PROGRAM
and
PROCEEDINGS

THE NEBRASKA ACADEMY
OF
SCIENCES
1880-2008

including the

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

128th Anniversary Year

One Hundred-Eighteenth Annual Meeting

April 18, 2008
OLIN HALL OF SCIENCE - NEBRASKA WESLEYAN UNIVERSITY
LINCOLN, NEBRASKA

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The 2008 Fall Retreat of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, October 8 - 11 (Thursday, Friday, and Saturday).

President: Ross Dinwiddie, Central City High School, Central City, NE
President-Elect: Dan Sitzman, Omaha North High School, Omaha, 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/officers.htm

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

3. **Lincoln Gem & Mineral Club**
   Web site: http://incolor.inebraska.com/jna/gemclub/lgmc.htm

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*
   Annual Meeting, May 16 - 18, 2008, Scottsbluff, NE

8. **Nebraska Psychological Society**
   http://www.nebpsych.org/

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

10. **Nebraska Space Grant Consortium**
    Web site: http://www.unomaha.edu/nasa/

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

THE NEBRASKA ACADEMY OF SCIENCES, INC.

302 Morrill Hall, 14th & U Streets
Lincoln, Nebraska 68588-0339

Affiliated with the American Association for the Advancement of Science
And
National Association of Academies of Science

GENERAL INFORMATION

Members and visitors will be registered at Olin Hall of Science, Nebraska Wesleyan University, 50th & St. Paul, Lincoln, Nebraska. The registration fee is $20.00 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 32 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 18, 2008

7:30 a.m.	REGISTRATION FOR ACADEMY, Lobby of Lecture wing, Olin Hall
8:00	Aeronautics and Space Science, Session A, Olin 249
	Collegiate Academy, Biology Session A, Olin B
	Collegiate Academy, Chemistry and Physics, Session A, Olin 324
	Earth Science, Olin 224
8:30	Biological and Medical Sciences, Session A, Olin 112
	Biological and Medical Sciences, Session B, Smith Callen Conference Center
	History and Philosophy of Science, Olin 325, combined section
	Teaching of Science and Math, Olin 325, combined section
	Applied Science and Technology, Olin 325, combined section
	Junior Academy, Senior High REGISTRATION Olin Hall Lobby
9:00	Junior Academy, Senior High Competition, Olin 124, Olin 131
9:29	Chemistry and Physics, Section A, Chemistry, Olin A
9:50	Aeronautics and Space Science, Poster Session, Olin 249
11:00	MAIBEN MEMORIAL LECTURE, OLIN B
	David Kofoed, CSI Divsion Commander, Douglas County Sheriffs Department, Omaha, NE
12:00	LUNCH, PATIO ROOM, STORY STUDENT CENTER
	(pay and carry tray through cafeteria line, or pay at NAS registration desk)
12:55 p.m.	Earth Science, Olin 224
1:00 p.m.	Collegiate Academy, Biology Session A, Olin B
	Collegiate Academy, Biology Session B, Olin 249
	Chemistry and Physics, Section B, Physics, Planetarium
	Collegiate Academy, Chemistry and Physics, Session A, Olin 324
	Collegiate Academy, Chemistry and Physics, Session B, Olin 325
	Junior Academy, Junior High REGISTRATION, Olin Hall Lobby
	Junior Academy, Senior High Competition, (Final), Olin 110
1:15	Chemistry and Physics, Section A, Chemistry, Olin A
1:30	Anthropology, Olin 111
	Biological and Medical Sciences, Session C, Olin 112
	Biological and Medical Sciences, Session D, Smith Callen Conference Center
	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
Olin 249

8:05am 1. *IN-SITU* ELLIPSOMETRIC ANALYSIS OF THE PHOTOFIXING OF RTV EFFLUENT ON MgF_2 COATED GLASS SUBSTRATES. N.J. Ianno* and D.W. Thompson, Department of Electrical Engineering, University of Nebraska–Lincoln.

8:20 2. AN ANALYSIS OF ORION SPACECRAFT LEAK DETECTION AND VEHICLE-LEVEL LEAK IDENTIFICATION. Andrew Kelley*, Department of Mechanical Engineering, University of Nebraska–Lincoln.

8:35 3. MINIATURE *IN VIVO* ROBOTS FOR NATURAL ORIFICE TRANSLUMENAL ENDOSCOPIC SURGERY. Amy C. Lehman*, Nathan A. Wood, and Shane M. Farritor, Department of Mechanical Engineering, University of Nebraska–Lincoln.

8:50 4. EFFECTS OF CLASS I HISTONE DEACETYLASE INHIBITION UPON ONCOGENE AND TUMOR SUPPRESSOR GENE REGULATION. Holly Sukup*, Linda Buckles, Sanjib Chowdhury, Gillian Howell, Lisa Humphrey, and Michael Brattain, Eppley Cancer Center, University of Nebraska Medical Center, Omaha.

9:05 5. COMPARING DIFFERENT METHODS OF FACIAL RECONSTRUCTION. Juana Acosta* and Nicole Wall, Department of Biology, College of Saint Mary, Omaha.

9:20 6. CHANGES IN POSTURAL CONTROL DUE TO INTERVENTION IN MULTIPLE SCLEROSIS PATIENTS CAN BE DETECTED: A MODEL FOR FUNCTIONALLY IMPAIRED ASTRONAUTS. Jessie Huisinga*, HPER Biomechanics Lab, University of Nebraska at Omaha; and Mary Filipi, College of Nursing, University of Nebraska Medical Center, Omaha.

9:35 7. GAIT CHANGES FOLLOWING AN ACUTE PERIOD OF ISCHEMIA IN HEALTHY YOUNG INDIVIDUALS. Sara A. Myers* and Nick Stergiou, HPER Biomechanics Laboratory, University of Nebraska at Omaha.

9:50 BREAK/POSTER PRESENTATIONS

10:10 8. STUDIES ON THE DISTRIBUTION OF THE PARMOTREMA PERFORATUM GROUP IN SE OKLAHOMA, EASTERN AND CENTRAL TEXAS, WESTERN LOUISIANA, AND WESTERN ARKANSAS. Rebecca Moshman* and Robert Egan, Department of Biology, University of Nebraska at Omaha.

10:25 9. IDENTIFICATION OF GEOLOGICAL STRUCTURES FROM LINEAMENTS ON REMOTELY-SENSED IMAGES OF THE BLACK HILLS-PINE RIDGE REGION. Jennifer L. Balmat* and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.

10:40 10. ASSESSING WATER CLARITY OF NEBRASKA RESERVOIRS USING SATELLITE REMOTE SENSING. Jack Dohrman, School of Natural Resources, University of Nebraska–Lincoln.

10:55 11. USING REMOTE SENSING TO QUANTIFY EROSION RATES OF FOSSIL TRACKWAYS AT TOADSTOOL GEOLOGICAL PARK. J. Zwiebel*, M.B. Leite, H.E. LaGarry, B.H. Breithaupt, and N.A. Matthews, Department of Physical and Life Sciences, Chadron State College, Chadron.

11:10 12. DEVELOPING A HIGH-PRECISION, LOW-COST FIELD INSTRUMENT FOR MONITORING THE PIGMENT CONTENT AND COMPOSITION IN GRAIN AND FRUIT CROPS. Arthur Zygielbaum*, Donald Rundquist, and Anatoly Gitelson, School of Natural Resources, University of Nebraska–Lincoln.

11:25 13. INTERACTIVE CLASSROOM MATERIALS ON LIGHT. Christopher M. Siedell*, Kevin M. Lee, Andrew Frederick, Center for Science, Mathematics, & Computer Education, University of Nebraska–Lincoln.

11:40 14. STIMULATING STUDENT INTEREST IN AEROSPACE THROUGH THE CONVERSION OF A T-29 BACK INTO "FLYING" CLASSROOM. Evan Killeen* and John McLean*, Department of Education, Strategic Air & Space Museum, Ashland.

AERONAUTICS AND SPACE SCIENCE

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

CONSTRUCTION AND UTILIZATION OF AN ELECTRIC FIELD MILL TO MEASURE THE ELECTRIC FIELD OF THE EARTH. Heather Finney, Department of Physics, Hastings College, Hastings.

MACROSCOPIC SCATTERING: RIGID BODY IMPACT OF A BASEBALL BY A BAT. Josh Tomayer, Department of Physics, Hastings College, Hastings.

THE DESIGN, CONSTRUCTION, AND ANALYSIS OF AN ACOUSTIC LEVITATION APPARATUS. Chris Kube, Department of Physics, Hastings College, Hastings.

INVESTIGATION OF MAGNETIC DAMPENING ON A NON-FERROMAGNETIC AIR TRACK. Geoffrey Bergman, Department of Physics, Hastings College, Hastings.

EXAMINATION OF SPECIES DIVERSITY WITHIN *TRYPANOSOMA* OF AUSTRALIAN FRESHWATER TURTLES. Ashley Freyre and Scott Snyder, Department of Biology, University of Nebraska at Omaha.

