interacted adhesive proteins and the surface. The steric fit concept emphasizes the van der Waals component, while the electrostatic fit is a long-range electrostatic component of the above interactions. Comparing engineered nanocystaline coating by ion beam assisted deposition (IBAD) to the most commonly used metallic and ceramic biocompatible materials with microcrystalline structures, including carbon based implants (PyC, DLC), cobalt chromium alloys, titanium, and zirconium dioxides indicates that our engineered nanostructures may be modified to result in optimal adhesion of proteins.

**DOMAIN SWITCHING DYNAMICS IN THE FERROELECTRIC POLYMERS FILMS STUDIED AT THE NANOSCALE**

P. Sharma, T. Reece, A. Rasmussen, S. Roberts, S. Ducharme, and A. Gruverman, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68588

Copolymer polyvinylidene fluoride trifluoroethylene (PVDF-TrFE) has been in talk for its potential applications in microelectromechanical systems and mass data storage devices. However, still a lot of work needs to be done to understand the static and dynamic behavior of PVDF-TrFE at the nanoscale. In this study, Piezoresponse Force Microscopy (PFM) has been used to investigate the effect of morphology on polarization distribution and switching properties of ultrathin films of PVDF-TrFE (80:20). The films were deposited on highly doped Si substrate using the Langmuir-Blodgett technique. Films morphology and crystallinity have been controlled by depositing a varying number of molecular monolayers (ML) and subjecting films to annealing. The PVDF-TrFE films of 1 ML and 3 ML thickness exhibited isolated mesas approximately 200-400 nm in lateral size. The PFM images show that the mesas are in generally in a polydomain state which can be modified by applying a bias to the PFM tip. In this paper, we report the switching studies of the PVDF-TrFE nanomesas as a function of bias magnitude and duration. The results show that the domain growth is strongly influenced by the defects, grain boundaries and the pinning centers. It is found that the domain growth is of the fractal type with the fractal dimension of ~ 1.4.

**SPIN DENSITY DISTRIBUTION IN SYSTEMS WITH FRUSTRATED TRIANGULAR MAGNETIC STRUCTURE**

P. Lukashev and R. Sabirianov, Department of Physics, University of Nebraska at Omaha, NE 68182

We present results of ab-initio calculations for the non-collinear spin density (SD) distribution in the systems with frustrated triangular magnetic structure (Mn-based antiperovskites, \(\text{Mn}_3\text{A(N)} (\text{A}=\text{Ga, Zn})\)) in the ground state and under external mechanical strain. We show that SD in the (111)-plane of the unit cell (in particular, in the atomic sphere around Mn atom) is distinctly non-uniform, i.e. both direction and magnitude of SD strongly depend on the distance from Mn site within atomic sphere. We show that the evolution of SD under external mechanical stress exhibits more diverse features than expected in the rigid spin model. In particular, under applied strain we observe the appearance of spin “domains” in the (111)-plane of the unit cell in which SD rotates in opposite directions. The rotation of SD reverses if tensile strain changes to compressive, but the shape of the “domains” stays somewhat stable. We have shown that the change in SD distribution under strain depends on the interplay of exchange interactions governing the rotation of SD in the localized high SD region and the structure of SD in the highly inhomogeneous vortex structure in the interstitial region.
**EARTH SCIENCES**

**CONCRETIONS IN NEBRASKA SANDSTONES PROVIDE CLUES TO THE HISTORY OF UTAH’S NAVAJO AQUIFER**  
David B. Loope, Richard M. Kettler, and Karrie A. Weber, Department of Geosciences, University of Nebraska–Lincoln, NE 68588-0340

In 1943, C.B. Schultz of the University of Nebraska described pipy concretions cemented by calcite from sandstones within the Arikaree Group of western Nebraska and eastern Wyoming. He showed that the concretions are oriented generally W-E and interpreted their orientation as evidence for eastward flow of ancient groundwater through these Miocene strata. Pipy concretions cemented by thick rinds of iron-oxide are common within outcrops of the Navajo Sandstone exposed in the deep canyons of Grand Staircase-Escalante National Monument in south-central Utah. We measured the orientations of 163 of these concretions over a broad area stretching from the edge of the Aquarius Plateau to the Colorado River. The concretions lie nearly perfectly parallel to one another, and are oriented NW-SE (parallel to the course of the modern Escalante River, a tributary of the Colorado). Because these pipy concretions are closely associated with joints in the sandstone, they clearly formed after the Navajo Sandstone had become lithified and folded into broad anticlines and synclines. Our work indicates that the concretions formed within the last 2 million years. Prior to two million years ago, the ancestral Escalante River already was draining the southeast slopes of the Aquarius Plateau, but it had not yet cut canyons into the Navajo Sandstone. When the Colorado River started to cut a canyon into the Navajo Sandstone, it drastically changed the hydraulic head within the Navajo aquifer. Groundwater started to vigorously flow southeastward through the Navajo Sandstone (directly beneath the bed of the Escalante River) and iron-rich carbonate concretions started to form. The carbonate minerals with the greatest iron content were later dissolved when the aquifer became oxidizing, leaving iron oxide minerals behind. As the Colorado Plateau continued to be uplifted and rivers deepened their canyons, the concretions (like those in western Nebraska) were raised above the water table and exposed on the walls of canyons and buttes.

**EVIDENCE OF A LATE PALEOZOIC FAUNAL KILL IN THE HUGHES CREEK SHALE MEMBER, FORAKER FORMATION (LATE PENNSYLVANIAN?/EARLY PERMIAN?) IN SOUTH-EASTERN NEBRASKA**  
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The Hughes Creek Shale Member of the Foraker Formation represents the regressive sequence of a typical midcontinent cyclothem. The fauna in the lower part consists of mostly large, thick-shelled marine invertebrates that include fusulinids, bryozoans, brachiopods, and echinoderms. Near the middle of the Hughes Creek, there is a very fine-grained, greasy feeling layer about 2.5 cm thick above which the rich marine fauna is not present. The greasy bed contains clay and silt-sized particles and flakes of mica indicative of a bentonite facies of altered volcanic ash. The very fine-grained sediments for about 10 cm above the ash bed are devoid of fauna and contain a few small, opaline concretions. From 10 to 20 cm above the ash bed, the sediments attain more normal marine constituents and a fauna similar to that below the ash returns at about 20 cm above the ash. The ash bed has now been documented at two separate localities. The source of the ash is not known. Fission track dates of the ash may decide whether the Hughes Creek Shale is either latest Pennsylvanian or earliest Permian in age.
IDENTIFICATION OF SUBTLE STRUCTURAL FEATURES IN THE BLACK HILLS-PINE RIDGE REGION, NEBRASKA-SOUTH DAKOTA, USA

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Structurally, the region between the Black Hills in southwestern South Dakota and Nebraska’s Pine Ridge is subtle but significant. This region is transitional between the complexly folded and faulted Black Hills and a relatively undeformed part of the craton. This study was undertaken in an attempt to understand the relationships between surface lineaments and underlying structures in the Pine Ridge region. The integration of remote-sensing techniques, well log data and field observations provides the opportunity to bring new clarity to the geological problem. Ground verification of remotely-sensed lineaments was met with qualified success. Large-scale, long lineaments were difficult to identify in the field and most remain uncorrelated with any mapped structure. Formation top data from the Nebraska, South Dakota and Wyoming oil and gas commissions were analyzed using raster GIS techniques to create subsurface elevation maps of key stratigraphic horizons. In some cases areas of steepest bedrock attitude coincide with long lineaments likely representing basement faults. Field data in the form of lithostratigraphic and structural mapping add details to this picture. Within a limited study area on the Pine Ridge near Chadron, Nebraska, fine-scale, short lineaments coincide with normal-faulted Miocene-age rocks. South-vergent small-scale thrusts were identified in the field south of Chadron. A cross-bedded feldspathic conglomeratic sandstone (maximum clast size 12 mm) of probable upper Miocene age (previously unmapped) contains angular coarse alkali feldspar clasts, metamorphic rock fragments, and southward crossbed dips. These features suggest a Black Hills origin. We interpret the conglomeratic unit as tectonic sediments shed by a tectonically active highland—a greater Black Hills block.

AN ANALYSIS OF DROUGHT IMPACTS IN KENTUCKY

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Drought has plagued Kentucky in nearly every decade since climate records have been kept. Although impacts from drought may be widespread, they have not been properly documented. This research attempts to document and analyze how drought has impacted Kentucky (with a particular focus on the drought that occurred in 2007), and to assist members of the Kentucky Division of Water in devising a state drought plan that emphasizes mitigation instead of response. Impacts from the drought of 2007 were determined by collecting and archiving a sample of news reports from around the state. Due to the high number of reports of impacts on agriculture and water supplies, they were determined to be major impacts. Impact reports concerning recreation and tourism, wildfire, plant and animal species, and small businesses were less prevalent and were determined to be minor impacts. To address the major impacts, surveys were distributed to members of Kentucky’s Cooperative Extension Service and municipal water companies to determine how prepared they were for the drought of 2007. For minor impacts, data were obtained from various institutions to further analyze their significance. It was found that drought impacts should be more frequently documented, and that should be done by facilitating routine surveys to stakeholders and by enhancing communication between stakeholders and with state and federal agencies. Further research should be done to identify how potential future issues, such as population change, may impact the vulnerability of various sectors to drought if it continues to play a role in Kentucky’s climate.
CONTROLS ON GEOMORPHOLOGY OF STREAMS FLOWING OFF THE PINE RIDGE, NORTHEASTERN NEBRASKA

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The Pine Ridge is a southwest-northeast trending escarpment in northwestern Nebraska. Numerous groundwater-fed streams flowing to the north off the escarpment are tributaries to the White River. Analysis of these streams’ gradients, discharge and watershed topography can be used as tools for understanding the interaction between surface water and ground water as well as the geomorphic evolution of the Pine Ridge region. Streams are sensitive to tectonic events, and analyzing their profiles can help identify tectonic features. They are also an important source of water for the vegetation, wildlife and culture of the region. Discharge measurements in several Pine Ridge streams made in the summer of 2009 indicate a complex interaction between surface water, ground water and bedrock geology. Each stream has a unique discharge trend, with the only common trend being a gaining reach near the head of each stream. Discharge data from one stream shows a highly varied change in discharge near its head and therefore does not fit the trend. Further analysis of discharge data, longitudinal profiles and lineament/stream coincidence will be needed to determine their interrelationships.

ASSESSING THE FEASIBILITY OF MONITORING NITRATES AND PHOSPHATES IN CHADRON CREEK, NORTHEASTERN NEBRASKA

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Chadron Creek is one of the main water sources for the city of Chadron, Nebraska. According to the city’s water supplier, contamination in the stream is assumed to be significant, due to the watershed being used by cattle, farms and wildlife. Chadron Creek’s water quality is currently being monitored by the Chadron State College Watershed Team (WST). Five parameters are being currently tested: pH, temperature, conductivity, total dissolved solids (TDS) and dissolved oxygen (DO). This research is intended to assess the feasibility of monitoring total orthophosphate and nitrate levels as an addition to the current WST parameters. EPA maximum contaminant level (MCL) for nitrates in drinking water is 10 ppm. There is no specific EPA MCL for orthophosphates, although the EPA recommends that the concentration of total phosphates not exceed 0.1ppm in streams in order to avoid eutrophication. Three duplicate samples were taken from each of three sites on Chadron Creek for both nitrate and total orthophosphate determination. The water samples were tested for nitrates by using an Orion™ nitrate electrode. Phosphate determination was done using the ascorbic acid method. Preliminary assessment of the data shows nitrate levels were much greater than 5ppm on all sites during sampling dates in November and December 2009. Phosphate levels were found to be less than or near to 0.1ppm on all sites during the sampling dates. According to these results, continuing the monitoring of nitrates is highly warranted. Continued phosphate monitoring, while not as justified as nitrate monitoring, could still provide complementary data that can contribute towards a better understanding of the state of Chadron Creek’s water quality.
DETERMINING THE PATHWAYS OF CALCIUM IONS BY EXAMINING NATURALLY OCCURRING HOT SPRINGS OF THE FALL RIVER, HOT SPRINGS, SD

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Naturally occurring hot springs are found as a result of geothermally heated groundwater emerging from the crust. Hot springs are valued for their high mineral content, and are thought to have some medicinal and healing values. Using the flow rate and temperature of the Fall River at Hot Springs, SD, locations of the naturally occurring hot springs that feed into this river were identified and serve as reference points for the analysis of water chemistry. Using atomic absorption spectroscopy, calcium ion concentrations of the river water above, at, and below the identified reference points were analyzed, as well as samples of pure spring water. Calcium ion concentration increases abruptly at the first large spring and remains at high levels until the confluence with the Cheyenne River, even though the temperature steadily decreases in this reach. The calcium data suggest that this ion is being dissolved into solution mainly as a result of the increased temperatures of the springs, and is not precipitating out at a rate comparable to the spring input rate.