POPULATION GENETICS OF *SPIRORCHIS SCRIPTA* (DIGENEA: SPIRORCHIIDAE) IN FRESHWATER TURTLES. Dominique Freyre and Scott Snyder, Department of Biology, University of Nebraska at Omaha.

LESSONS LEARNED FROM A NASA/NSF SPONSORED ONLINE EARTH SYSTEM SCIENCE COURSE FOR TEACHERS. Neal Grandgenett, Bill Schnase, and Steve Hamersky, Department of Teacher Education, University of Nebraska at Omaha; and Robert Shuster, Department of Geology, University of Nebraska at Omaha.

ANTHROPOLOGY AND GEOGRAPHY

Co-Chairpersons: Peter Bleed and Stephen Damm
Department of Anthropology and Geography
University of Nebraska–Lincoln
Olin Hall 111

1:30 p.m. WELCOME

1:40 1. TEMPORAL INSANITY: WOODLAND ARCHAEOLOGY AND THE CONSTRUCTION OF CHRONOLOGY. Erin Dempsey, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:00 2. CLUES TO THE RELATIONSHIP OF THE RIVERBANK SITE TO OTHER OHIO HOPEWELL SITES THROUGH INSTRUMENTAL NEUTRON ACTIVIATION ANALYSIS ON POTTERY. Amanda Landon, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:20 3. TAPHONOMY OF GUNS. Andrew LaBounty, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:40 4. "CHARGING THESE ENTRENCHMENTS AGAINST MODERN RIFLES IS TERRIBLE": THE ARCHAEOLOGY OF HUMAN BEHAVIOR IN COMBAT: EL CANEY, CUBA, JULY 1, 1898. William Altizer, Department of Anthropology and Geography, University of Nebraska–Lincoln.

BIOLOGICAL AND MEDICAL SCIENCES

Chairperson: Theodore Burk
Department of Biology, Creighton University, Omaha

SESSION A

Session Chairperson: Theodore Burk, Creighton University, Omaha
Olin 112

8:30 1. NKT CELLS: FRIEND OR FOE? Veneracion G. Cabana*, Division of Science and Mathematics, Union College, Lincoln; and Jordan Lang, Department of Pathology, University of Chicago, IL.

8:45 2. GENETICALLY ENGINEERED MICE AS MODELS FOR ATHEROSCLEROSIS. Jordan Lang*, Department of Pathology, University of Chicago, IL; and Veneracion Cabana, Division of Science and Mathematics, Union College, Lincoln.

9:00 3. THE EFFECT OF SODIUM AND GLUCOSE TRANSPORTERS ON PLASMA GLUCOSE CONCENTRATIONS. Kelvin Herold*, Josh Enovoldson, Eddie Perry, Megan Perry, Zane Downs, Dan Sufficool, and Veneracion G. Cabana, Division of Science and Mathematics, Union College, Lincoln.

9:15 4. CREATION OF GALECTIN-3 MUTANTS DEFICIENT IN LACTOSE BINDING AFTER SITE-DIRECTED MUTAGENESIS. Jon DeMuth*, Department of Computer Science, University of Nebraska at Omaha; and Linda C. Chaney and William G. Chaney, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.

9:30 BREAK

9:45 5. RECEPTOR SUBTYPES INVOLVED IN LUNG FIBROBLAST-MEDIATED COLLAGEN GEL CONTRACTION STIMULATED BY LYSOPHOSPHATIDIC ACID AND SERUM. Stephanie A. Brady*, Department of Computer Science, University of Nebraska at Omaha; and Nancy A. Schulte, Karen M. Kassel, and Myron L. Toews, Department of Pharmacology and Experimental Neuroscience, and Stephen I. Rennard, Department of Internal Medicine, University of Nebraska Medical Center, Omaha.

10:00 6. REDUCING BOTTLENECKS IN PROTEOMICS DATA ANALYSIS. Adam S. Cornish* and Mark A. Pauley, Department of Computer Science, University of Nebraska at Omaha; and Pawel Ciborowski, Center for Neurovirology and Neurodegenerative Disorders, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.

10:15 7. A CLOSER LOOK INTO THE rRNA GENE COMPLEX OF PATHOGENIC MEMBERS OF ACTINOBACTERIA. Laura E. Heuermann* and Dhundy Bastola, Department of Computer Science, University of Nebraska at Omaha.

10:30 8. ROLE OF HUMAN N-CADHERIN PROMOTER SEQUENCES IN REGULATING N-CADHERIN GENE EXPRESSION. Kate Marley*, Amy Hamik, HeLea Messersmith, Maggie Sheehy, and Mark Wilson, Department of Biology, Doane College, Crete.

11:00 MAIBEN MEMORIAL LECTURE - OLIN B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

Session Chairperson: Kimberly A. Carlson, University of Nebraska at Kearney
Smith Callen Conference Center

8:30 1. STABILITY OF A FOREIGN PROTEIN IN CHIMERIC CVB3: POTENTIAL FOR GENE DELIVERY. Christine E. Gilling*, Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney; and Kyung-soo Kim, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha.

8:45 2. *IN VITRO* STUDIES OF BOVINE LEUKEMIA VIRUS. J. A. Isaacson*, N. Raasch, and R. Nelson, Department of Biology, Nebraska Wesleyan University, Lincoln.

9:00 3. INFLUENCE OF EXERCISE TRAINING ON GENE EXPRESSION IN DIABETIC RATS. Robert Daro*, Ashley Stillwell, and Janet Steele, Department of Biology, University of Nebraska at Kearney.

9:15 4. UP-REGULATION OF PRO-INFLAMMATORY CYTOKINES BY THE AORTIC ENDOTHELIAL CELL LINE SVEC4-10EE2 IN REPSONSE TO ALCOHOL METABOLITES. Chris D. Peters*, Geoffrey M. Thiele, and Michael J. Duryee, Department of Internal Medicine, University of Nebraska Medical Center, Omaha, and The VA Alcohol Research Center, the Veterans Affairs Medical Center, Omaha.

9:30 BREAK

9:45 5. EFFECT OF CARBON CHAIN LENGTH AND NUMBER ON THE LIPID OXIDATION ACTIVITY OF URANIUM. Deniece Oelsligle* and W. E. Briner, Department of Psychology, University of Nebraska at Kearney.

10:00 6. CHANGES IN GST GENE EXPRESSION IN LARGE CAGED POPULATIONS OF *DROSOPHILA MELANOGASTER*. Anjeza Pashaj*, Kimberly A. Carlson, Kylee Gardner, and Darby J. Carlson, Biology Department, University of Nebraska at Kearney; and Lawrence G Harshman, School of Biological Sciences, University of Nebraska–Lincoln.

10:15 7. CHANGES IN GENE EXPRESSION PROFILES RELATED TO MORTALITY OVER THE LIFE SPAN OF LARGED CAGED POPULATIONS OF *DROSOPHILA MELANOGASTER*. Kylee Gardner*, Kimberly A. Carlson, Anjeza Pashaj, and Darby J. Carlson, Department of Biology, University of Nebraska at Kearney; and Lawrence G Harshman, School of Biological Sciences, University of Nebraska–Lincoln.

10:30 8. CO-EVOLUTION IN *DROSOPHILA MELANOGASTER*: THE EFFECTS MALES HAVE ON LIPID CONTENT IN EGGS. Tara M. Somer*, M. H. Wang, and L. G. Harshman, School of Biological Sciences, University of Nebraska–Lincoln.

11:00 MAIBEN MEMORIAL LECTURE - OLIN B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

Session Chairperson: Theodore Burk, Creighton University, Omaha
Olin 112

1:30 1. PLASTICITY IN REPRODUCTIVE EFFORT IN THE BURYING BEETLE *NICROPHORUS PUSTULATUS*: EFFECTS OF COMPETITION AND BODY SIZE. Michael Mcguire*, M. Gwartney, J. Space, and C. M. Rauter, Department of Biology, University of Nebraska at Omaha.

1:45 2. GENE EXPRESSION ASSAYS OF LIGNIN BIOSYTHESIS IN SWITCHGRASS STEMS. Austin S. Nuxoll*, Anna Barber, and Paul Twigg, Department of Biology, University of Nebraska at Kearney.

2:00 3. NEW HOST AND GEOGRAPHIC DISTRIBUTION RECORDS FOR HELMINTH PARASITES IN THREE SPECIES OF BATS (*CHIROPTERA:* VESPERTILIONIDAE) FROM THE PINE RIDGE OF NEBRASKA. Chris T. McAllister*, Department of Physical and Life Sciences, Chadron State College, Chadron; and Charles R. Bursey, Department of Biology, Pennsylvania State University-Shenango Campus, Sharon, PA.

2:15 4. COPPERHEAD TRANSLOCATION IN NEBRASKA: A COMPARISON BETWEEN TRANSLOCATED AND RESIDENT SNAKES. Paul J. Rodriguez* and James D. Fawcett, Department of Biology, University of Nebraska at Omaha.