WAVELET INSPIRED ANALYSIS OF DISCRETE ATMOSPHERIC DATA

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Mathematical decompositions have been widely used throughout the scientific community to study atmospheric processes. One such decomposition is the wavelet transform. Wavlet decomposition allows for the temporal localization of spectral changes in a signal. Here, a Haar discrete wavelet decomposition is used to study the underlying statistical structure in several atmospheric variables. Some of this statistical structure is not evident from visual examination of the raw time series but becomes more evident when using wavelet analysis techniques. In this study, tipping-bucket rain gauges and a sonic anemometer were used for data collection. Tipping-bucket rain gauges are discrete instruments that indicate when a specified volumetric accumulation interval (here 0.01 inch) has been surpassed. The time of this accumulation (‘tip’) is then recorded. The rain gauges were placed in a five by six array with approximately 1.5 meter spacing. Additionally, a sonic anemometer – collecting wind velocity and temperature data at 32 Hz – was used. Data collected showed the expected diurnal signal in temperature data. Multiple interesting physical signatures are identified from the wavelet decomposition of this data.

DIRECT IMAGING OF RAINDROP IMPACTS

Josh Beck, Michael L. Larsen, and Aaron Clark, Department of Physics, University of Nebraska at Kearney, NE 68849

One of the greatest challenges of drop-by-drop rain characterization is automated localization. In the past, it was necessary for researchers to engage in the strenuous task of manually identifying and reading, one at a time, positions of drop arrivals on a specially prepared surface. This would take much of time to accomplish and would yield a relatively small amount of data to be processed. In an effort to make the process easier, faster, and increase the amount of data gained, we used MATLAB, software included with our high speed camera, and various programming techniques to successfully develop an algorithm for edge detection on a compound image. This algorithm has been used on various images. It can successfully infer the relative position of raindrop arrivals for a drop-by-drop detection area. The algorithm can be used on images of raindrops to identify the position of drop arrivals to ultimately gain a better understanding of rain microphysics.
FILTER PAPER BASED DISDROMETER
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This research re-investigates a technique pioneered in the 1960s to use filter paper to determine the size and distribution of raindrops. To improve this technique, we have built a mechanical device to move the filter paper automatically during a rain event. The filter paper is treated with a chemical so that arriving water drops leave a stain, similar to standard colored tissue paper with water spilled on it. From the stain left by the water droplet, the original drop size can be determined. Assuming that the relationship between the diameter of the stain and actual diameter of a water droplet can be described via a simple power-law, we can explore the true raindrop size distribution and its evolution in time and space. Historically, one of the challenges of this technique was protecting or drying the filter paper before the data were compromised due to paper bleed-through. In order to combat this dilemma, a digital camera is used to record the image of the filter paper before collection. Instead of the painstaking, labor-intensive method of measuring each stain by hand, we are able to use a camera to examine the data digitally. Then, with computer software we wrote, the information is analyzed to determine the area of the stain. From the area, the diameter of stain can be determined and correlated to the diameter of a raindrop. In order to combat different densities of rainfall during an event, part of the device covering has been made adjustable to expose the filter paper for more or less time. Ultimately, this information will help better our understanding of atmospheric phenomena and storm evolution.

AFFORDABLE WAYS OF MEASURING RAIN ONE DROP AT A TIME
Michael L. Larsen, Department of Physics, University of Nebraska at Kearney, NE 68849

Microphysical studies of rain rely on detailed knowledge of raindrop size distributions. These size distributions are known to vary as a storm evolves and from place to place within a storm. Being able to fully characterize how the raindrop size distribution evolves in time and space is a central problem in atmospheric microphysics and could yield clues to raindrop dynamics, aerosol sources, and precipitation accumulation variability. In an effort to reliably measure this size distribution at several locations on a modest budget, the Atmospheric Physics research group at UNK has developed a multifaceted approach to drop-by-drop rain measurement. A variety of instruments – using various physical properties of raindrops – are currently under development. Preliminary results have shown that it is possible to obtain reliable scientific data about raindrop arrivals using instruments far less expensive than currently commercially available instruments.

DEVELOPMENT OF AN ACOUSTICAL RAINDROP DISDROMETER
Kyle A. McClary and Michael L. Larsen, Department of Physics, University of Nebraska at Kearney, NE 68849

We are creating an acoustical disdrometer that is sensitive to raindrops 1-5 mm in diameter. Using a dedicated circuit and custom built “cup” devices, we convert an acoustical signal into a measurable voltage reading. Our ultimate goal is to build a dependable and accurate disdrometer that can be used to analyze ground-truth radar measurements, test rainfall size distributions, and investigate the statistics of the time series generated by arriving raindrops. Similar but more expensive solutions to this problem exist commercially. Our current device costs approximately $30-40 to build, compared to about $15,000 for the most similar commercial instrument (the Joss-Waldvogel disdrometer). Our goal is to calibrate this device to compete with commercial disdrometers in areas such as cost efficiency, variable size detection, and ease of data acquisition. Results so far indicate that the circuit is able to detect simulated drops from 0.5 – 5.0 mm in diameter. Through further calibration, we hope to have a working prototype by fall 2010.

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HISTORY AND PHILOSOPHY OF SCIENCE

Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha, Nebraska, 68106

Since the beginning of human history mankind has attempted to provide an explanation for the origin of humans and other creatures. The Jewish and Christian communities explained the origin of living organisms and their adaptations to their environment to an all knowing God. The idea that organisms may change by natural processes was not investigated as a biological process until the Middle Ages.

Numerous individuals, including Gregory of Nyssa, Augustine, Thomas Aquinas, Paley, Redi, Pasteur, Lamarck, Erasmus Darwin, Charles Lyell, Charles Darwin and others set the stage for the theological and scientific underpinnings of the theory of evolution.

DID INDUCTION AND EMPIRICISM PLAY A ROLE IN DARWIN’S DEVELOPMENT OF HIS THEORY OF NATURAL SELECTION?
Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha, Nebraska, 68106

The principle of induction is linked to its founder Francis Bacon (1561-1626), an English statesman and essayist. Bacon played a role in shaping modern science as he was critical of the prevailing metaphysical speculations of medieval scholastic philosophers. In the nineteenth century John Stuart Mill (1806-1873), an English philosopher and economist, was an influential proponent of the principle of induction. Francisco Ayala suggests that Bacon and Mill proposed induction as a means of achieving “objectivity,” while avoiding subjective preconceptions.

In his Autobiography, Darwin asserts that he proceeded based on Bacon’s principle of induction and without any theory collected facts on a wholesale scale. But in his notebooks and correspondence Darwin suggested that he came upon the idea of natural selection in 1837, some years before he speculated on the subject, suggesting that the facts are very different from his claims of using the principle of induction.

TEACHING OF SCIENCE AND MATH

DETERMINING THE NITRATE, ARSENIC AND ATRAZINE LEVELS ALONG THE PLATTE AND REPUBLICAN RIVERS
Randall Lienemann, Franklin Public School, Franklin, NE 68939; and Mike Zarate, Lexington Public School, Lexington, NE 68850

It is easy to see and understand the value of managing and teaching natural resources found in Nebraska. With the Republican River Compact and talk of diverging Platte River water into the Republican Water Basin, one needs to be certain our water supply is clean of any contaminates. In order to test the aquifers along the Platte and Republican rivers we decided to collaborate. We plan to have the students from our schools test the ground and surface waters for arsenic, coliform bacteria, nitrates, and atrazine along these two rivers using EPA and state approved methods and standards. By testing these water supplies, we can make sure the water is safe for wildlife and human consumption, as well as educate the private landowners in how to maintain a clean water supply.
Pollution in these water supplies may come from point or non-point sources. The presence of coliform bacteria in drinking water sources is indicative of contamination and must be considered a threat to human health. During spring planting time atrazine is commonly used as a corn and sorghum herbicide, which moves from the rivers into an aquifer and well field via induced discharge. The concentration of atrazine in the river is dependent upon time of year and precipitation in the river basin. Our students will conduct a study to determine the travel times and mechanics of movement of atrazine near the two rivers. Additionally, students will test water for coliform bacteria, arsenic, and nitrates levels.

**PUSHING ARROWS: THE STEPWISE DEVELOPMENT OF ARROW PUSHING SKILLS**
Josh Yost and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

The introduction to mechanisms in organic chemistry is often the first exposure by a student to this way of understanding and explaining reactions. The difficulty of this process is demonstrated by the multitude of texts and articles published to help students understand this perspective on organic reactions. A series of problems were developed to help students understand the concept of reaction mechanisms. The worksheets developed use a “build up” approach to get students to understand the rules and principles of organic mechanisms. The worksheets start from simple one step reactions, to interesting pharmaceuticals, to biosynthesis mechanisms. This approach allows students to gain a better understanding of reaction mechanisms and to give them the knowledge base to be confident in predicting future reaction mechanisms.

**USING MOLECULAR ORBITALS TO ILLUSTRATE AND UNDERSTAND ORGANIC REACTIONS**
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The use of molecular orbitals in organic chemistry has been growing dramatically over the last decade. The advent of easily accessible desktop molecular modeling programs, such as Spartan and Gaussian, allow orbital surfaces to be generated quickly. Animations showing how reactions proceed are also very abundant. A combination of molecular orbitals and reaction paths are studied to acquire an understanding of how a reaction proceeds along a typical reaction path. A study of the HOMO-LUMO orbitals, bond formation, transition states, and orbital overlaps can help describe how and why a reaction proceeds the way it does. The molecular modeling was completed using Spartan ’08 semi-empirical AM1, PM3 and/or DFT computational method B3LYP/6-31G*. The reactants are brought together along reaction path from about 5Å apart to the final bond lengths. Common undergraduate chemistry reactions, such SN1, SN2, Diels-Alder, bromonium ion reactions, are studied.

**ENHANCING LABORATORY SAFETY INSTRUCTION: INTRODUCING MSDS SHEETS INTO THE FRESHMAN LABORATORY**
Kendra Timm and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

Material Safety Data Sheets (MSDS) are ubiquitous in both the public and private sectors. Federal Right-to-Know laws have mandated that MSDS be available to any individual who works with or is exposed to chemicals in their place of work. The utility of MSDS to any individual is controlled by the ability to interpret the information summarized in safety sheets as well as access to the sheets. Most
freshman level laboratory materials do not address the safety information in MSDS when they present safety guidelines for laboratory activities. Supplemental materials and activities designed to introduce MSDS to General Chemistry students will be presented.

**COLLEGIATE ACADEMY**

**BIOLOGY**

**SESSION A**

**INDIRECT TREE RECRUITMENT BY SMALL MAMMALS AS SIGNIFICANT DISPERasers**

**OF SWARTZIA CUBENSIS AND DIALIUM GUIANENSE SEEDS IN A NEOTROPIC FOREST**

Eric A. Noel, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and B.R. McMillan, Department of Plant and Wildlife Sciences, Brigham Young University, Provo, UT 84602; and J.A. Yunger, Department of Biological and Environmental Sciences, Governors State University, University Park, IL 60466

Through seed dispersal and predation, terrestrial mammals should be an important component of the mechanisms that determine patterns of tree recruitment in tropical forests. Despite their great abundance in Neotropical forests, small rodents as seed predators and dispersers remain largely forgotten by population-recruitment analysts. In order to identify the small mammal species within the study area, a live-trap small-mammal census was conducted at the Las Cuevas Research Station in Belize. Individuals were marked with ear tags and data was taken on tag number, species, sex, body mass, reproductive condition, hair sample and capture location. To investigate the fates of seeds in a hunted primary forest in Belize, we placed seeds of *Swartzia cubensis* Britton & Wilson and *Dialium guianense* Steud into three treatment types: 1) open control plots accessible by all size classes of animals, 2) exclosures accessible only to small mammals and 3) exclosures excluding small and large mammals. The exclosure and trapping experiments in combination showed that the spiny pocket mouse, *Heteromys desmarestianus* Hall was the dominant handler of both seed species. Most of the seeds were killed immediately upon removal, but many of the seeds (3-18%) were dispersed and buried (scatterhoarded) by *Heteromys* and therefore protected from predation by other animals. Results of this study supported predictions by previous researchers that small rodents are dominant terrestrial granivore dispersers in Neotropical forests. The role of small rodents as seed dispersers, however, has never been fully appreciated.