2:30 5. ISOLATION OF MICROORGANISMS FROM AN ALKALINE LAKE ECOSYSTEM THAT SECRETE FERULIC ACID ESTERASES ACTIVE AT HIGH pH. Dana L. Schultz* and J. Shaffer, Biology Department, University of Nebraska at Kearney; and B. Luedtke, Department of Microbiology and Molecular Genetics, Oklahoma State University, Stillwater, OK; and B. Plantz, School of Biological Sciences, University of Nebraska–Lincoln.

2:45 BREAK

3:00 6. A POSSIBLE CAROLINIAN RELICT FLORA IN THE NEBRASKA SANDHILLS. Steven B. Rolfsmeier*, Kansas State Herbarium, Manhattan, KS; and Ronald R. Weedon, High Plains Herbarium, Chadron State College, Chadron.

3:15 7. EXTRACTION AND PRELIMINARY ISOLATION TECHNIQUE FOR ANTIMICROBIAL BIOACTIVE CONSTITUENTS OF GREAT PLAINS BIDENS (ASTERACEAE). Leigha M. Curtiss* and Ronald R. Weedon, High Plains Herbarium, Chadron State College.

3:30 8. ANALYSIS OF LEGHEMOGLOBIN TRANSCRIPT LEVELS IN PARTRIDGE PEA TISSUES. Katie A. Langenfeld*, Anna Barber, and Paul Twigg, Department of Biology, University of Nebraska at Kearney.

3:45 9. KINETIC STUDIES ON *ARABIDOPSIS THALIANA* dUTPASE. Ishwari Poudel*, Department of Biological Systems Engineering; and Kittichai Chaiseeda, Department of Chemistry; and Hideaki Moriyama, Department of Chemistry and Center for Biotechnology, University of Nebraska–Lincoln.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

Session Chairperson: Mark Reedy, Creighton University, Omaha
Smith Callen Conference Center

1:30 1. CONSTRUCTION OF A MUTANT FORM OF TIMP-2 TO EVALUATE MMP-INDEPENDENT AND MMP-DEPENDENT FUNCTIONS OF TIMP-2 ON NEURAL CREST MIGRATION. Ann Jizba* and M. Reedy, Department of Biology, Creighton University, Omaha; and P. Brauer, Department of Biomedical Sciences, Creighton University, Omaha.

1:45 2. EXPRESSION OF α_3 INTEGRIN IN AVIAN EMBRYOS DURING THE STAGES OF CARDIAC NEURAL CREST MIGRATION. Lan Uyen Tran* and M. Reedy, Department of Biology, Creighton University, Omaha; and P. Brauer, Department of Biomedical Sciences, Creighton University, Omaha.

2:00 3. INFLUENCE OF EXERCISE TRAINING AND DIABETES ON ADRENERGIC AND CHOLINERGIC RECEPTOR SENSITIVITY IN RAT VASCULAR TISSUE RINGS. Ashley Stillwell*, Robert Daro, and Janet Steele, Department of Biology, University of Nebraska at Kearney.

2:15 4. DETECTION OF COLOSTRUM ANTIBODIES AGAINST *CLOSTRIDIUM PERFRINGENS*. Daniel McDermott*, Chadron State College, Chadron; and Avery Paulson, University of Nebraska–Lincoln.

2:30 5. EVOLUTIONARY RESPONSES OF TOLERANCE RANGES TO UNVARYING CONDITIONS: A STUDY EXAMINING pH ADAPTATION IN *ESCHERICHIA COLI*. Liza Meiksins* and Alistair J. Cullum, Department of Biology, Creighton University, Omaha.

2:45 BREAK

3:00 6. ACTIVATED MICROGLIA STIMULATE NEURONAL SURIVAL AND NEUROGENESIS FOLLOWING DAMAGE. Kristi Lorenzen* and A. Shibata, Department of Biology, Creighton University, Omaha.

3:15 7. ANALYSIS OF NEUROGENESIS AND NEURODEGENERATION IN ATOH1-CRE DICER NULL MUTANT MICE. Sarah Hake* and A. Shibata, Department of Biology, Creighton University, Omaha; and M. Pierce, G. Soukup, and B. Fritzsch, Department of Biomedical Sciences, Creighton University, Omaha.

3:30 8. EXERCISE TRAINING NORMALIZES ACE AND ACE2 IN THE BRAIN OF RABBITS WITH PACING INDUCED CHRONIC HEART FAILURE. Sumit Kar*, College of Arts and Sciences, Creighton University, Omaha; and Lie Gao, and Irving H. Zucker, Department of Cellular and Integrative Physiology, University of Nebraska Medical Center, Omaha.

3:45 9. CONSTRUCTION OF A NON-POLAR MUTATION IN *HPRG*, A POTENTIAL REGULATORY TYPE III SECRETION CHAPERONE IN *PSEUDOMONAS SYRINGAE*. Elizabeth Kurien* and Karin van Dijk, Department of Biology, Creighton University, Omaha; and Matthew R. Zeleny, and James Alfano, School of Biological Sciences, University of Nebraska–Lincoln.

4:00 10. CD 38 REGULATION IN HUMAN ASTROCYTES: ROLE OF MAP KINASE PATHWAY. Jeffrey J. Belmont*, School of Biological Sciences, University of Nebraska–Lincoln; and S. Banerjee and A. Ghorpade, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.

CHEMISTRY AND PHYSICS

Chairperson: Scott Darveau
Department of Chemistry,
University of Nebraska at Kearney

SECTION A, CHEMISTRY
10:00 a.m. Featured Speaker: Marjorie Langell
Olin A

9:29 a.m. WELCOME

9:30 1. ELECTRON STIMULATED DESORPTION OF WATER FROM A STEPPED NiO SURFACE. Michael A. Stutzman* and M.A. Langell, Department of Chemistry, University of Nebraska–Lincoln.

9:45 2. $Ni_{x-1}Cu_xO$ ROCKSALT SOLID SOLUTIONS: A UNIQUE ENVIRONMENT FOR Cu^{2+}. Jesse N. Voelker*, K.J. Gaskell, A. Starce, and M.A. Langell., Department of Chemistry, University of Nebraska–Lincoln.

10:00 3. TRANSITION METAL OXIDE SURFACES. Marjorie Langell*, Department of Chemistry, University of Nebraska–Lincoln.

10:45 BUSINESS MEETING

11:00 MAIBEN MEMORIAL LECTURE - OLIN B

12:00 p.m. LUNCH

1:15 4. ANALYSIS OF COPPER CLADDING OF A SUNKEN SHIP. James D. Carr*, Department of Chemistry, and Brent M. Wilson, Department of Mechanical Engineering, University of Nebraska–Lincoln.

1:30 5. DESIGN OF COLORIMETRIC DRUG SENSORS. Andrea E. Holmes*, Jordan Groathouse, Mike Guericke, Marcus Anderson, Casey Gustafson, Katie Wilcox, Christa Flitcroft, and Jacob Francis, Department of Chemistry, Doane College, Crete.

1:45 6. DOCKING STUDIES OF BINDING MODES FOR PROTEIN KINASE INHIBITORS. Haizhen Zhong* and Jenna Stang, Department of Chemistry, University of Nebraska at Omaha, Omaha.

2:00 7. ENTRAPMENT OF PROTEINS IN HYDRAZIDE-ACTIVATED SILICA FOR HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY. Abby Jackson*, Hai Xuan, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

2:15 8. DRUG-PROTEIN DISSOCIATION RATE MEAUREMENTS USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY AND PEAK PROFILING. John E. Schiel*, C. M. Ohnmacht, E. Papastavros, and D. S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

2:30 BREAK

2:45 9. INVESTIGATING PROTEIN-HYDROXYAPATITE INTERACTIONS AND THEIR ROLE IN COLLAGEN MINERALIZATION. Casey L. Gustafson, Kaylee R. Troxel, Helen A. Kraye, Mark V. Wilson, and Erin E. Wilson*, Department of Chemistry, Doane College, Crete.

3:00 10. STRUCTURE AND MECHANISM OF THE *GLMS* RIBOZYME. Juliane K. Soukup[1,2]*, G.A. Soukup[2], J. Souchek[1], K. Klawuhn[1] and J.A. Jansen[1]. [1]Departments of Chemistry and [2]Biomedical Sciences, Creighton University, Omaha.

3:15 11. DFT STUDIES OF THE FREE ENERGY, ENTHALPY, AND ENTROPY OF ANION BINDING OF TETRA-OXOCYCLOHEXADIENYLIDENE PORPHYRINOGEN IN SOLUTION. Paul A. Karr* and Brian Jundt, Department of Physical Science and Mathematics, Wayne State College, Wayne; and Amy L. McCarty, Melvin E. Zandler, and Francis D'Souza, Department of Chemistry, Wichita State University, Wichita, KS; and Katsuhiko Ariga and Jonathan P. Hill, International Center for Young Scientists, National Institute for Materials Science, Namiki 1-1, Tsukuba 305-0044, Ibaraki, Japan.

3:30 CLOSING COMMENTS

CHEMISTRY AND PHYSICS

Chairperson: Gintarus K. Duda
Department of Physics
Creighton University, Omaha

SECTION B, PHYSICS
Planetarium

1:00 pm WELCOME

1:05 KEYNOTE ADDRESS: HIERARCHICAL MODELING OF PROTEIN FOLDING AND AGGREGATION. Dr. Patricia Soto, Department of Physics, Creighton University, Omaha.