**A YEAR LONG VIEW OF THE SEASONAL AND DIEL PRESENCE OF HUMPBACK WHALES IN THE ANTARCTIC**

Taryn L. Overton, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and S.V. Parijs, Protected Species Branch, Northeast Fisheries Science Center, Woods Hole, MA 02543-1026; and I.V. Opzeeland, Ocean Acoustic, Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany 27515

Large gaps still exist in our understanding of the fundamental ecology of Antarctic marine mammals, as investigations are severely hampered by the animals’ inaccessibility. In particular there is little information on long term seasonal trends and distribution patterns of most Antarctic whale species. Improving our understanding of these species and the effects that changes in habitat might have on survival is vital, as current climatic trends are rapidly altering the polar environments. The PerenniAL Acoustic Observatory in the Antarctic Ocean (PALAOA) was constructed in 2005 to obtain real-time, year-round broadband underwater acoustic data from the Antarctic coastal ocean. The observatory utilizes a hydrophone array deployed underneath the Antarctic ice shelf to autonomously
and continuously record the underwater soundscape. The PALAOA recordings contain a variety of cetacean vocalizations, as well as vocalizations of four Antarctic pinniped species. The recordings enable characterization of seasonal patterns in species specific acoustic repertoire size, composition and call activity. This project focused on analyzing the detector results of humpback whale moan calls in acoustic data collected across 12 months in 2008. Results showed seasonal patterns in calling with a peak in March/April and small numbers of calls in August. These results demonstrate that humpback whales are present off the Antarctic Peninsula in the Austral fall and winter. The calling peak for March/April was short in duration lasting around five days (3/27/2008 to 4/2/2008), while the remainder of those months and in August calls were present in small numbers. Diel patterns showed a peak in March at 2300 and April had a peak at 0700. When the two months were combined, the peak was at 0700. Too few calls were present in other months to look at diel patterns. Future analyses will focus on adding data from 2006, 2007 and 2009 to this data set.

THE ISOLATION AND ANALYSIS OF QUORUM SENSING MOLECULES IN MYCOBACTERIUM SMEGMATIS (TREVISAN) LEHMANN & NEUMANN

Bailey A. Maresh, J. Harden, F. Iseka, and A. McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln, Nebraska 68504; and J.D. Cirillo, Texas A&M University, College Station, Texas 77843-1114

Quorum sensing is a mechanism that many bacterial species use to control their population density. This mechanism begins when the bacterial cell releases small molecules that are allowed to diffuse in and out of the cell. Once these molecules are present at a high enough density, they are detected by the bacterial cells, taken into the cells, and then used to activate a transcriptional regulator which is used to respond to the population density. It is thought that quorum sensing plays a major role in some diseases caused by organisms like *Canada albicans* (Robin) Berkhout, *Pseudomonas aeruginosa* (Schröter) Migula, and *Mycobacterium tuberculosis* Schönlein. Tuberculosis is still a major disease found around the world. According to the World Health Organization, more than one third of the world’s population has been infected by tuberculosis, and the rate of infection is approximately one per second. Because *Mycobacterium tuberculosis* is a pathogenic organism, *Mycobacterium smegmatis*, which has a very similar genome, and is non-pathogenic, was used to investigate quorum sensing mechanisms. In order to investigate these mechanisms, signaling molecules were extracted from *Mycobacterium smegmatis* and tested for a response on lawns of *Streptomyces* spp. Further research involves the isolation and structure determination of the extracted molecule. The results obtained from *Mycobacterium smegmatis* experiments hope to be applied to *Mycobacterium tuberculosis*. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

IDENTIFYING GENES THAT FUNCTION IN QUORUM SENSING, A TYPE OF CELL-TO-CELL COMMUNICATION, IN MYCOBACTERIUM SMEGMATIS (TREVISAN) LEHMANN & NEUMANN

Kirsten L. Foster, P.J. Aylward, and A. McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and J. Cirillo, College of Medicine, Texas A & M University, College Station, TX 77843-1114

Bacteria are capable of regulating gene expression in response to a variety of extracellular signals. When the signal is produced by the bacteria itself it is termed quorum sensing. Many more efforts are needed to identify signal communication molecules for their practical use in medicine, agriculture, and industries. In *Mycobacterium tuberculosis* Zopf it is not yet known whether or not a quorum sensing system exists. By using *Mycobacterium smegmatis* (Trevisan) Lehmann & Neumann
as a test strain, we can try to locate the genes or gene that codes for quorum sensing. Using transposon mutagenesis, *Mycobacterium smegmatis* mutants are obtained and then tested for their quorum sensing ability with *Streptomyces* spp. *Streptomyces* is used because it has a well established quorum sensing system and responds by creating aerial hyphae and pigmentation as a visual response to the interaction with *Mycobacteria* spp. With further research after our efforts, the molecule and then the gene that codes for quorum sensing can be identified and then be applied to quorum sensing in *Mycobacterium tuberculosis*. This is important to study because of its disease causing ability in humans. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

**IN VITRO MECHANISM FOR THE INTERNALIZATION OF SUPERPARAMAGNETIC IRON-OXIDE NANOParticles BY MONOCYTE-MACrophages**

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The phagocytic features of monocyte-derived macrophages and their ability to reach sites of inflammation make them favorable target cells to increase our understanding of disease and infection through improved diagnostic and drug therapy. Oxidation of a dextran coating on superparamagnetic iron oxide (SPIO) particles allowed the conjugation of immunoglobin G (IgG) to the surface of the particle. The IgG-SPIO complex significantly increased the uptake of particles into monocytes and macrophages. This study aimed to investigate the effects of coating, temperature, size, and concentration on the mechanism of *in vitro* internalization of SPIO. The likely mechanism of uptake was considered to be through Fc receptors due to their well-studied interactions with IgG. The mechanism of internalization was dependent upon several factors and occurred independent of Fc receptors. Particles loaded into monocyte-derived macrophages have possible implications for improved drug delivery to sites of inflammation resulting from infectious diseases.

**THE DEVELOPMENT OF SILAC TO ELUCIDATE PHENOTYPIC CHANGES OCCURRING DURING MACROPHAGE DIFFERENTIATION**

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In order to accurately study cell differentiation, one must develop a clear and concise method of quantitative proteomics. In recent years this was done by 2D gel electrophoresis, but due to high variability this method is becoming obsolete. Recently, the development of stable isotope labeling by amino acids in cell culture (SILAC) has emerged to allow the large scale study of protein groups in vivo. In this study we developed a method of SILAC that allowed us to observe large amount of protein turnover. Through our method of 1) Plating cells for SILAC differentiation, 2) Lysis of cells for protein quantification, 3) In solution protein clean up and tryptic digestion using Filter Aided Sample Preparation, 4) Protein clean-up with C-18 spin columns, 5) Protein Sequencing by LC-MS/MS, 6) Calculating peptide ratios using Maxquant, and 7) Statistical Analysis of Maxquant results we were able to observe protein turnover in 1800+ protein groups. These protein groups were analyzed to observe phenotypic changes that occur over the course of cell differentiation. We applied our method to accurately show that through SILAC, we can accurately study differentiation on a large scale, with high accuracy. We are hopeful that further SILAC experiments can be used to study the proteome of cells during differentiation.
ETHANOL-ELICITED PROTEASOME INHIBITION AFTER CYTOCHROME P450 2E1 INDUCTION IN HEPATOMA CELLS

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These experiments were designed to explore the effects of ethanol on proteasome activity, specifically to determine if induction of CYP2E1 in hepatoma cells causes a reduction in proteasome activity and whether this proteasome inhibition causes cell death. Huh7 CYP2E1 and Huh7.5 cells were treated with either zero (control) or 50 mM ethanol and incubated for 48 hours. CYP2E1 was only significantly expressed in the Huh7 CYP2E1 cell line. In the Huh7 CYP2E1 ethanol-treated cells, there was a significant increase in the level of CYP2E1 expressed when compared to Huh7 CYP2E1 control cells, but not between the ethanol-treated and control Huh7.5 cells. Proteasome activity was significantly decreased in Huh7 CYP2E1 ethanol-treated cells compared to Huh7 CYP2E1 control cells, and there was no significant change in proteasome activity in Huh7.5 cells. Huh7 CYP2E1 and Huh7.5 cells were treated with MG262 (a proteasome inhibitor) and incubated for 18 hours. There were decreases in cell viability in both the Huh7 CYP2E1 and Huh7.5 cell lines at specific concentrations. It was concluded that ethanol induces CYP2E1 activity and thereby decreases proteasome activity in Huh7 CYP2E1 cells. This proteasome inhibition can, in turn, lead to cell death. Another goal of the experiments was to create transfected cells that over-expressed cytokeratin 18 and were susceptible to protein aggregation. HepG2, VL-17A, Huh7 CYP2E1, and Huh7.5 cells were transfected by Effectene®, Lipofectamine®, and nucleofection using varying concentrations of cytokeratin 18 green fluorescent protein. It was found that Effectene ® was more effective than Lipofectamine®; however, nucleofection was the most efficient. In addition, Huh7 CYP2E1 cells demonstrated a significantly higher transfectability than other cell lines.

MODULATION OF BACTERIAL BIOFILM FORMATION BY SPECIFIC AND NONSPECIFIC ANTIBODIES

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Biofilms are 3-dimensional structures composed of microorganisms tightly attached to a solid substrate by means of the production of an extracellular matrix. The formation of biofilms occurs wherever microbes and an interface of two materials are present, both in nature and on the surfaces of indwelling medical devices, the latter presenting potentially serious medical implications. Once encased in the exopolymer, biofilms are notoriously resistant to chemical control and physical removal, making prevention of biofilm formation a desirable control option compared to removal. In medicine, control methods must be compatible with concerns for patient safety. In this study we examined the effects of specific and nonspecific antibodies (Ab) and amino acids on bacterial attachment to substrate (a 96-well plate). Antibodies to killed bacterial vaccines (Escherichia coli, Pseudomonas aeruginosa, Enterococcus faecalis and Staphylococcus aureus) were raised individually in male Sprague Dawley rats, and the polyclonal sera collected. Presence of anti-bacterial Ab was confirmed using optimal proportions. Bacterial attachment to the substrate was scored visually (microscopically) and using a Thermo Multiscan Plus plate reader. Attachment of both bacteria and bacteria-Ab complexes was examined in both unmodified and pre-incubated wells. There was no significant different in attachment of control bacteria (without Ab) and Ab-bacteria aggregates. Pre-incubating wells with nonspecific bovine serum reduced attachment significantly, while pre-incubation with BSA had no inhibitory effect on attachment to substrate. Preincubation of wells with 0.1 M alanine solution (pH 7.0) enhanced bacterial attachment to the substrate. Bound Ab did not significantly affect binding of bacteria to substrate compared with control bacteria. However, pre-incubation with serum, protein, or hydrophobic amino acids affected bacterial attachment.
THE CHARACTERIZATION OF METHYLMALONATE SEMIALDEHYDE DEHYDROGENASE IN *ARABIDOPSIS THALIANA*

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Little is known about the characterization of methylmalonate semialdehyde dehydrogenase (MMSDH) in *Arabidopsis thaliana*. MMSDH catalyzes the last step in the valine degradation pathway converting (methyl)malonate semialdehyde to propionyl- or acetyl-CoA, respectfully. Previous studies looked at the function of MMSDH in mammalian systems and in rice which confirmed that MMSDH is not only important for valine degradation but also for the TCA cycle. MMSDH deficiencies in humans result in developmental delay that can be corrected with nutritional support. In this study it was found that *A. thaliana* seeds lacking MMSDH expression exhibit poor germination rates compared to wild-type seeds and become wrinkled following desiccation. Root length studies between knockout and wild-type seedlings on the presence and absence of sucrose showed that MMSDH knockout seeds need an external carbon source for proper growth and development. The previous phenotypes suggest MMSDH may play a significant role in mobilization or metabolism of storage lipids early in germination.