1:45 1. USER INTERFACES FOR THE STAR SLOW CONTROLS SYSTEM. A.U. Abeysekara*, T.S.McShane, M. Cherney and Y.N. Gorbunov, Department of Physics, Creighton University, Omaha.

2:00 2. DYNAMIC LIGHT SCATTERING IN PHOSPHATE GLASSES. Roberto L. Fabian Jr.* and David L. Sidebottom, Department of Physics, Creighton University, Omaha.

2:15 3. GLASS FORMING DYNAMICS OF AQUEOUS MALTOSE FROM DYNAMIC LIGHT SCATTERING. Mark Durante* and David L. Sidebottom, Department of Physics, Creighton University, Omaha.

2:30 4. LASER MONITORING SYSTEM FOR ALICE. Benjamin Rizzo, Department of Physics, Creighton University, Omaha.

2:45 BREAK

3:00 5. LATEST RESULTS IN THE DIRECT DETECTION OF NEUTRALINOS. Stephanie J. Schuk, Department of Physics, Creighton University, Omaha.

3:15 6. PHOTO- AND BIO-PHYSICAL CHARACTERIZATIONS OF LIPOPHILIC DYES FOR NEURONAL TRACING. Jeff Tonniges*, M. Hansen, and M. Nichols, Physics Department; and B. Fritzsch, Biomedical Science Department, Creighton University, Omaha; and B. Gray, Molecular Targeting Technologies, Inc., West Chester, PA.

3:30 7. ANALYSIS OF A LOW STATISTICS SAMPLE. Eric S. Watson, Department of Physics, Creighton University, Omaha.

3:45 8. NONLINEAR FIT ANALYSIS OF X-RAY DETECTION EFFECIENCY USING EXCEL AND MATHEMATICA ROUTINES. Hans T. Wrage* and S.J. Cipolla, Department of Physics, Creighton University, Omaha.

4:00 9. DIFFUSION OF FLUORESCENTLY-LABELED LIPOPHILIC DYES. Maria Hansen[1]*, Jeremy Duncan[2], Bernd Fritzsch[2], Michael G. Nichols[1,2], and Brian Gray[3]. [1]Department of Physics, [2]Department of Biomedical Sciences, Creighton University, Omaha; and [3]Molecular Targeting Technologies, INC. West Chester, PA.

EARTH SCIENCES
PEOPLE, THE PLANET AND PROSPERITY: SYMPOSIUM ON THE RESOURCES OF THE CHADRON CREEK WATERSHED

Co-Chairpersons: Jennifer L. Balmat and Joshua W. Balmat
Department of Physical & Life Sciences
Chadron State College, Chadron
Olin 224

8:00 a.m. OPENING REMARKS

8:05 1. THE PEOPLE, PLANET, AND PROSPERITY COMPETITION AT CHADRON STATE COLLEGE. Jennifer L. Balmat*, R. Pinkelman, P. Johnson, D. J. Schweitzer, and M. B. Leite, Stream Team, Chadron State College, Chadron.

8:15 2. A HISTORICAL PERSPECTIVE OF CIVIC WATER PROJECTS, CHADRON, NEBRASKA. Daniel J. Schweitzer* and J. R. Hyer, Department of History, Chadron State College, Chadron.

8:30 3. CHEMISTRY OF WATER QUALITY IN CHADRON CREEK WATERSHED. Rebecca Pinkelman*, A. Fischer, and Z. Varpness, Department of Physical and Life Sciences, Chadron State College, Chadron.

8:45 4. ANALYSIS OF FECAL COLIFORM BACTERIA IN CHADRON CREEK. Muriah L. Messersmith*, D. S. McDermott, J. A. Brummer, A. M. Cox, L. M. Curtiss, A. L. Schauer, and A. M. Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron.

9:00 5. ECONOMIC IMPACT OF THE SPOTTED TAIL WILDFIRE ON CHADRON, NEBRASKA. Jessica Burke*, N. Hagan, R. Burke, and T. Swanke, Department of Economics, Chadron State College, Chadron.

9:15 6. MACROINVERTEBRATE ASSESSMENT OF CHADRON CREEK, NEBRASKA. Pam Johnson* and S. Blood, Department of Physical and Life Sciences, Chadron State College, Chadron.

9:30 7. RANGELAND AND UPLAND FOREST HEALTH EVALUATION OF THE CHADRON CREEK WATERSHED, DAWES COUNTY, NEBRASKA. Justin Lemmer*, A. Horn, S. Morse, K. Karlburg, J. Julson, C. Butterfield, Department of Physical and Life Sciences, Chadron State College, Chadron.

9:45 8. THE FISHES OF CHADRON CREEK, DAWES COUNTY, NEBRASKA. Virgilo A. Villeda*, K. Charron, C. Lecher, W. J. Svoboda, and C. T. McAllister, Department of Physical and Life Sciences, Chadron State College, Chadron.

10:00 9. PRELIMINARY GEOLOGY OF THE CHADRON CREEK WATERSHED, DAWES COUNTY, NEBRASKA. Joshua W. Balmat, J. L. Balmat*, M. J. Culver, A. C. Butterfield, C. A. Kaiser, J. Zwiebel, H. E. LaGarry, and M. B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.

10:15 10. DISCHARGE OF CHADRON CREEK, DAWES COUNTY, NEBRASKA. Austin Butterfield*, J. L. Balmat, J. W. Balmat, K. Young, M. Culver, C. A. Kaiser, J. Zwiebel, M. B. Leite, and H. E. LaGarry, Department of Physical and Life Sciences, Chadron State College, Chadron.

10:30 CLOSING REMARKS

11:00 MAIBEN MEMORIAL LECTURE - OLIN B

EARTH SCIENCES

Co-Chairpersons: Jennifer L. Balmat and Joshua W. Balmat
Department of Physical & Life Sciences
Chadron State College, Chadron
Olin 224

12:55 p.m. OPENING REMARKS: Jennifer L. Balmat and Joshua W. Balmat

1:00 1. THE DIRTY CREEK TRACKWAYS: A NEW VERTEBRATE TRACKWAY SITE FROM THE OGALALA NATIONAL GRASSLAND IN NORTHWESTERN NEBRASKA. Hannan E. LaGarry* and M. B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron; and W. B. Wells, University of Nebraska State Museum, Lincoln; and J. Martin and A. Malchow, The Mammoth Site of Hot Springs, Hot Spring, SD.

1:15 2. A BIOSTRATIGRAPHIC RANGE EXTENSION FOR THE LEPTAUCHENINE OREODONT *SESPIA* IN NORTHWESTERN NEBRASKA. Ed Welsh, South Dakota School of Mines and Technology, Rapid City, SD; and M. B. Leite*, and H.E. LaGarry, Department of Physical and Life Sciences, Chadron State College, Chadron.

1:30 3. ESTIMATED LIFETIME OF THE HIGH PLAINS ACQUIFER IN BOX BUTTE COUNTY, NEBRASKA. Joshua Balmat*, J. L. Balmat, and M. B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.

1:45 4. MICROBIAL MEDIATION OF URANIUM AND ARSENIC CONCENTRATIONS IN NEBRASKA PUBLIC WATER SUPPLY WELLS. Kevin J. McVey* and D. C. Gosselin, School of Natural Resources, University of Nebraska–Lincoln; and L. M. Klawer, Department of Biology, Doane College, Crete.

2:00 CLOSING REMARKS AND SECTION MEETING

HISTORY AND PHILOSOPHY OF SCIENCE
TEACHING OF SCIENCE AND MATH
APPLIED SCIENCE AND TECHNOLOGY

Co-Chairpersons: Claire M. Oswald, College of Saint Mary, Omaha
Julia Polak, Milligan Elementary School, Milligan
Aurietha Hoesing, NJAS President, Omaha
Olin 325

8:30 a.m. 1. A COMPARISON OF THE HIPPOCRATIC OATH (MEDICAL ETHICS) AND BIOETHICS. Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.

9:00 2. AN ETHICAL DISCUSSION OF EMBRYONIC, FETAL, AND POST-NATAL ANIMAL-HUMAN HYBRIDS. Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.

9:30 3. OUTREACH TO NATIVE AMERICAN COMMUNITIES: AN ETHNOBOTANY CURRICULUM. Kim Soper*, Liliana Bronner, Roxanna Jokela, and Maurice Godfrey, University of Nebraska Medical Center, Omaha.

9:45 4. JEOPARDY–COLLEGE STYLE. Richard L Pennington, Georgia Gwinnett College, Lawrenceville, GA.

10:00 5. DATA ANALYSIS IN APPLIED SCIENTIFIC RESEARCH: EXAMPLES OF QUALITATIVE TECHNOLOGY INNOVATION. Brent D.Bowen, College of Public Affairs and Community Service, University of Nebraska at Omaha.

10:15 6. CRITICAL TASK MANAGEMENT AND ERROR IDENTIFICATION IN A HIGH RISK TECHNOLOGY ENVIRONMENT. Robert H. Moser* and Brent D. Bowen, College of Public Affairs and Community Service, University of Nebraska at Omaha.

10:30 BUSINESS MEETING

11:00 MAIBEN MEMORIAL LECTURE - OLIN B

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Dale Benham, Department of Biology
Nebraska Wesleyan University, Lincoln

SESSION A
Olin B

8:00 a.m. 1. A COMPARISON OF CYTOTOXIC LYMPHOCYTE STIMULATION USING DENDRITIC CELL PRIMING THAT HAVE BEEN PRIMED BY LYSATE OR TEXOSOMES. Alexander W. Praus, University of Nebraska Medical Center, Omaha.

8:12 2. DEVELOPMENT OF AN IMMUNOFLUORESCENT ASSAY USING RECOMBINANT PROTEINS EXPRESSED IN INSECT CELLS FOR THE SCREENING AND CONFIRMATION OF HUMAN HERPESVIRUS-8 ANTIBODIES. Lynsey Crosby*, Department of Biology , Nebraska Wesleyan University, Lincoln; and V. Minhas, K.L. Crabtree, and C.D. Wood, School of Biological Sciences, University of Nebraska–Lincoln.

8:24 3. INVESTIGATION OF POTENTIAL UPF1 KINASES IN *SACCHAROMYCES CEREVISIAE*. Chris Cummings, University Of Nebraska–Lincoln.

8:36 4. THE CCR4-NOT CO-ACTIVATOR HAS POST-TRANSCRIPTIONAL FUNCTIONS IN GCN4P REGULATED GENE EXPRESSION. Kelly A. Westfall*, N. Barcomb, and M.J. Swanson, College of Arts and Sciences, University of Nebraska at Omaha.

8:48 5. STRUCTURAL CHARACTERISTICS OF A COXSACKIEVIRUS B3 GENOME CONTAINING A SINGLE BASE MUTATION. Erin G. Rosenbaugh* and W. E. Tapprich, Department of Biology, University of Nebraska at Omaha.

9:00 6. ANALYZING THE STRUCTURE OF COXSACKIEVIRUS B3 GENOMIC RNA BY SITE-DIRECTED MUTAGENESIS. Bonnie J. Errett* and W. E. Tapprich, Department of Biology, University of Nebraska at Omaha.

9:12 7. ANALYZING A LONG RANGE RNA PAIRING INTERACTION IN THE 5' NONTRANSLATED REGION (NTR) OF THE COXSACKIEVIRUS B3 GENOME. Alisha M. Anderson* and W. E. Tapprich, Department of Biology, University of Nebraska at Omaha.

9:24 BREAK

9:36 8. MUMIFICATION AND PALYNOLOGY: WHAT WE CAN LEARN IN REGARDS TO TIME AND LOCATION OF DEATH. Cheslee Cornell, College of Saint Mary, Omaha.

9:48 9. IDENTIFYING THE TIME AND RELATIONSHIP BETWEEN DIFFERENT DECOMPOSING CADAVER MASSES AND NINHYDRIN-REACTIVE NITROGEN IN SOIL AND ITS RELEVANCE TO ESTIMATION OF POST-MORTEM INTERVAL. Ashley M. Spicka*, Department of Biology, Nebraska Wesleyan University, Lincoln; and D.O. Carter, Department of Entomology, University of Nebraska–Lincoln.

10:00 10. PERFORMANCE EVALUATION OF PERSONAL WATER FILTERS IN RURAL DOMINICAN COMMUNITIES. Jennifer Biggs*, T. Nguyen, and G. Michels, College of Arts and Sciences, Creighton University, Omaha.

10:12 11. CONTROL OF PROGESTERONE SYNTHESIS: EFFECTS OF METFORMIN AND AICAR ON BOVINE CORPUS LUTEAL CELLS. Lauren Gengenbach*, Department of Biology, Nebraska Wesleyan University, Lincoln; and X. Hou and J. Davis, Department of Obstetrics & Gynecology and Olson Center for Women's Health, University of Nebraska Medical Center, Omaha.

10:24 12. EFFECTS OF CHELATED AND INORGANIC TRACE MINERALS ON CONCEPTION AND BIRTH CHARACTERISTICS OF BLACK ANGUS COWS (*BOS TAUSUS*). Jill LaBore* and B. Elder, Department of Biology, Doane College, Crete.

10:36 13. EVALUATION OF CHLOROVIRUSES FROM ALKALI LAKES IN WESTERN NEBRASKA. Megan Larsen* and G. Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln; and D. D. Dunigan and J. L. Van Etten, Department of Plant Pathology and Nebraska Center for Virology, University of Nebraska–Lincoln.

11:00 MAIBEN MEMORIAL LECTURE - OLIN B

12:00 LUNCH

1:00 14. ANCIENT MARINE ALGAL VIRUSES FROM SEDIMENT CORE SAMPLES. Katee Holznagel*, Department of Biology, Nebraska Wesleyan University, Lincoln; and D. D. Dunigan, Department of Plant Pathology and the Nebraska Center for Virology, University of Nebraska–Lincoln; and L. L. Robbins, USGS Center for Coastal and Watershed Studies, St. Petersburg, FL.

1:12 15. TAKING A CLOSER LOOK AT THE PHOTOSYNTHETIC PIGMENTS OF *HESPERIS MATRONALIS* (DAME'S ROCKET), AN INVASIVE SPECIES TO NEBRASKA. Kali Frey, Department of Biology, College of Saint Mary, Omaha.

1:24 16. AN EXAMINATION OF PHOTOSYNTHETIC PIGMENTS OF *ELYMUS HYSTRIX*, A NATIVE SPECIES TO NEBRASKA. Molly McGowan, College of Saint Mary, Omaha.

1:36 17. AN ANALYSIS OF PHOTOSYNTHETIC CONTENT OF GARLIC MUSTARD, *ALLIARIA PETIOLATA*, AN INVASIVE PLANT SPECIES IN NEBRASKA. Jennifer S. Anit, College of Saint Mary, Omaha.

1:48 18. A COMPARISON OF PHOTOSYNTHETIC PIGMENTS IN NATIVE SPECIES BUCKBRUSH AND BOTTLEBRUSH WITH INVASIVE SPECIES DAMES ROCKET AND GARLIC MUSTARD. Lynn Jenkins, College of Saint Mary, Omaha.

2:00 19. INHIBITION OF *STAPHYLOCOCCUS AUREUS* BY *OSMORHIZA LONGISTYLIS* ROOT EXTRACTS. Jason N. Herold*, Jennifer Antisdel*, B. Corbett, and D. Stallwood, Metropolitan Community College, Omaha.

2:12 20. SCREENING FOR INHIBITION OF ANTIBIOTIC RESISTENCE MECHANISMS ATTRIBUTED TO PLANT EXTRACTS. Lauren Hanthorn*, D. Peitz, and D. Christensen, Department of Life Sciences and Physical Sciences, Wayne State College, Wayne.

2:24 21. SIGNIFICANCE OF VARIABLES FOR SHARP-TAILED GROUSE LOCATIONS AT CRESCENT LAKE NATIONAL WILDLIFE REFUGE IN NEBRASKA. Heidi Swanson, Department of Life Sciences, Wayne State College, Wayne.

2:36 22. EFFECTS OF *MICROCYSTIS AERUGINOSA* ON THE GROWTH AND DEVELOPMENT OF *CULEX TARSALIS* AND *DAPHNIA MAGNA*. Brian M. Maronde* and B. Elder, Doane College, Department of Biology, Doane College, Crete.

2:48 BREAK

3:00 23. THE EFFECTS OF BURN FREQUENCY ON SPECIES RICHNESS AND ABUNDANCE OF ARTHROPODS IN TALL GRASS SAVANNA. Lawrence Barringer*, Department of Biology, Nebraska Wesleyan University, Lincoln; and J.A. Haarstad, Cedar Creek Ecosystem Science Reserve, Bethel, MN.

3:12 24. A COMPARISON OF GENETIC CHANGES BETWEEN LONG TERM AND SHORT TERM MICROHABITATS WITHIN THE TALLGRASS PRAIRIE IN *ANDROPOGON GERARDII*. Caitlin Schaffert*, K. Marley, and B. Elder, Department of Biology, Doane College, Crete.

3:24 25. BRINS FIRE: ONE YEAR POST WILDFIRE AQUATIC COMMUNITY RESPONSE IN OAK CREEK, AZ. Mitchel D. Bern*, Department of Biology, Doane College, Crete; and J. P. Shannon, Department of BioSciences, Northern Arizona University, MPCER, Flagstaff, AZ.

3:36 26. ARACHNID POPULATION RECOVERY IN A RESTORED TALL GRASS PRAIRIE. Mitchel D. Bern* and B. Elder, Department of Biology, Doane College, Crete.

3:48 27. LENGTH OF N-TERMINAL EXTENSION DOES NOT AFFECT PEPTIDE PRESENTATION BY MHC I. Greg Timblin*, Departments of Biology and Chemistry, Nebraska Wesleyan University, Lincoln; and T. Kanaseki and N. Shastri, Department of Molecular and Cell Biology, Division of Immunology, University of California Berkeley, Berkeley, CA.