A COMPARISON OF RANGE-OF-MOTION RECOVERY FOLLOWING ANTERIOR CRUCIATE LIGAMENT REPAIR WITH TWO GRAFT TYPES

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The anterior cruciate ligament (ACL) connects the femur to the tibia and is the main support for the motions on the knee. This ligament is susceptible to tearing from a variety of athletic maneuvers, particularly a vigorous twisting or a severe direct blow to the knee. The patella tendon graft and the semitendinosus graft are the two most common graft types used in ACL repair. There has been debate as to which graft type would lead to quicker recovery. The purpose of this study was to determine if there is a difference in the recovery time required for each of the graft types. Range of motion measurements were collected from patients having ACL repair with one of the two grafts within the last 6 years. This data was collected from physical therapy clinics that kept progress charts on patients. A sample size of at least 80 range of motion measurements were collected for each graft type at various dates post operation. A regression analysis was used to evaluate the data collected which included graft type, age, days post operation, and degrees of flexion. Preliminary findings suggest there is a statistically significant difference between the two graft types when comparing the range of motion in short term recovery.

DEVELOPMENT OF AN *IN VITRO* MODEL TO INVESTIGATE COMMUNICATION BETWEEN RESPIRATORY EPITHELIAL CELLS AND ANTGEN PRESENTING CELLS

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The role of Toll-like receptor 3 (TLR-3) signaling in respiratory epithelial cells may be important for communication with underlying antigen presenting cells (APC). In order to investigate this, 16HBE epithelial cells and KG-1 cells will be cultured in vitro, separated by a Transwell membrane. Before this can be assessed, we must execute preliminary experiments. 16 HBE cells must form an intact monolayer in the Transwell before TLR-3 can be stimulated with POLY IC (synthetic dsRNA); transepithelial electrical resistance (TEER) of around 450 Ohms/cm² will reveal an intact monolayer. In order to determine if KG-1 cells can be used to represent APC, they will be stimulated and analyzed for increased surface expression of proteins, which represent maturing APC. An intact monolayer of 16 HBE cells was never achieved. Even when the Transwells were treated with fibronectin coating solution to approximate extracellular matrix, TEER never reached 450 Ohms/cm². It was determined that KG-1
cells can be used to represent APC because stimulated KG-1 cells did show upregulation of dendritic cell marker CD11C. An intact monolayer of 16HBE cells in Transwell must be achieved before future experiments are carried out to investigate the role and communication of TLR-3 signaling in respiratory epithelial cells with underlying APC. This work was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

EXPLORATION OF INNATE IMMUNE RESPONSES OF RESPIRATORY EPITHELIAL CELLS IN VITRO
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Viral infection of epithelial tissue has been shown to cause innate immune responses in in vivo studies. Initial host responses to virus infections of the airways are triggered through Toll-like receptor 3 (TLR3). An in vitro model utilizing human bronchial epithelial cell line 16HBE will provide important information needed to investigate the mechanism by which this occurs. In the experiments reported here, immunofluorescence microscopy was used to detect the presence and cellular location of transcription factor nuclear factor kappa- B (NF-kB) in 16 HBE cells. Cultured 16HBE cells were treated with varying concentrations of TNF-α in an effort to develop control assays for detection of NF-kB pathway activation and subsequent production of interferon-α. The amount of interferon-α produced was measured using ELISA and showed that 16 HBE cells were not producing interferon-α following treatment with TNF-α. Further investigation of the mechanism of TLR3 activation could lead to improvements in treatment of virus infections and inflammation of the respiratory tract. This work was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

INHIBITION OF BOVINE LEUKEMIA VIRUS mRNA EXPRESSION BY A COMBINATION OF RIBAVIRIN AND INTERFERON
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Bovine Leukemia Virus (BLV) is an oncogenic retrovirus which currently infects approximately 30-40% of cattle in the United States. BLV is closely related to HTLV-1, Human T-lymphotropic Virus type I, which causes T-cell leukemia and T-cell lymphoma in humans, the main reason for using it in this study. A long term goal of our research with BLV involves identifying successful viral inhibition methods (discovered initially with BLV) that could potentially be used for treatment of human T-cell leukemia and T-cell-lymphoma. To determine effects of antiviral drugs on mRNA production by BLV, persistently BLV-infected fetal lamb kidney (FLK) cells were treated with a combination of Ribavirin and Interferon-Alpha. We have previously shown that this drug combination is very effective at inhibiting BLV-induced syncytium formation in vitro, without any detectable loss of cell viability. Upon isolation of the RNA from both the treated and untreated FLK cells, quantitative reverse transcriptase polymerase chain reaction was utilized to measure the amounts of the target gene, GAG, by fluorescence with SYBR-green dye. Relative quantitative analysis was then conducted (via normalization against GAPDH) to determine that viral replication as measured by the time of fluorescence of the GAG gene, had decreased an average of 2.6-fold, therefore confirming inhibition of BLV. This work was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.
KINETIC ASSESSMENT OF STAPHYLOCOCCUS AUREUS BIOFILM MATRIX GROWTH
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Previous studies have indicated that S. aureus biofilm age is directly related to macrophage intimacy with the biofilm surface. The purpose of this study is to identify whether the age of the biofilm allows for a more extensive extracellular matrix to be formed which in turn causes a decrease in macrophage intimacy to the biofilm surface. This will be achieved by culturing 4, 6 and 8 day old S. aureus biofilms (S. aureus contain GFP for imaging). The biofilm will then be marked or stained with TOTO 3, wheat germ agglutinin, or anti-S. aureus PGN. These will be used for visualization of eDNA, polysaccharide intercellular adhesion, and peptidoglycans respectively. The extracellular matrix will then be imaged and measured for thickness and density among the three age groups. Imaging is done with confocal microscopy. In order to transport the fragile biofilms to the confocal facilities a method will need to be developed to fixate the biofilm. This work was funded by the Nebraska IN-BRE NIH grant #P20RR16469.

USE OF LISTERIA MONOCYTOGENES InlB AS A POSSIBLE DRUG DELIVERY SYSTEM
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Listeria monocytogenes is a Gram-positive food borne pathogen with a special ability to internalize into mammalian cells. Many proteins are important in the organism’s survival in host cells. However, the internalin proteins InlA and InlB play vital roles of binding to the host cells membranes and initiating the internalization and spread of the bacterium. This innate ability has become of special interest in trying to create a drug delivery model by attaching a drug to the protein itself. The inlB gene was housed in pET-44 (Invitrogen) for expression in various E. coli cell lines. Expression trials were performed with successful Western blots exhibited via E. coli C41-DE3 (Lucigen). Immediate future steps will include fluorescent tagging of the protein and monitoring whether or not it is naturally taken in by human cell lines in vitro. This work was funded by the Nebraska IN-BRE NIH grant #P20RR16469.

USE OF LISTERIA MONOCYTOGENES InlC AS A POSSIBLE COMPONENT IN A DRUG DELIVERY SYSTEM
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Listeria monocytogenes is a bacterial pathogen known to induce phagocytosis in non-professional phagocytes. The mechanism by which this occurs involves bacterial surface proteins called the Internalins. An additional excreted internalin (InlC) protein may enhance forced phagocytosis and is the subject of this study. The inlC gene has been cloned into pET-46 (Novagen) and will be housed in E. coli CD41 (Lucigen) for protein over-expression and purification purposes. Upon successfully isolated, future studies will focus on tagging of the protein (utilizing a MAT tagging system) and determining if the protein is internalized in mammalian cells. Successful results make the protein a possible candidate as a component of a drug delivery system. This work was funded by the Nebraska IN-BRE NIH grant #P20RR16469.
MINIMALLY TRANSFORMED HUMAN EMBRYONIC PALATAL MESENCHYME (HEPM) CELLS EXPRESS N-CADHERIN
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N-cadherin is a gene typically expressed in mesenchymal cells during development following the epithelial-to-mesenchymal transition, a global change in gene expression and cell behavior. In order to study the transcriptional regulation of the human N-cadherin gene it would be ideal to study that process in an untransformed mesenchymal cell line. Most cell lines are both highly transformed and epithelial in nature, and while some do express N-cadherin, they do not express N-cadherin in the tissue from which they are derived. Very few mesenchymal cell lines exist and those that are available do not grow well in culture. Human embryonic palatal mesenchyme (HEPM) cells are one available line. This pre-osteoblastic mesenchyme cell line grows well in culture, has 46 chromosomes and does not have any known chromosomal anomalies. Results will be presented indicating that HEPM cells endogenously express N-cadherin, but not E-cadherin, making HEPM cells a much better cell line in which to study N-cadherin transcription than other lines typically used for this purpose. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

STEPWISE CLONING AND EVALUATION OF FRAGMENTS OF THE HUMAN N-CADHERIN PROMOTER
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N-cadherin is a transmembrane cell-adhesion protein normally expressed in cells such as fibroblasts and neurons and following the epithelial-to-mesenchymal transition during development. Regulation of N-cadherin transcription has implications for both cancer and kidney integrity. Most human cancers arise in epithelial tissue that does not normally express N-cadherin, though expression of N-cadherin has been correlated with development of a motile cancer phenotype. Kidney cells normally express N-cadherin and in rats downregulation of N-cadherin expression has been correlated with loss of kidney integrity. Previous studies in our lab using N-cadherin promoter reporter constructs have shown the highest luciferase expression from a reporter including a fragment spanning +10 to -462bp of the N-cadherin gene. When a fragment from +10 to -1975bp of the N-cadherin gene was evaluated, luciferase expression was significantly lower. A fragment from 5’ end of the -1975bp fragment ligated onto the -462bp reporter, gave reporter expression that met or exceeded the level of expression from the -462bp reporter alone, suggesting that some sequence between -462bp and -1896bp may be a binding site for a transcriptional repressor. Without any obvious candidate binding sites, we have used PCR to clone fragments across this region and have evaluated their ability to regulate expression of a luciferase reporter. Luciferase results suggest that a 225bp fragment spanning -1280bp to -1055bp may be adequate to reproduce the repression of luciferase expression produced by the largest fragment spanning the whole region. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

THE N-CADHERIN PROMOTER IS METHYLATED IN HUMAN BT-20 BREAST CANCER CELLS
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DNA Methylation is the covalent attachment of methyl groups to regions of DNA enriched in CpG islands, stretches with a higher than expected CG sequences. Recently, methylation of the
N-cadherin gene in rat kidney cells has been correlated with down-regulation of N-cadherin gene expression and subsequent loss of kidney integrity. The human N-cadherin gene has not been evaluated for methylation although like most regulatory regions, the promoter sequence is rich in CpG islands. Methylation of tumor-suppressor genes, such as E-cadherin, has been linked with development of cancerous growth. We have recently identified a human breast cancer cell line, BT-20, that does not express endogenous N-cadherin despite being able to drive expression of transiently transfected N-cadherin promoter reporters with an expression pattern similar to breast cancer lines that do express endogenous N-cadherin. Because these cells seem to express the transcription factors necessary for N-cadherin transcription we were interested in exploring whether the N-cadherin promoter is methylated in this cell line. To assess the methylation status of the human N-cadherin, we have used methylation specific PCR which can detect methylation of specific sequences, and determined that a sequence in the promoter of the human N-cadherin gene is methylated in BT-20 breast cancer cells. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

PROTEASES IN ENVIRONMENTAL DUST INDUCE AIRWAY EPITHELIAL INFLAMMATORY MEDIATORS

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Rationale: Persons exposed to swine confinement facilities have evidence of an increased bronchial inflammatory response and are at a greater risk of developing COPD. We have previously observed that unknown compounds in hog confinement dust extract (HDE) elicit inflammatory responses from bronchial epithelial cells. We have recently identified that proteases including porcine pancreatic elastase are present in the dust. We hypothesized that proteases found in this dust may influence airway inflammatory processes by increasing cell adhesion molecule (ICAM-1) expression and inflammatory mediators IL-6 and IL-8 release of human bronchial epithelial cells.

Methods: Confluent bronchial epithelial cells (BEAS-2B) were pretreated with one of the following: protease inhibitor cocktail (PI), porcine elastase antibody, or alpha-1 antitrypsin (AT) for 30’, followed by 5% HDE or porcine pancreatic elastase (PPE) for an additional 24 hours. The cells were stained for CD54 (ICAM-1) and analyzed by flow cytometry, and culture supernatants were assayed for cytokines by ELISA. HDE was analyzed by gelatin zymography for protease activity.

Results: Treatment of human bronchial epithelial cells with HDE increased surface expression of ICAM-1 (60-fold MFI vs. con) and induced IL-6 and IL-8 release (23, and 7.5 fold vs. control respectively). Likewise, porcine pancreatic elastase (PPE) increased both ICAM-1 (90-fold, high dose, vs. con) and IL-6/IL-8 release (26.6, and 8.8 fold vs. con, respectively) in a concentration dependent manner. Protease inhibitor cocktail and alpha-1 antitrypsin each inhibited HDE induced surface expression of airway epithelial cell ICAM-1, IL-6 release (PI: 14.8 fold decrease, AT: 7 fold decrease), and IL-8 release (PI: 16 fold decrease, AT: 9.5 fold decrease) compared to HDE alone. In addition, HDE was found to contain proteases after analysis by gelatin zymography, and this activity was sensitive to protease inhibitor treatment.