4:00 28. TIMING AND PRODUCTION OF A QUORUM SENSING MOLECULE IN *MYCOBACTERIUM SMEGMATIS* AS SEEN ON BACTERIAL LAWNS OF *STREPTOMYCES GRISEUS* AND *STREPTOMYCES COELICOLOR*. Traci A. Dieckmann* and A. McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln.

4:12 29. THE CELLULAR LOCALIZATION AND ACTIVATION OF TOLL-LIKE RECEPTOR 3 SIGNALING IN PULMONARY MUCOSAL EPITHELIAL CELLS. Nathan M. Anderson* and T. M. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.

4:24 30. PHYSIOLOGICAL RESPONSES OF CALU-3 CELLS TO INFECTION BY SELECTED BACTERIAL NOSOCOMIAL BACTERIA. Kristen Donovan*, A. Farlow, and B. Clement, Department of Biology, Doane College, Crete.

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Dale Benham, Department of Biology
Nebraska Wesleyan University, Lincoln

SESSION B

Olin 249

1:00 1. CLONING, OVER-EXPRESSION AND PURIFICATION OF inlB GENE/PROTEIN FROM *LISTERIA MONOCYTOGENES* FOR POSSIBLE USE IN DRUG DELIVERY. Brittany Cody*, S. Pearcy and D. Christensen, Department of Life Sciences, Wayne State College, Wayne.

1:12 2. INHIBITION OF LACTOSE UTILIZATION, VIA PLANT EXTRACTS, IN MICROORGANISMS OF MILK AS ANALYZED BY O-NITROPHENYL -β-D GALACTOPYRANOSIDE (ONPG) ASSAYS. Tracy Lammers*, D. Peitz, and D. Christensen, Departments of Life Sciences and Physical Sciences, Wayne State College, Wayne.

1:24 3. *LISTERIA MONOCYTOGENES* VIRULENCE GENE REGULATION AS ASSESSED THROUGH NORTHERN BLOTTING UPON EXPOSURE TO HOTDOGS. Janea Rise*, Shawn Pearcy, and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.

1:36 4. *LISTERIA MONOCYTOGENES* VIRULENCE GENE REGULATION AS ASSESSED THROUGH RT-PCR UPON EXPOSURE TO HOTDOGS. Katie Peterson*, S. Pearcy, and D. Christensen, Department of Life Sciences, Wayne State College, Wayne.

1:48 5. QUALITATIVE AND QUANTITATIVE ANALYSIS OF PBCV-1 INFECTION OF CHLORELLA USING BOTH FLUORESCENT MICROSCOPY AND FLOW CYTOMETRY. Sara G. Wilson* and G. Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln.

2:00 6. MEASUREMENT AND ANALYSIS OF PLANT HEIGHT, SECOND-STAGE JUVENILES, FECUNDITY, AND REPRODUCTION FACTORS IN SOYBEAN CYST NEMATODES, *HETERODERA GLYCINES*. Jenna L. Slagle*, Department of Biology, Nebraska Wesleyan University, Lincoln; and L.J. Geisler and A.D. Ziems, Plant Pathology, University of Nebraska–Lincoln.

2:12 7. BROWN MIDRIB SORGHUM WITH TWO DIFFERENT GENOTYPES THAT AFFECT THE LIGNIN PATHWAY WHICH MIGHT HELP PROTECT AGAINST PATHOGENIC AND NONPATHOGENIC *FUSARIUM* SPECIES. Melissa Ebeling, Department of Biology, Nebraska Wesleyan University, Lincoln.

2:24 8. ALCOHOL ATTENUATES TRACHEAL AIRWAY SMOOTH MUSCLE CONTRACTION. Chelsea R. Ruhge*, Department of Biology, Nebraska Wesleyan University, Lincoln; and P.J. Oldenburg, T.A. Wyatt, and J.H. Sisson, Pulmonary, Critical Care, Sleep and Allergy Medicine Section, Department of Internal Medicine, University of Nebraska Medical Center, and Research Service, Department of Veterans Affairs Medical Center, Omaha.

2:36 9. AN ANALYSIS OF INPATIENT CARE FOR CHRONIC RENAL FAILURE IN THAILAND UNDER THE UNIVERSAL COVERAGE SCHEME. Alina K. Kanasuta*, Department of Biology, Nebraska Wesleyan University, Lincoln; and K. Pongpirul, and O. Chuayruang, Department of Preventive and Social Medicine Faculty of Medicine, Chlalongkorn University, Bangkok, Thailand 10330

2:48 BREAK

3:00 10. OVER-EXPRESSION OF GLI1 IN B-CHRONIC LYMPHOCYTIC LEUKEMIA PATIENTS WITH POOR CLINICAL OUTCOME. Katy Emanuel*, Department of Biology, Nebraska Wesleyan University, Lincoln; and G V. Hegde and S. S. Joshi, Departments of Genetics, Cell Biology & Anatomy, Pathology & Microbiology, Internal Medicine and Oncology/Hematology, University of Nebraska Medical Center, Omaha.

3:12 11. SEASONAL COMPARISON OF VITAMIN D LEVELS IN PATIENTS WITH CYSTIC FIBROSIS. Natalie C. Brooks*, Department of Biology, Nebraska Wesleyan University, Lincoln; and H. Thomas, J. Columbo, B. Mordeson, and T. Hallberg, Pediatric Pulmonology, University of Nebraska Medical Center, Omaha.

3:24 12. FORMATION OF SYNCYTIA BY CAT LUNG CELL LINE AFTER CO-CULTURE WITH BOVINE LEUKEMIA VIRUS-INFECTED FETAL LAMB KIDNEY CELLS. Nicholas D. Raasch* and J.A. Isaacson, Department of Biology, Nebraska Wesleyan University, Lincoln.

3:36 13. THE $p16^{INK4A}$ ANTIBODY AS AN EARLY DETECTION INDICATOR OF CERVICAL INTRAEPITHELIAL LESIONS ASSOCIATED WITH THE INTEGRATION OF THE HUMAN PAPILLOMAVIRUS IN CERVICAL BIOPSIES. Nick Zimmerman, $HT(ASCP)^{CM}$, Histology Department, Pathology Medical Services P.C., Lincoln.

3:48 14. USE OF A BALB/C-$RAG2^{-/-}\gamma_c^{-/-}$ HUMANIZED MOUSE MODEL TO EVALUATE HUMAN IMMUNODEFICIENCY VIRUS TYPE 1 IMMUNOPATHOLOGY AND THE EFFICACY OF AN HIV-1 VACCINE CANDIDATE. Aaron J. Persinger*, Department of Biology, Nebraska Wesleyan University, Lincoln; and S. Gorantla, H. Sneller, C. Gebhardt, T. Ikezu, C. Duke, J. Bowers, C. Wood, H.E. Gendelman, S. Dewhurst, and L. Poluektova, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.

4:00 15. CONCENTRATION-DEPENDENT INHIBITION OF BOVINE LEUKEMIA VIRUS INFECTION BY ANTIVIRAL AGENTS. Richard K. Nelson* and J.A. Isaacson, Nebraska Wesleyan University, Lincoln.

4:12 16. PRODUCTION OF ANTIBODIES SPECIFIC FOR *LEPTOSPIRA CANICOLA, L. HARDJO, L. POMONA, L. ICTERO,* AND *L. GRIPPO* USING TRITON X-114 EXTRACTION AND SURFACE IMMUNOPRECIPITATION. Kathryn J. Lance*, Department of Biology, Nebraska Wesleyan University, Lincoln; and L. Carlson, Manufacturing Technical Group, Pfizer, Lincoln.

4:24 17. EVALUATION OF POSSIBLE REFERENCES FOR AN ELISA USED FOR TESTING THE POTENCY OF A VACCINE. April Krueger*, Nebraska Wesleyan University, Lincoln; and H. Klink and P. Baker, Pfizer Inc., Lincoln.

COLLEGIATE ACADEMY

CHEMISTRY AND PHYSICS

Chairperson: David Treichel
Nebraska Wesleyan University, Lincoln

SESSION A

Session Chairperson: David Treichel, Nebraska Wesleyan University, Lincoln
Olin 324

8:00 a.m. 1. THE USE OF CIRCULAR DICHROISM SPECTROMETRY TO DIFFERENTIATE BETWEEN THE ENANTIOMERS OF METHAMPHETAMINE. Andrea E. Holmes, Mike Guericke, Christa Flitcroft, and Katie Wilcox*, Department of Chemistry, Doane College, Crete.

8:12 2. EVALUATION OF METHODS TO CAP MOLECULAR FRAGMENTS IN CALCULATING ENERGIES OF INTERACTION IN AVIAN PANCREATIC POLYPEPTIDE. Marcus P. D. Hatfield[1,2]*, Nicholas Y. Palermo[2], József Csontos[2], Richard F. Murphy[2], and Sándor Lovas[2]. [1]Nebraska Wesleyan University, Lincoln and [2]Department of Biomedical Sciences, Creighton University, Omaha.

8:24 3. ELECTROGENERATED CHEMILUMINESCENT DETECTION COUPLED WITH MICROCHIP CAPILLARY ELECTROPHORESIS: A GREEN APPROACH TO SEPARATION AND DETECTION. Sarah Fredrick*, Sarah Wirth, Matthew S. Burkhead, and Erin M. Gross, Department of Chemistry, Creighton University, Omaha.

8:36 4. STRUCTURAL CHARACTERIZATION AND ANALYSIS OF A PRE-QUEUOSINE RIBOSWITCH. Natalie German[1]* and Juliane K. Soukup[1,2]. [1]Departments of Chemistry and [2]Biomedical Sciences, Creighton University, Omaha.

8:48 5. OXIDATION REACTIONS OF INORGANIC GASES BY POTASSIUM SUPEROXIDE. Andrew M. Allen*, Michael Anderson, and Bruce Mattson, Department of Chemistry, Creighton University, Omaha.

9:00 6. DETERMINING OFFSETS BY A SEISMIC REFLECTION SURVEY ON THE STATE-LINE FAULT. Matt Beachly, Department of Physics, Hastings College, Hastings.

9:12 7. TWO-PHOTON EXCITED FLUORESCENCE INTENSITY- AND LIFETIME-BASED NADH IMAGING TO DETERMINE THE CELLULAR METABOLIC STATE. Meg M. Marquardt[2]*, LeAnn M. Tiede[1], Michael G Nichols[1,2] and Richard Hallworth[1]. [1]Department of Biomedical Sciences and[2] Department of Physics, Creighton University, Omaha.

9:24 8. CONSTRUCTION AND IMPLEMENTATION OF PARTICLE IMPACT DAMPING FOR VIBRATION SUPPRESSION. Kyle Phillips, Department of Physics, Hastings College, Hastings.

9:36 9. INVESTIGATION OF THE IDENTITY AND MECHANISM OF SERUM CALCIFICATION FACTOR IN COLLAGEN MINERALIZATION. Kaylee R. Troxel*, Casey L. Gustafson, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete.

9:48 10. SELF HEALING DENTAL COMPOSITES. Josh Steere*, Brittany Wertzberger, M. Latta, and S. M. Gross, Department of Chemistry, School of Dentistry, Creighton University, Omaha.

10:00 11. β -CYCLODEXTRIN SUPRAMOLECULAR INCLUSION COMPLEXES AS DUAL GUEST HOSTS. Rachel Steadman*, Department of Chemistry, Nebraska Wesleyan University, Lincoln; and C. J. Eckhard and Van Ngyuen, Department of Chemistry, University of Nebraska–Lincoln.

10:08 12. ISOLATION OF NATURAL PRODUCTS FROM HERBAL SUPPLEMENTS. Brittany Van Beek* and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.

10:16 13. CONFIGURATIONAL ANALYSIS OF D- AND L-METHAMPHETAMINE BY THE EXCITON CHIRALITY METHOD. Christa C. Flitcroft* and Andrea Holmes, Department of Chemistry, Doane College, Crete.

10:24 14. MATERIAL PROPERTIES OF PROTEIN NANOFIBRILS. Jennie Burns, College of Arts and Sciences, Creighton University, Omaha.

10:36 15. LOCALIZATION AND GENETIC ENGINEERING OF A NOVEL COILED COIL-HELIX COILED COIL-HELIX DOMAIN CONTAINING PROTEIN, CHCHD6. Shea Welsh* and Sharmin M. Sikich, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.

11:00 MAIBEN MEMORIAL LECTURE - OLIN B

1:00 16. INVESTIGATION OF MAGNETIC DAMPENING ON A NON-FERROMAGNETIC AIR TRACK. Geoffrey Bergman, Department of Physics, Hastings College, Hastings.

1:12 17. CONSTRUCTION AND UTILIZATION OF AN ELECTRIC FIELD MILL TO MEASURE THE EARTH'S ELECTRIC FIELD. Heather Finney, Department of Physics, Hastings College, Hastings.

1:24 18. FRACTURE TOUGHNESS AND DYNAMIC MECHANICAL ANALYSIS OF URETHANE BASED DENTAL COMPOSITES. Brittany Wertzberger*, M. Latta, and S. M. Gross, Department of Chemistry, Creighton University, Omaha; and School of Dentistry, Creighton University, Omaha.

1:36 19. A METHOD FOR THE DETERMINATION OF GAUSSIAN 03 SCRF-PCM SOLVENT PARAMETERS FOR ANY SOLVENT FOR ANY MODEL CHEMISTRY. Brian Jundt* and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne.

1:48 20. LUMINESCENT CHEMOSENSORS OF TRANSITION AND HEAVY METAL DOPED ANTHRAQUINONE DERIVATIVES. Rebecca Pinkelman, Department of Chemistry, Chadron State College, Chadron.

2:00 21. THE DESIGN, CONSTRUCTION AND ANALYSIS OF AN ACOUSTIC LEVITATION APPARATUS. Christopher Kube, Department of Physics, Hastings College, Hastings.

2:12 22. THE ROLE OF POLYGLUTAMIC AND POLYASPARTIC ACID SEQUENCES IN HYROXYAPATITE GROWTH. Helen A. Kraye*, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete.

2:24 23. SYNTHESIS OF 4-(NAPHTHYLMETHYL)-L-HISTIDINE DERIVATIVES FOR STRUCTURE-ACTIVITY STUDIES OF POSITION 10 OF CGRP. Hayley Young* and Martin Hulce, Department of Chemistry, and D. David Smith, Department of Biomedical Sciences, Creighton University, Omaha.

2:36 24. MACROSCOPIC SCATTERING: RIGID BODY IMPACT OF A BASEBALL ON A BAT. Joshua Tomayer, Department of Physics, Hastings College, Hastings.

2:48 25. VARIABILITY IN BULLET MANUFACTURING. Jennifer R. Paulsen* and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.

3:00 BREAK

3:12 26. FRIEDEL CRAFTS ALKYLATION OF EUGENOL. Jeremy Wilmes*, Vanessa Hahn*, and David Peitz, Department of Physical Science and Mathematics; and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.

3:24 27. THE SWEET SPOTS AND DEAD SPOT OF A TENNIS RACQUET. Jose Martinez, Department of Physics, Hastings College, Hastings.

3:36 28. DETECTION OF ELECTROCHEMILUMINESCENCE BETWEEN FLUOROQUINOLONES AND TRIS(2,2'-BIPYRIDYL)RUTHENIUM(II). Matthew S. Burkhead* and E.M. Gross, Department of Chemistry, Creighton University, Omaha.

3:48 29. DEVELOPMENT OF A FIXED FREQUENCY AEROSOL ALBEDOMETER. Danielle Policarpio*, N. Barta, R. DuVall and Jon Thompson, Department of Chemistry, University of Nebraska at Kearney.

4:00 30. DYNAMICS OF SPEAR THROWING James Martin, Department of Physics, Hastings College, Hastings.

4:12 31. CONDUCTIVITY MEASUREMENTS OF IONIC LIQUID CONTAINING COMPOSITES. Zachary P Rosol*, E. S. Sterner, E. M. Gross, and S. M. Gross, Department of Chemistry, Creighton University, Omaha.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

SESSION B
Session Chairperson: Nathanael Fackler
Nebraska Wesleyan University, Lincoln
Olin 325

1:00 32. EFFECTS OF ANNEALING ON $CuIn_{1-x}Ga_xSe_2$ NANOCRYSTALLINE MATERIALS PREPARED BY SOLVOTHERMAL MEANS. Adam T. Haussler*, Anatole Mirasano, Scott A. Darveau, and Christopher L. Exstrom, Department of Chemistry, University of Nebraska at Kearney.

1:12 33. SYNTHESIS OF MONOSUBSTITUTED 1,2,3-TRIAZOLES FROM TANDEM DEPROTECTION/'CLICK' REACTIONS. Matthew E. Keeney* and James Fletcher, Department of Chemistry, Creighton University, Omaha.

1:24 34. THE DIELS-ALDER REACTION AND THE DIFFICULTIES ASSOCIATED WITH AN ACTIVATED DIENEOPHILE. Travis Reed*, Megan Kehrli*, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.

1:36 35. SYNTHESIS OF CARBOXYLIC ACID FUNCTIONALIZED MULTIDENTATE 1,2,3-TRIAZOLE CHELATORS VIA THREE-STEP ONE-POT TRANSFORMATIONS. Michael G. Keeney* and James Fletcher, Department of Chemistry, Creighton University, Omaha.

1:48 36. CHARACTERIZATION OF A CONSERVED GLUTAMINE IN THE COILED COIL-HELIX COILED COIL-HELIX DOMAIN OF THE NOVEL MITOCHONDRIAL PROTEIN, CHCHD3. Dena Brock* and Sharmin M. Sikich, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.

2:00 37. FABRICATION OF CARBON INK MICROELECTRODES FOR MICROCHIP CAPILLARY ELECTROPHORESIS. Sarah R. Wirth*, S.J. Fredrick, and E.M.Gross, Department of Chemistry, Creighton University, Omaha.