Conclusion: Proteases, specifically porcine pancreatic elastase in dust from hog barns may regulate airway epithelial cell inflammatory responses in vitro and may contribute to dust-induced airway disease.

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STRESS-INDUCED DIET CHANGES CAUSES WEIGHT GAIN IN MICE
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Research suggests that minor stresses may lead to ill health not only by causing changes in blood pressure, but also by causing changes in diet choices which can lead to weight gain and heart disease. The changes in diet can have many causes like emotional eating, availability, and energy density of the food. One study showed that when minor stresses are presented to humans for a short amount of time, high-fat sweet foods were consumed more. Therefore, this study was conducted to see if stress causes mice to choose high-fat sweet food over regular pellet food and therefore causes them to gain weight. Thirty-five adult male and female mice were used in the study. They were divided into four groups. The first group was the control group which contained one less mouse compared to the rest. The next group was stressed by either being placed in cold water (stress A) for 10 minutes or by being constrained (stress B) for 10 minutes and were given only pellet food. A random number generator was used to determine what stress the mice were going to receive or if they were allowed to rest for the day which was done daily for 40 days. This was done in order to not cause chronic stress which can lead to appetite and weight loss and decrease the likelihood of desensitization. The next group was not stressed, however they had the option of eating either the pellet food or a mixture of peanut butter and fruit loops. The last group was stressed by using the same stressing methods and given the option of both types of food. The mice and food types were weighed every seven days in order to look at weight gained and amount of food consumed. Both groups of stressed mice gained weight over the 40 day period while the non-stressed mice maintained their weight with normal fluctuations. There is sufficient evidence to suggest that the stressed mice with the high-fat high-sugar diet gained more weight than the stressed mice with only pellet food.

AMERICAN PIKA (OCHOTONA PRINCEPS) SURVEY IN GLACIER NATIONAL PARK AND ITS RELATIONSHIP TO GLOBAL WARMING
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Previous studies have shown that American Pika (Ochotona princeps) historically were found in the low elevations associated with the Great Basin, but recently they have been disappearing from those home ranges. Currently pikas are being found in higher elevations which is thought to be due to the fact that they are very sensitive to warmer temperatures. In fact, pikas will die in approximately thirty minutes after being exposed to temperatures of 78°F or higher. This temperature sensitivity makes pikas a model organism for studying the effects of global climate change. Pikas populations were studied in Glacier National Park, found in the northwestern corner of Montana, during the summer of 2009. The primary purpose of this study was to set a baseline for where pikas are living in the park, and to begin what we hope to be a long term study of the elevations that pikas inhabit. Because pikas had never before been rigorously studied in the park it was first necessary to determine where they were living. Since talus fields were previously shown to be likely habitats for pikas, a map was created indicating talus fields in the park and thus potential home ranges of the pikas. Mapped talus fields then served as a starting point for a survey of pikas. During surveys pika populations were monitored along with recording the habitat, slope gradient, temperature, elevation, and behavior of pikas. Results of the 2009 population study showed that pikas are not as active during the midday when the temperatures were warming. Additionally, a baseline was set to show what elevations pikas inhabit in the park.
THE EFFECT OF THE PRESUMPTIVE BLOOD-TEST REAGENT, FLUORESCENEIN, ON THE RECOVERY OF DNA

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Fluorescein has recently been used as a presumptive reagent to detect latent bloodstains, other than Luminol. The ability to detect the stains is directly related to the sensitivity of fluorescein. Visualization of fluorescein does not require a completely dark environment and the reaction persists longer than luminol. A range of diluted bloodstains from 1:10 to 1:1,000,000 were made and detected with fluorescein. Each dilution could be detected by the fluorescein. A DNA analysis was conducted using the newly developed technique RT-PCR. DNA could be recovered from each sample, illustrating that fluorescein is a viable alternative to luminol.

THE EFFECTS OF DIFFERENT SHIPPING TEMPERATURES AND STORAGE TIMES ON THE DETECTION OF TRITRICHOMONAS FOETUS BY PCR

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Tritrichomonas foetus (Riedmuller) is a parasite that infects the genital tracts of cattle. Preputial fluids from two Tritrichomonas foetus negative bulls were inoculated into InPouches, a two-chambered envelope that contains antimicrobial agents that suppress competing micro flora. Half of the InPouches were inoculated with a diluted Tritrichomonas foetus suspension, while others were not. Then 195 of the 400 InPouches were placed in a -20 °C freezer, while the other 205 were incubated at 37 °C for a two-day period, which stimulated a two-day transport time. PCR test were run on the samples to see how accurate the PCR test is at detecting T. foetus DNA in the samples. The sensitivity, or number of true positives, became better the longer that the InPouches stayed in the lab before the PCR tests were run. The specificity, or true negatives, of the test, stayed about the same over the varying days. As for the temperature, the frozen temperature decreased the amount of true positives seen, therefore, InPouches should not be sent frozen.

Δ-9 TETRAHYDROCANNABINOL CONCENTRATION OF HEMP (CANNABIS SATIVA L.) IN LANCASTER COUNTY, NEBRASKA

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Cannabis sativa can be found growing wild throughout Lancaster County and is more commonly called hemp or ditch weed. The main psychoactive compound in Cannabis is Δ-9 Tetrahydrocannabinol (THC). To be considered hemp, the plant must produce THC concentrations of 0.3% (dry weight) and below. To be marijuana the THC concentrations will be greater than 0.31%. Twenty Cannabis sativa plants were collected during the 2009 growing season. THC was extracted from the leaf and inflorescence using chloroform or hexane. Mass Spectrometry/Gas Chromatography was accomplished on the extract to determine the amount of THC in the plant material. The results of the experiment are yet to be determined and will be reported at a later date.
PREDATOR RISK ASSESSMENT FOR THREE LEVELS OF THREATENING APPROACHES IN THE BLACK TAILED PRAIRIE DOG (CYNOMYS LUDOVICIANUS (ORD, 1815))

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Assessment of environment is important for an animal’s survival including reproduction, foraging, and avoidance of danger, and the assessment techniques used across taxa differ due to environment, e.g.- abundance/scarcity of nutrients, quantity of predators present, and lifestyles, e.g.- colony/free-range, number of offspring per litter. My aim was to address qualities of predator assessment techniques used among colonial, burrowing black tailed prairie dogs (Cynomys ludovicianus). By self-emulating a predator by human approach for 3 approaches (low-threat, averted threat, and high-threat), data consisting of intervals of distance and time were recorded for initial alert, flight initiation distance, and final escape into burrow. Difference was found between the high-threat and the other two, low-threat and averted threat approaches.

EFFECTS OF VARYING LEVELS OF NITROGEN APPLICATION ON CORN YIELDS

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Nitrogen (N) application is a major input in the commercial production of corn. Yields can be severely damaged if inadequate amounts of N are available. However, excessive use of N has detrimental effects including additional costs to the producer and environmental effects including nitrate contamination of groundwater. In this experiment, levels of N ranging between 179 and 235 kg/hectare were applied to several test plots to find if commonly utilized levels of N application significantly increase yield over lower levels. The application levels chosen were based on accepted practices in the testing region and a professional crop consultancy firm. After testing, industrially recommended N application levels did not produce yields that differed significantly from those produced by lower N application levels. This suggests that commonly used N application levels may be higher than optimal, leading to increased costs and environmental effects.

THE EFFECT OF HUMAN DISTURBANCE ON THE FORAGING BEHAVIOR OF PIPING PLOVERS (CHARADRIUS MELODUS (ORD, 1824)) AND SANDERLINGS (CALIDRIS ALBA (PALLAS, 1764))

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Understanding the best approach to minimize the effect of human disturbance on species is important to maintain and preserve endangered populations. Humans’ recreational activity at beaches is a disturbance that may negatively impact shorebirds ability to forage. The purpose of this study was to determine how the degree of human activity affects piping plovers’ and sanderlings’ ability to feed. I selected beach sites at Lake McConaughy where these species could be found both in the absence of humans or in varying intensity of human activity. The level of human activity and the percent of time spent foraging were determined for each shorebird sampled. The results indicated that the amount of
time spent foraging for both species was significantly different at varying levels of human activity. However, the presence of plovers and sanderlings exposed to varying degrees of human activity did not yield identical results. The presence of plovers in foraging regions directly decreased as the degree of human activity increased; but when humans were near foraging regions of sanderlings the birds’ presence decreased regardless of the intensity of human activity. The quality of feeding is one of many components that play a role in the fitness of a species (Schoener, 1971). Understanding conditions that are more conducive to inhabiting foraging regions may improve a species ability to feed, which in return may increase fitness and help conserve a population. These results suggest that controlling the degree of human activity on the beach may have a larger impact for some species, while simply controlling for the presence or absence of human activity may have a large impact for other types of species.

THE EFFECTS OF BLACK AND CLEAR PLASTIC MULCH ON SOIL TEMPERATURE, PREVENTION OF WEEDS, AND YIELD OF NORTH AMERICAN CANTALOUPE (CUCUMIS MELO L. VAR. RETICULATUS (NAUDIN))

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Farmers use plastic mulch to enhance the microclimate of horticulture plants in order to increase crop yields. However, plastic mulch is a costly purchase that may not benefit farmers if by using it does not result in a profit. Therefore, analyzing three measurements affected by plastic mulch will give an indication if it is a logical purchase. First, temperature readings determine if clear and black plastic mulch increase soil temperature compared to bare soil. Second, measuring weed growth indicate plastic mulch’s ability to inhibit weeds. Third, the yield of Cucumis melo L. var. reticulate is measured. Both types of plastic mulch increased the soil temperature. However, there was only a significant difference between clear plastic mulch versus bare soil. Both rows containing plastic produced significantly more cantaloupe than bare soil but no significant difference compared to each other. In addition, bare soil had more weed growth than the rows containing plastic but limited data resulted in no determination of significant difference. Therefore, plastic mulch increases yield and is a profitable purchase.

A COMPARISON OF EXTRACTION TECHNIQUES FOR ISOLATING BIOLOGICALLY ACTIVE QUORUM SENSING MOLECULES FROM MYCOBACTERIUM SMEGMATIS

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Ethyl acetate and hexane extractions were utilized to obtain biologically active samples from the test strain, Mycobacterium smegmatis (Trevisan) Lehmann & Neumann. After growing a working M. smegmatis mc²155 culture to the desired density, the culture was centrifuged and the supernatant was filtered, extracted, and re-suspended according to the protocol used for either ethyl acetate or hexane. In order to test for biological activity, Streptomyces coelicolor (Waksman & Henrici) was utilized as the indicator strain. Spores were streaked onto a R2YE plate, and the extract was spotted on a 6mm sterile filter paper disc on the plate for testing. All ethyl acetate extractions conducted showed signs of biological activity, however only 3 of the 6 hexane extractions showed signs of biological activity. A
general trend was observed that showed working cultures with lower volumes of *M. smegmatis* mc²155 tended to show better results. The best results were obtained at OD₆₀₀ readings between 0.749 and 0.831. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

**SCREENING AN OVER-EXPRESSION MYCOBACTERIUM SMEGMATIS LIBRARY TO DETERMINE THE GENE(S) INVOLVED IN QUORUM SENSING**

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Quorum Sensing (QS) plays a key role in pathogenesis and cell-to-cell communication in many different bacterial species (Zhang and Dong, 2004). Quorum sensing has been found to occur in such bacterial species as *Pseudomonas aeruginosa* (Schröter) Migula and *Candida albicans* (Robin) Berkhout. The bacterial genus *Streptomyces* spp also has an extensively studied Quorum Sensing system. It has been shown that aerial hyphae formation and the development of antibiotics are two QS responses seen in *Streptomyces* spp. The bacterial genus *Mycobacteria* spp is similar to *Streptomyces* spp in that both are gram-positive bacteria, have a Guanine-Cytosine (G-C) rich genome, and commonly dwell in the soil. Based on these similarities it is hypothesized that *Mycobacteria* spp has a QS system and preliminary results have shown that Streptomyces spp responds to a molecule secreted by Mycobacteria spp. In this study, *Streptomyces* spp is being used to study QS in *Mycobacteria* spp by utilizing an over-expression *Mycobacterium smegmatis* (Trevisan) Lehmann & Neumann library. Screening of the over-expression *M. smegmatis* library can be used to determine what gene(s) are involved in QS in *Mycobacteria* spp. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

**A TRANSPON MUTAGENESIS EXPERIMENT OF MYCOBACTERIUM SMEGMATIS (TREVISAN) LEHMANN & NEUMANN USING HIMARI MYCOBACTERIOPHAGE TO IDENTIFY INTEGRAL QUORUM SENSING GENES**

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Quorum sensing is a density dependent regulatory process used to control the biological activity of bacterial colonies. The mycobacterium family of bacteria is responsible for a variety of infectious diseases like tuberculosis and leprosy. Quorum sensing has been shown to be an important target for fighting infections and hopefully may be blocked to prevent the growth of bacteria. One key piece of information that must be described more thoroughly is the genetic basis for the quorum sensing in mycobacteria spp. This was the original point of our experiment to study randomly generated mutants’ biological activity and begin to narrow the genes responsible for this mechanism. After struggling with contamination and a lack of growth we were not able to obtain significant results. Not enough mutant colonies were present from the mutagenesis colony formation protocol to proceed much farther. Also, our PCR has not yielded evidence of DNA material that would allow us to accurately identify the colonies as *Mycobacterium smegmatis* (Trevisan) Lehmann & Neumann mutants. However, we were able to make some initial strides in the experiment that will help in the future to further the experiment. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.
GENETIC VARIATION IN FLUORESCENT PSEUDOMONAD PhlID IN RHIZOSPHERIC POPULATIONS OBTAINED FROM WHEAT AND SORGHUM SOIL AT THE HAVELOCK AREA OF LINCOLN, NEBRASKA

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Immensely beneficial to a variety of crops, fluorescent pseudomonas are one of the most vigorously studied methods for improving crop yield and overall defense. Many fluorescent pseudomonas are beneficial to plants, but they are found in differing magnitudes and strains depending on geographic location and soil quality. Fluorescent pseudomonad genetic variation has been studied among a wide array of crops and soil locations, but not in Eastern Nebraska between sorghum and wheat. In this study, 63 fluorescent pseudomonad samples gathered from the rhizospheric soil of two breeds of sorghum, RTx433 and Redlan, and a breed of wheat, all taken from two locations, Mead, Nebraska, and the Havelock area of Lincoln, Nebraska, were genetically analyzed, through PCR and enzymatic digests, to determine if there is genetic uniformity between the PhlID locations of the fluorescent pseudomonas from both locations and all three plant breeds. The poor quality of the samples used in this study hampered the results, possibly to the point of being inconsequential; 39 of the samples, all of those from Mead and five from Havelock, proved to be contaminated and therefore unusable. The limited data set hurt the scope of the project because only pseudomonas obtained from the soil of one location, Havelock, could be analyzed, rather than two. Consequentially, the data show general genetic uniformity between the fluorescent pseudomonas harvested from the rhizospheric soil of the RTx433 and Redlan breeds of sorghum and a normal strain of wheat at the Havelock area of Lincoln, Nebraska.

CHARACTERIZATION OF SET DOMAIN PROTEINS FROM AN ALGAE AND A BACTERIUM

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Epigenetic processes can heritably modify gene expression without any change in DNA sequence. They play an important role in eukaryotic development as well as in protecting the genome from molecular parasites such as transposons and viruses. Epigenetic gene silencing can occur at either the transcriptional level, transcriptional gene silencing (TGS), or at the posttranscriptional level, posttranscriptional gene silencing (PTGS). Previous research using mutagenesis screens have identified several components of the molecular machinery involved in TGS, in *Chlamydomonas reinhardtii*, a single-celled green alga. One of these mutants, Mut-11, also showed reactivation of a transcriptionally silenced transgene, and defects in transposon mobilization, cellular growth, and sensitivity to DNA damaging agents. Sequence analyses revealed that the interrupted gene *Mut11* encodes a 370 amino acid long polypeptide containing 7 WD40 repeats. Mut11p is part of a protein complex, including two SET domain-containing polypeptides that are required for transcriptional silencing. The *Set3* gene was cloned using RT-PCR and then expressed into protein. When tested in methyltransferase assays the SET3 protein was shown to methylate histone H3. SET domain proteins have also been identified in bacteria. This includes the plant pathogen *Xanthomonas campestris* that possesses genes that may encode SET domain proteins. This raises an interesting question of function since there are no histone proteins in bacteria. A gene encoding a SET domain protein and a gene encoding a histone-like protein (HUP) from the bacterium *Xanthomonas campestris* were cloned and expressed. The bacterial SET protein had little to no methyltransferase activity on HUP or eukaryotic histones. Future research could explore the possibility that this protein methylates a different protein in the bacterium. This work was supported by NIH grant number 2P20RR016469-04.
CHEMICAL EFFECTS ON REPRODUCTIVE STRATEGIES OF SOYBEAN CYST NEMATODE (HETERODERA GLYCINES) IN FIELD CONDITIONS

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An anonymous experimental treatment was studied through the University of Nebraska–Lincoln to find if the soybean cyst nematode population would be lowered after the chemical was applied. This study sought to identify which treatment would best manage the soybean cyst nematode population. Chemical treatments were applied at 100 kg/ha, 400 kg/ha or 0 kg/ha on different replications at the same time. The reproduction factors for Heterodera glycines were calculated approximately one month after the treatments were applied. T-tests were run to see if there was a significant difference between the populations at different times of the crop year after the chemical treatments were applied. The results from the three different chemical treatments were the same, finding no significant difference between the populations at planting and midseason. The treatment with 0 kg/ha of chemical applied had the lowest reproduction factor, henceforth, the most significant in our observations.

SURVIVAL OF CANDIDA ALBICANS ON COPPER ALLOY METALLIC SURFACES

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Candidiasis is currently the fourth most common cause of nosocomial bloodstream infections in the United States. Finding novel ways to inhibit the spread of Candida spp. in hospitals is increasingly important due to the prevalence of species which are resistant to antifungal medications. It has previously been shown that copper metal is toxic to Candida albicans. In this study, the survival rate of C. albicans cells on stainless steel, copper, and copper alloy metallic surfaces was determined. In addition, we examined the differences in toxicity of the metals on cells grown at 30°C and those grown at 37°C. The results of this experiment have shown that copper metal is highly effective at killing C. albicans with all of the cells plated on 99% copper metal surfaces being killed within one minute. All of the alloys tested were also highly effective at killing the cells; deactivating all C. albicans cells in 2 to 20 minutes. These findings demonstrate the toxic effects of not only copper metal but many types of copper alloys. Many copper alloys are less expensive than pure copper and can thus be a more economical way for hospitals to combat the spread of pathogenic cells.

THE ROLE OF FeoB IN LOW AFFINITY MANGANESE TRANSPORT IN SYNECHOCYSTIS SP. PCC 6803

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Manganese is a trace element that is likely required by all living organisms. It is of particular importance to oxygenic photosynthetic organisms, such as cyanobacteria; therefore, the overall quota for manganese required by oxygenic photosynthetic organisms is greater than that of nonphotosynthetic organisms. In Synechocystis sp. PCC 6803, a fresh water cyanobacterium, high affinity manganese transport is mediated by an ABC-type permease known as MntABC. Studies have shown this transporter to function when cultures are grown under manganese starvation conditions; however, studies have suggested that a low affinity manganese transporter also exists. The focus of this study was to determine whether FeoB, a known iron transporter, plays a role in low affinity manganese transport in Synechocystis sp. PCC 6803.
SOIL MICROBIAL COUNTS AS AFFECTED BY DECOMPOSITION OF PIGLETS
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The objective of the study was to evaluate changes in soil microbe as affected by decomposition of piglets. Six piglets were buried in each of four graves (replications). Every two weeks one piglet from each grave was exhumed, and the grave soil at burial level was sampled for microbial growth. The soil samples were serially diluted and dilutions were incubated on three different types of culture media: Sabouraud Dextrose Agar for a fungi count; Nutrient Agar for bacteria count; and Glycerol Yeast Extract Agar for actinomycetes. Total bacterial counts were made for each sample. Samples were sent to a lab for analysis of organic matter, phosphorus, potassium, magnesium, calcium, sodium and pH. Representative colonies were characterized by Gram stain, colony morphology, and cell morphology. The results show that bacteria count dropped the first two weeks of piglet decomposition and increased the last four weeks. Soil samples taken one meter away from the piglets showed lower counts of bacteria compared to the soil around the piglets. The actinomycete counts also decreased the first two weeks and raised the last four weeks of decomposition, but the sample away from the piglets showed higher amounts of actinomycetes. The fungus counts showed a drop in the first week but increased in the middle weeks and dropped in the last weeks. Fungal counts away from the piglets were similar to those near the piglets.

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DETECHIP® 2.0: AN ENHANCED MOLECULAR SENSOR ARRAY FOR DRUGS AND THEIR CUTTING AGENTS
Jordan Beaber, J. Francis, J. Groathouse, M.V. Wilson, K.A. Lucas, and A.E. Holmes, Department of Chemistry, Doane College, Crete NE 68333

DETECHIP® is a highly selective small molecule sensor array. Combining colorimetric and fluorimetric assays, DETECHIP® provides thirty-two different responses to determine the identity of a test sample. DETECHIP® is applicable for use in the lab as well as in the field. The sensor array has been enhanced to diagnose narcotics that are diluted with adulterants also known as cutting agents. Color and fluorescence changes are recorded numerically and a thirty-two digit binary identification code can be constructed for comparison of test analytes and known compounds. DETECHIP® is applicable to a variety of drugs, and can even detect explosive agents, such as trinitrotoluene (TNT).

DEVELOPMENT OF AN ASSAY TO DETECT AND QUANTITATE ATRAZINE IN SOIL
Charles Cohlmia and Eric J. Haas, Department of Chemistry, Creighton University, Omaha, NE 68178

Here we report a method devised for the extraction of atrazine (2-chloro-4-isopropylamino-6-ethylamino-s-triazine) from soil samples. These were collected in farmland of western Nebraska with the collaboration of Dr. J. Platz and M. Konz of the Creighton Department of Biology and C. Driscoll of the Creighton Department of Environmental Sciences. Twenty mL of a 1:1 methanol:water solution were used to extract atrazine from 10 g of soil from each sampling site. These were shaken and centrifuged
to fully extract the herbicide and separate the solution from the remaining soil. A commercial ELISA immunoassay kit (Abraxis LLC, Warminster, PA), supplied by the Creighton Department of Biology, was used to detect the presence of atrazine in our samples. Absorbances were calibrated using known concentrations of Atrazine to construct a standard curve. Most samples showed minute levels of the herbicide in the soil, but two samples showed 2.4 ppm and 1.5 ppm atrazine, respectively. Gas Chromatography/Mass Spectrometry (GC/MS) analysis will be used to verify ELISA results and quantitatively determine precise concentrations in soil.

SYNTHESIS AND ENZYME INHIBITION STUDIES OF MULTIDENTATE Ru(II) ORGANO METALLIC COMPLEXES

David J. Jung and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

1,4-Disubstituted-1,2,3-triazole rings are the products of copper-catalyzed Huisgen 1,3-dipolar cycloadditions, commonly called ‘click’ reactions. Recent reports in the chemical literature have described using multi-step one-pot click chemistry transformations to prepare bidentate and tridentate chelators comprised of 1,2,3-triazole units from trimethylsilyl-protected butadiyne, 2-ethynylpyridine and 2,6-diethynylpyridine presursors, respectively. These compounds can be used to create Ru(II) complexes via coordinative interactions, and the synthetic versatility of this click approach allows the incorporation of a wide range of substituents to the periphery of such complexes. The goal of this project was to prepare a series of octahedral Ru(II) complexes possessing one, two, three, four or six copies of enzyme inhibitor units via organometallic synthesis and evaluate the relationship between inhibitor display and inhibitory activity against a metalloenzyme target. Using an in vitro competitive binding assay against the metalloenzyme carbonic anhydrase, this study has shown that multivalent analogs increase carbonic anhydrase inhibition exponentially relative to monovalent analogs for this octahedral Ru(II) family of complexes. Details regarding the synthesis, physical characterization, and enzyme inhibition assays of these Ru(II) complexes will be presented.

GENERAL SYNTHESIS AND ATOM-PROBE MAPPING OF RARE EARTH HEXABORIDE NANOWIRES

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Rare-earth hexaborides (REB₆) have received renewed research interest in recent years because of their unique electronic and physical properties such as extremely high melting point, semiconductivity, fluctuating valence and low work function. Though several methodologies exist for the synthesis of several metallic REB₆ systems, a methodology for the general synthesis and growth of single crystalline rare earth hexaborides has not been reported. Furthermore, the determination of stoichiometry and dopant levels in REB₆ nanomaterials through conventional electron dispersive x-ray (EDX) based techniques cannot provide an accurate measure of material qualities or compositions due to the secondary emission of x-ray from boron. Here we report the development of a generalized vapor-liquid-solid method with Pd-nanoparticles for the growth of both single-crystalline metallic and semiconducting REB₆ nanowires (RE = Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Yb). Local electrode atom probe method was applied to elucidate accurate composition analysis of these nanowires and verify the detailed growth mechanism of these systems.
PROBING BIOMINERALIZATION USING A NOVEL DOUBLE DIFFUSION GEL SYSTEM
Garrett Paulman, E. Doane, K. Troxel, M.W. Plano Clark, M. Wilson, and E. Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Mineralization of biopolymers occurs appropriately in bone and teeth, and inappropriately in blood vessel walls and tendons. Regulation of this biomineralization process is thought to be accomplished by matrix proteins expressed in these tissues, though the process is not fully characterized. In an effort to probe the regulation of biomineralization, we have developed a two-dimensional system consisting of separation by slab-gel protein electrophoresis followed by in-gel mineralization studies. Identified mineralization promoters or inhibitors can be extracted from the gel and identified by mass spectrometry. Development and validation of this apparatus will be presented.

DETERMINATION OF CAFFEINE AND TAURINE IN ENERGY DRINKS USING REVERSED PHASE CHROMATOGRAPHY
Jared Loschen, Annette C. Moser, University of Nebraska at Kearney, NE 68849-1150

A method to separate and quantify caffeine and taurine in energy drinks was developed for use in undergraduate analytical laboratories. In this method, taurine and caffeine were separated using a 46 x 250 mm Spherisorb Amino 5 μm column using a methanol-buffer mobile phase. A series of calibration curves were constructed to allow for the creation of two calibration curves which allowed for the amounts of caffeine and taurine in energy drinks to be quantified.

EXTRACTION OF DENTIN PHOSPHOPHORYN FROM BOVINE FEMUR
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Non-collagenous proteins (NCPs) in bone matrix play a large role in the regulation of mineralization. As improper mineralization of tissues can lead to disease states, the complete understanding of the mineralization process and the proteins that control it is an important goal. Dentin phosphophoryn (DPP), one of the non-collagenous proteins, is a highly acidic (pI – 1.1) mineralization promoter in bones and teeth. The large negative charge on this protein has impeded efforts at characterization. In this study, DPP was isolated from bovine femurs. NCPs were extracted from bovine cortical bone sequentially into guanidine and EDTA solutions. The EDTA fraction was dialyzed and DPP isolated by precipitation with calcium ion. Following a second EDTA and dialysis step to remove Ca²⁺, the DPP was lyophilized. Final extract was characterized on a novel double-diffusion gel system designed to test in vitro mineralization-regulation ability of NCPs. Results of DPP isolation and mineralization studies will be presented.

LOCALIZATION AND GENETIC ENGINEERING OF A NOVEL COILED COIL-HELIAX COILED COIL-HELIAX DOMAIN CONTAINING PROTEIN, CHCHD6
Kilie Stover, Karisa Stover, Josh Sypal, and Sharmin M. Sikich, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

The novel mitochondrial protein Chchd6 contains a coiled coil-helix coiled coil-helix (CHCH) domain. Involvement in localization and subcellular function of this protein is unknown. The CHCH domain contains two cysteines within each helix structure in a C-X₉-C motif. This particular domain has been found in other mitochondrial proteins such as Cox17, which is a copper binding protein thought to be required for metallation of a mitochondrial transmembrane protein; as well as Mia40, a protein that assists in the translocation of proteins into the inner-membrane space. Known proteins containing
similar motifs were used to define the potential function of Chchd6. The Chchd6 DNA sequence was cut from the cDNA cloning vector pDNR-LIB, and ligated into the vector pFLAG in order to express a FLAG-tagged Chchd6 protein in mammalian cells for observation. With the FLAG-tagged protein, we hope to determine localization of Chchd6. Using bioinformatic techniques, several post-translational modification sites were found to be used as possible mutation points. By mutating these specific sequences and observing mammalian-expressed wild-type and mutant proteins in an epifluorescent scope, the localization and function of Chchd6 may become better understood. This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

MULTI-STEP ONE-POT CLICK REACTIONS OF ‘FAST’ DYE DIAZONIUM SALTS
Jacqueline E. Reilly and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

Sharpless-Meldal ‘click’ reactions have been shown to be effective components of multi-step one-pot click transformations. Reactant precursors capable of rapidly forming organic azides are desirable for click reactions in order to avoid the potential dangers of isolating small organic azide molecules, as well as for their improvement in synthetic efficiency. The goal of this study was to evaluate whether diazonium salts can be used as efficient organic azide precursors in one-pot multi-step click transformations. A wide variety of aromatic diazonium salts, also known as ‘fast’ dye salts, are commercially available. We specifically analyzed two-step and three-step click transformations involving aromatic diazonium salts reacting with terminal alkyne and trimethylsilyl-protected alkyne reagents. Each two step reaction involved in-situ formation of organic azides by reaction of diazonium salt with sodium azide, followed by copper-catalyzed Huisgen 1,3-dipolar cycloaddition in aqueous solution. Each three step reaction additionally involved the promotion of a base-catalyzed trimethylsilylalkyne deprotection by potassium carbonate. Details of the synthetic conditions promoting these multi-step reactions as well as the characterization of the resulting 1,2,3-triazole products will be presented.

DEVELOPMENT OF A CHROMATOGRAPHIC IMMUNOASSAY TO DETERMINE THE CONCENTRATION OF VIRGINIAMYCIN IN WATER SAMPLES
Taylor Carlson and Annette C. Moser, University of Nebraska at Kearney, Kearney, NE 68849-1150

A chromatographic immunoassay capable of determining the concentration of virginiamycin in water samples has been developed. In this method, the sample is preconcentrated using an anti-virginiamycin antibody column. After concentration, a reversed phase column was used to separate the virginiamycin from the buffer peak. The area of the resulting virginiamycin peak allowed for the quantification of the amount of virginiamycin in the original sample. Using this method, a minimum concentration of 1 ppb could be detected. The linear range for this method was determined to be 1 ppb to 100 ppm.

SECONDARY STRUCTURE OF OSTEOPONTIN-BASED PEPTIDES CHANGE UPON ADSORPTION TO HYDROXYAPATITE
Crystal Vander Zanden, M.V. Wilson, and E. Wilson, Department of Chemistry, Doane College, Crete, NE 68333

The mechanisms by which bone mineral production are regulated are complex, and our knowledge pertaining to this topic is very limited. One protein involved in this regulation is osteopontin. This protein is mostly unordered in solution, but it is capable of adsorbing to hydroxyapatite and altering
its growth. We know very little about the conformation that it adopts when bound to the mineral surface. Peptides containing putative mineral-binding sequences from osteopontin were synthesized, including known phosphorylations. These peptides were exposed to hydroxyapatite to allow them to adsorb onto the surface. The secondary structure of these peptides was studied using circular dichroism and infrared spectroscopy. UV/vis spectroscopy was used to determine the dissociation constants to learn more about the strength of the interaction between the peptide and the hydroxyapatite. Results of these studies will be presented.

**COMPARISON OF THE COMPUTED UV/VIS SPECTRA OF PYRAZINACENES AT VARIOUS MODEL CHEMISTRIES**

Sarah Salisbury and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

A series of edge-sharing condensed oligopyrazine analogues of acenes, the pyrazinacenes were synthesized and characterized by our colleagues. A pyrazinacene was chosen for our investigation and optimized to a stationary point on the Born–Oppenheimer surface. Next, frequency calculations were run to confirm optimization to a minimum. Finally, the UV/VIS spectrum was computed using TD-DFT with the B3LYP/6-31G(df, p), B3LYP/6-31G(2df, p), and B3LYP/6-31G(3df, p) model chemistries. The spectra computed with the various model chemistries were then graphed using an in-house developed method and compared to the experimentally determined spectrum.


**WILD PLUM: PARTICLES OF IMPROVED OPTICAL BRIGHTNESS AND FLUORESCENCE**

Jordan Groathouse, M. Wilson, K. Lucas, and A. Holmes, Department of Chemistry, Doane College, Crete, NE 68333

We have developed blue fluorescent solids that impart optical brightness, color purity, and fluorescence to camouflage skin imperfections in cosmetic applications. The new substances have controlled solubility and stability which is important for cosmetic formulations such as make ups, lotions, etc. The characterization, optical properties, and consumer data will be reported.

**ULTRA PERIPHERAL COLLISIONS AND THE TIME OF FLIGHT DETECTOR AT RHIC**

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

At RHIC (Relativistic Heavy Ion Collider) two atomic nuclei are stripped of their surrounding electrons and accelerated to near the speed of light. Creighton is a member of a collaboration that studies ultra peripheral collisions through STAR (Solenoidal Tracker At RHIC), one of four detectors at RHIC. UPC’s (Ultra Peripheral Collisions) occur when two nuclei pass each other at a very short distance yet still interact with one another only through electromagnetic means. While the nuclei continue along the beam line, only altered slightly if at all, particles are produced from the interaction. Trigger detectors enable the STAR detector to select the events of interest that will go to storage. Over the past couple of years, the CTB (Central Trigger Barrel) has been replaced by the TOF (Time of Flight) trigger detector. We will discuss the impact the TOF detector has on the STAR collaboration’s study of the UPC’s.
OBSERVATIONS OF THE FRESNEL AND ARAGO LAWS USING A MACH-ZEHNDER INTERFEROMETER

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Interferometers have been used extensively to study the earth’s atmosphere and astronomical objects via the Hubble Space Telescope (HST) and the Atmospheric Infrared Sounder (AIRS) platform. A Mach-Zehnder interferometer was constructed to investigate the interference laws of Fresnel and Arago. Using a combination of polarizers, mirrors and quarter-wave plates the four interference laws of Fresnel and Arago were studied. The results were then compared to the theoretical interpretation using Stoke’s Parameters.

USING TWO-PHOTON EXCITED FLUORESCENCE INTENSITY AND LIFETIME-BASED NADH IMAGING TO INVESTIGATE THE EMT6 CELL LINE

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Cancerous cells differ metabolically as compared to noncancerous cells, and this difference can be used to differentiate the two. We have utilized two-photon fluorescence imaging of intrinsic mitochondrial reduced nicotinamide adenine dinucleotide (NADH) to study the metabolic status of murine EMT6 cells under different treatment conditions. Recent published studies employ fluorescence lifetime imaging (FLIM) to determine the ratio of the free to enzyme-bound fluorophores populations that occur during changes in metabolism. We have used both traditional intensity based methods and FLIM in order to evaluate the extent to which NADH conformation changes with metabolic state. Treatment with both metabolic uncouplers and inhibitors caused systematic shifts in both the lifetime and populations of the free and bound pools of NADH. We are also investigating the extent to which glucose concentration modifies the NADH pools. Possible implications for the study of cancer will be summarized.

This research is funded by N.I.H R15-GM085776 and P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH).

MEASURING ION FLIGHT TIMES USING AN EMBEDDED REAL TIME CONTROLLER

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A real time programmable automation controller was used to gather the times of flight of ions within an experimental apparatus used to measure electron impact ionization cross sections. The controller is a National Instruments product that was programmed using LabVIEW software. Methods for using the controller to initiate an electron beam pulse and an ion extraction pulse, to gather the time of flight measurement made by a time-to-amplitude converter module, and to display those measurements on a spectrum graph in real time on a remote host computer will be presented. The experimental apparatus is part of a collection of equipment given to one of the authors by Rice University. An overview of the experimental method for measuring the electron impact ionization cross sections will be presented.
IN SEARCH OF THE PHI-MESON
Steven D. Pillen and J. Duckworth, Department of Physics, Creighton University, Omaha NE 68178

RHIC, the Relativistic Heavy Ion Collider, accelerates two atomic nuclei to near light speeds in opposing directions. When these atomic nuclei pass near each other in what are called “ultra peripheral collisions”, subatomic particles are emitted. Of particular interest is the rare production of the phi-meson, which can be detected through the tracking of the K+/K- pair into which it almost instantaneously decays. In the past, this detector included two tracking components: the outer tracker, the Time Projection Chamber (TPC), and an inner tracker, the Silicon Vertex Tracker. In the experiments performed in 2009 and forward, we have removed the SVT. Through computational models, we study the effect of the removal of the SVT on STAR’s ability to observe the process of phi-meson photo production.

THE DOPPLER EFFECT USING THE METHOD OF IMAGES
Tyler Bartsch, Physics Department, Hastings College, Hastings, NE 68902

The Doppler Effect has been utilized in numerous fields, from mechanics, to medicine, to astrophysics. The shift in frequency of sound as a siren approaches or recedes is a common experience. However, when sound waves are reflected from surfaces the analysis becomes more complex. Using a horizontally rotating speaker and stationary microphone the frequency distribution of sound waves was investigated, in an open air environment and one involving reflecting surfaces. The method of images was used to analyze the reflected sound. The experimental parameters of speaker and microphone location, rotational velocity of the speaker and type of reflecting surfaces were changed and the resulting frequency distribution was analyzed and compared to theory.

CELL ELASTICITY DETERMINATION BY STATIC AND DYNAMIC OPTICAL STRETCHING
Anya Burkart and Michael G. Nichols, Physics Department, Creighton University, Omaha, NE 68178

Under a mechanical load, bones are known to respond by increasing mass. However, there is little direct evidence that explains how this process occurs at the cellular level. The location of osteogenic cells in bone matrix makes it difficult to study the functional relationships between these cells. The identity of the primary mechanosensor has yet to be determined. We have used the optical stretcher, a dual-beam trap capable of stretching cells, to study the biomechanical properties of osteogenic cells. Our studies have accurately measured the elasticity of cells over increasing applied optical strain intervals. Measurements of the elasticity of 2T3 osteoblast-like cells and MLO-Y4 osteocyte-like cells show that these osteogenic cells are approximately 5.4 times stiffer than red blood cells. A current goal is to compare the measured cell stiffness with respect to time at a fixed strain. Dynamic stretching data would minimize the time cells are exposed to the lasers, reducing systematic error from cell heating. The shortened exposure time would also aid in high throughput cell screening. These investigations into the stiffness of osteogenic cells may improve our understanding of debilitating diseases such as osteoporosis and osteopetrosis, as well as skeletal structure changes in low gravity environments.

This research is funded by grant number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH).
CHARACTERIZATION OF THE DOMAINS OF THE NOVEL MITOCHONDRIAL PROTEINS, CHCHD3 AND CHCHD6
Joshua Sypal, Karisa Stover, Kilie Stover and Sharmin M. Sikich, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

The proteins Chchd3 and Chchd6 are novel mitochondrial proteins with an undetermined localization and function. Both of these proteins contain an unknown domain and a coiled coil-helix coiled coil-helix (CHCH) domain. The CHCH domain is characterized by two Cys-X$_9$-Cys repeats. This domain is also found in other mitochondrial proteins such as Cox17, which is utilized in copper metal binding, and Mia40, which assists in moving proteins into the inner membrane space. Bioinformatics tools were used to research the CHCH domain as well as the unknown domain for conserved residues and potential links to other known proteins. The hydropathy plots of Chchd3 and Chchd6 were generated to determine if they contain transmembrane regions. Secondary structure predictions were also used to compare the structure of Chchd3 and Chchd6. Conserved structure could be targeted for mutation in an effort to characterize residues responsible for localization and/or function. This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

SYNTHESIS OF DIARYLALKYNE-CONJUGATED PEPTIDES FOR CHEMOSENSING APPLICATIONS
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The goal of this project was to develop a synthetic approach to prepare arene-peptide conjugates that can serve as fluorescent chemosensors for Zn(II) analytes. By attaching peptide chain sequences inspired by naturally-occurring zinc finger motifs to a fluorescent diaryl alkyne, peptide chain interactions with the analyte should lock the arene rings into place, producing an increase fluorescence intensity that will serve as the sensor readout. Diarylalkyne regioisomers possessing both amine and carboxylic acid functional groups were prepared via palladium-catalyzed cross-coupling, and such compounds were shown to be fluorescent. Both solid and liquid phase Fmoc peptide coupling reactions were utilized to create diarylalkyne compounds with an Fmoc-protected amine unit and a carboxylic acid group. Purification was problematic for the liquid phase preparation of such diarylalkyne derivatives due to incomplete reaction between the aminoarencarboxylic acid and Fmoc-protected amino acids. To remedy this, analogous coupling to arene reactants immobilized on the solid phase was examined, as well as the direct synthesis of the diarylalkyne via palladium-catalyzed cross-coupling directly on-resin. HPLC and MALDI-TOF mass spectroscopic analysis were used to examine the purity of the Fmoc-protected diarylalkyne reactants as well as the completed peptide conjugate oligopeptide sequences. Details of the varying methods to conjugate diarylalkyne units with growing peptide chains prepared via solid-phase peptide synthesis will be described, as will the fluorescent properties of the resulting peptides in comparison to alkane-tethered arene control compounds. This project is supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.
LEFT-HANDED Z-DNA: A STRUCTURAL MOTIF THAT IS RECOGNIZED BY A CYANINE DYE

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Z-DNA has inverted helicity and is a higher energy form of the common right-handed B-DNA. The biological relevance of Z-DNA has been demonstrated by the discovery of transcription factors that selectively bind to Z-DNA and thus have a direct impact on gene expression. We demonstrate that the spermine induced left-handed Z-form of DNA is detected with a cyanine dye by circular dichroism via a unique newly formed signal.

UNDERSTANDING ANTIBIOTIC RESISTANCE

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The mechanism of β-lactam antibiotic resistance is studied using ampicillin resistant bacteria. One known mechanism of resistance for microbes to penicillin is the inactivation of penicillin by lactamase (which hydrolysis of the amide bond in penicillin). Deactivation of lactamase has been shown to occur with the use of sulbactam, which is similar in structure to ampicillin. When the amide bond in sulbactam is hydrolyzed, it forms a stable imine which irreversibly binds to the lactamase. A series of plant extracts and synthetic compounds are studied to see if the effects of sulbactum can be increased or duplicated. Antibiotic resistant bacteria (E. coli), ampicillin, sulbactam, and extracts are screened for possible inhibition of antibiotic resistance. Data on the combination of extracts in the presence of antibiotic and/or sulbactum, on the effects of the growth of the E. coli will be presented.

OPTIMIZATION OF EXTRACTION OF BONE NONCOLLAGENOUS MATRIX PROTEINS FROM PORCINE FEMUR

Alicia Exstrom, Morgan Martin, Elizabeth Doane, Mark V. Wilson, and Erin Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Noncollagenous bone matrix proteins are believed to be responsible for nucleating bone mineral and regulating its morphology, size and orientation with respect to collagen fibrils. Bone disease states arise when regulation by these proteins does not occur normally. Determining the presence and functions of these proteins in normal and abnormal bone samples will help us to understand the molecular mechanisms of bone diseases such as osteoporosis and osteopenia. Our goal was to extract proteins from porcine trabecular bone and identify which protein inhibit or promote bone mineral growth in vitro using a novel gel electrophoresis/gel diffusion method. Proteins were extracted into guanidinium hydrochloride and EDTA solutions in the presence of proteases inhibitors to prevent protein degradation. Extraction solutions were then dialyzed against buffer and lyophilized. Final results of protein extraction and mineralization studies will be presented.
SYNTHESIS OF PYRENE-BASED METAL CATION CHEMOSENSORS USING CLICK REACTIONS

Thomas W. Whetstone and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

The purpose of this project was to use a Click chemistry approach to synthesize organic molecules that will chelate metals and generate a fluorescent signal. The target organic chelators consisted of an aromatic bridge (with varying ortho, meta and para regiochemistry) connected through ether linkages to 1,2,3-triazole rings with attached pyrene units. These relatively complicated molecules can be prepared in only three steps from available starting materials. Because the heterocyclic triazole rings can coordinate to metal ions, the goal of this project was to measure whether metals interacting within the triazole binding pocket would cause the attached pyrene rings to change their intramolecular interactions and therefore their fluorescence properties, generating a fluorescent signal upon analyte binding. We examined two synthetic approaches to prepare the target compounds. In one approach, the ether linkages were prepared first and the resulting dialkyne was then used in a click reaction with azidopyrene reactants. In another approach azidopyrenes were first clicked to propargyl alcohol and then the bridging ether linkages were formed. Each prepared analog can be evaluated as a sensor by measuring changes in fluorescence signals in the presence of transition metal cations such as Zn(II), Fe(III) or Pd(II). Characterization of these compounds and details describing the advantages and disadvantages of each synthetic route will be described.

GENETIC ENGINEERING OF A NOVEL MITOCHONDRIAL PROTEIN, CHCHD3

Karisa Stover, Josh Sypal, Kilie Stover, and Sharmin M. Sikich, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

Chchd3 is a novel mitochondrial protein with undetermined function. Chchd3 contains two domains, one an unknown domain and the other a coiled-coil helix coiled-coil helix (CHCH) domain. The CHCH domain consists of two helical Cys-x₉-Cys motifs. This domain is also found in the mitochondrial protein Cox17, which functions in the binding and delivery of copper. The function of Cox17, as well as other CHCH domain-containing proteins, was taken into account while trying to determine the function of Chchd3. Previous work determined that Chchd3 is a mitochondrial protein. Through the use of online motif analysis programs, four specific phosphorylation sites, as well as glycosylation and myristylation sites, have been identified. By mutating these sequences, it may be possible to determine their involvement in the function and localization of Chchd3. In this work, the Chchd3 DNA was cut from the cDNA cloning vector pCMV-Sp.6 and ligated into a pFLAG vector with the intent to express the Chchd3 protein with a C-terminal FLAG tag for observational use in mammalian cells. With the flagged Chchd3 protein, we will be able to determine the effects of mutations on localization. This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.
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Special Recognition goes to Nebraska Wesleyan University for hosting our Annual Meeting and all the time and effort that entails.

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

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Nancy Rosenow is the Executive Director of the Dimensions Educational Research Foundation where she works with a cadre of national consultants who deliver research and resources to educators and families throughout the United States. Dimensions works in collaboration with the Arbor Day Foundation on a national initiative called Nature Explore, a program designed to help children re-connect with the natural world as an integral part of daily learning. She has spoken about the Nature Explore work in presentations to national and international groups, including the World Forum on Early Care and Education in 2005, 2007 and 2009. Dimensions and Arbor Day helped host the international Working Forums on Nature Education in 2006 and 2008, and will host the Connecting Children with Nature Action Forum in October 2010. She has authored recent articles for national publications such as Exchange magazine, Young Children magazine, and Out of the Box Training. She is also co-author of the Learning with Nature Idea Book.

She delivers trainings and keynote addresses to a variety of groups throughout the country. She is a member of the international Nature Action Collaborative for Children Leadership team, and is Nebraska’s past-president for the National Association for the Education of Young Children.
John Rosenow is the founder and Chief Executive of the million-member Arbor Day Foundation, which has been responsible for planting more than 200 million trees around the world. The Arbor Day Foundation created the Tree City USA community forestry program which today impacts 3400 towns, cities and military bases in all 50 states. The Foundation also is responsible for the Rain Forest Rescue program and Arbor Day Farm’s Lied Lodge, an international conference center dedicated to education and conservation.

Nature Explore is a collaborative program of the Arbor Day Foundation and Dimensions Educational Research Foundation. Throughout the nation, future scientists are being nurtured in Nature Explore Classrooms, nature-friendly outdoor spaces in child care centers, schools, parks, and nature centers. The goal of this comprehensive, research-based initiative is to help children and families develop a profound engagement with the natural world, where nature is an integral, joyful part of children’s daily learning.

The Nature Explore Program provides research-based workshops, design consultations and hands-on, field-tested resources to schools; nature centers; national forests, parks and wildlife refuges; zoos; arboretums and early childhood programs.

A network of certified Nature Explore Classrooms is developing throughout the United States. They are appropriate wherever a traditional playground might be built.

Nature Explore consultants are also available to deliver keynote addresses and presentations at educational and environmental conferences.

Since 1998, the Dimensions Foundation has been conducting on-going research on nature education at the Dimensions Early Education Programs, which serve as primary research classrooms, and currently at two additional regional research sites in Minnesota and California. The Nature Explore program works in collaboration with many national and international partners, including the Nature Action Collaborative for Children, sponsored by the World Forum Foundation; the Children and Nature Network; Keep America Beautiful and many others.
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