2:12 38. METHOD DEVELOPMENT FOR THE DETERMINATION OF SULFATE IN DISTILLERS GRAIN USING ION CHROMATOGRAPHY WITH CONDUCTIVITY DETECTION. Lindsey Wallman*, Department of Biology, Doane College, Crete, NE; and Michael Carlson, Toxicology, University of Nebraska Veterinary Diagnostic Center, Lincoln.

2:24 39. ADSORPTION OF HYDROGEN IN PALLADIUM: A CLASSROOM DEMONSTRATION AND A LABORATORY ACTIVITY. Elsbeth Klotz* and Bruce Mattson, Department of Chemistry, Creighton University, Omaha.

2:32 BREAK

2:45 40. USE OF PC's FOR CONTROL SYSTEMS AT STAR. Nicholas J. Busch, Department of Physics, Creighton University, Omaha.

3:12 41. SYNTHESIS AND ^{17}O NMR SPECTROSCOPY OF 9,10-DIPHENYLANTHRACENE ENDOPEROXIDE. John M. Carney*, Chad M. Lomas, and Martin Hulce, Department of Chemistry, Creighton University, Omaha.

3:24 42. AN EVALUATION OF PHARMACEUTICAL CONTAMINATION IN DRINKING WATER. Cyril M. Willson* and Jacqueline B. Scholar, Department of Natural Sciences, Bellevue University, Bellevue.

3:36 43. AN INVESTIGATION ON THE ORIGIN AND SIGNIFICANCE OF QUASAR OUTFLOWS. Sandra M. Behncke*, A. Showalter, and J. Gabel, Department of Physics, Creighton University, Omaha.

3:48 44. MODELING AND USAGE OF THE OPTICAL STRETCHER AND SOME OF ITS POTENTIAL APPLICATIONS FOR UNDERSTANDING CHANGES IN CELL SIGNALING DUE TO MECHANICAL STRESS. Timothy J. Smith* and M.G. Nichols, Creighton University, Omaha.

4:00 45. CONTROL INTERFACES FOR TWO ALICE SUBSYSTEMS. Robert P. Thomen, Department of Physics, Creighton University, Omaha.

4:12 46. STRUCTURAL AND MECHANISTIC STUDIES OF RIBOSWITCHES. Joshua Souchek[1]*, Kevin Klawuhn[1], Joshua A. Jansen[1] and Juliane K. Soukup[1,2]. [1]Department of Chemistry and [2]Department of Biomedical Sciences, Creighton University, Omaha.

4:24 47. PRODUCTION AND QUALITY CONTROL OF BIODIESEL. Andrew L. Wiedel* and Darius Agoumba, Department of Physical and Life Sciences, Wayne State College, Wayne; and Nicolas P. Stutzman, Northeast Nebraska Biodiesel, Scribner; and Robert Byrnes, Nebraska Renewal Energy Systems, Oakland.

JUNIOR ACADEMY OF SCIENCES

Co-Chairpersons: James Woodland, Nebraska Department of Education, Lincoln
Aurietha Hoesing, NJAS President, Omaha

8:30 – 9:00 a.m.	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	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

PROCEEDINGS

AERONAUTICS AND SPACE SCIENCE

IN-SITU ELLIPSOMETRIC ANALYSIS OF THE PHOTOFIXING OF RTV EFFLUENT ON MgF_2 COATED GLASS SUBSTRATES

N.J. Ianno and D.W. Thompson, Department of Electrical Engineering, University of Nebraska–Lincoln, NE 68588

Room Temperature Vulcanized (RTV) materials are commonly used to bond components of communication satellites and other types of spacecraft. The elevated satellite operating temperature causes the unused catalyst material in the RTV to volatize, which can then re-deposit or condense onto other spacecraft surfaces. In the presence of sunlight, this Volatile Condensable Material (VCM) can photo-chemically deposit onto optically-sensitive spacecraft surfaces and significantly alter their original, beginning-of-life (BOL) optical properties causing unintended performance loss of the spacecraft. Knowledge of the optical impact of photo-chemically-deposited VCM's is therefore a major concern of spacecraft designers and spacecraft-contamination engineers. In view of this we have employed in-situ spectroscopic transmission ellipsometry to monitor in real time the photofixing of RTV CV-2568 effluent onto a commonly used solar cell cover glass consisting of a 150 micron CMG substrate with a 90 nm MgF_2 anti reflection layer deposited on the surface.

AN ANALYSIS OF ORION SPACECRAFT LEAK DETECTION AND VEHICLE-LEVEL LEAK IDENTIFICATION

Andrew Kelley, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

There are many systems in a spacecraft that must work together perfectly in order to have a successful mission. This project involves analyzing a particular scenario regarding the Fault Detection, Isolation, and Recovery system and recommending a solution. Suppose the Guidance, Navigation, and Control system discovers an unexpected acceleration and knows that no thruster commands were issued. Several of the spacecraft's systems will be researched and modeled to predict their response to this unexpected event, and an appropriate solution will be proposed. This project will involve some detailed scenario development, Matlab and Simulink programming, other research, and an understanding of instrumentation, sensors, and control systems. When designing a new spacecraft, it is necessary to anticipate every imaginable event that could occur during the mission. This project will benefit NASA by considering one such occurrence, and determining a solution that will help maintain the safety of the crew and the vehicle.

MINIATURE *IN VIVO* ROBOTS FOR NATURAL ORIFICE TRANSLUMENAL ENDOSCOPIC SURGERY

Amy C. Lehman, Nathan A. Wood, and Shane M. Farritor, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

Performing surgical procedures through small incisions in the abdominal wall marked the first significant step towards reducing the invasiveness of surgical procedures. Many believe that the elimination of external incisions by accessing the abdominal cavity through a natural orifice, as in Natural Orifice Translumenal Endoscopic Surgery (NOTES), is the next step in reducing trauma in minimally invasive

surgery. The use of flexible endoscopy tools for NOTES limit the surgeon's ability to visualize and manipulate a surgical target. An alternative approach is to use miniature *in vivo* robots that are completely inserted into the abdominal cavity. These robots are not constrained by the entrance incision, and can be positioned throughout a procedure to provide the surgeon a stable platform for visualization and tissue manipulation. Preliminary prototypes have demonstrated great potential in animal model procedures, and the anticipated outcomes promise to further advance the application of NOTES to minimally invasive surgical procedures.

EFFECTS OF CLASS I HISTONE DEACETYLASE INHIBITION UPON ONCOGENE AND TUMOR SUPPRESSOR GENE REGULATION

Holly Sukup, Linda Buckles, Sanjib Chowdhury, Gillian Howell, Lisa Humphrey, and Michael Brattain, Eppley Cancer Center, University of Nebraska Medical Center, Omaha, NE 68198

The loss of the tumor suppressor gene (TSG) transforming growth factor beta receptor II (TGFßRII) is a common event associated with cancer progression. While mutational loss is prevalent in cancers with a positive microsatellite instability phenotype, the loss of TGFßRII is commonly associated with epigenetic silencing in breast cancer. Unlike gene mutations, epigenetic silencing events can be reversed. One class of epigenetic drug is the histone deacetylase inhibitors which inhibit removal of acetyl groups from DNA binding proteins. We have studied the effect of the inhibitor Belinostat (PXD101) on TGFßRII expression in the MCF-7L breast cancer cell line which has lost responsiveness to the growth inhibitory effects of TGFß. Belinostat dose-dependency increases TGFßRII mRNA expression. This increased expression is maximal at 24-48 hours. This HDACi also activates TGFßRII protein expression. Belinostat is a hydroxamic acid-based HDACi which inhibits both Class I and Class II HDACs. The Class I HDACs 1-3 tend to be overexpressed in tumor cells compared to their normal counterparts. In order to determine the specific HDACs involved in epigenetic silencing of the TGFßRII gene in breast cancer, the specific aims of my thesis project are: Specific Aim 1. Knockdown of HDAC 1, 2, and 3 by stable expression of shRNAs and determination of the effect on TGFßRII mRNA and protein expression. Specific Aim 2. To determine whether deacetylase activity is necessary for the effect of HDACs found to be involved in epigenetic silencing of TGFßRII by use of dominant negative HDAC constructs. Specific Aim 3. Determine the modifications of histones 3 and 4 and transcription factors that occur upon TGFßRII re-expression by chromatin immunoprecipitation assay.

COMPARING DIFFERENT METHODS OF FACIAL RECONSTRUCTION

Juana Acosta and Nicole Wall, Department of Biology, College of Saint Mary, Omaha, NE 68106

Forensic facial reconstruction plays an important role in the identification of unknown victims. There are two prominent methods used in Forensic facial reconstruction which include: three-dimensional facial clay reconstructions and three-dimensional computer reconstructions. Each method has a different level of accuracy and reliability. Past studies indicate that a three-dimensional computer generated image is the most accurate method. In the current study I am examining the two facial reconstruction methods and assessing their accuracy. From the assessments and research I have conducted I hypothesize that the most accurate method will be the three-dimensional computer generated image because of the variations that I can adjust and manipulate due to past data gathered from deceased individual contained within the computer software. The next step will be to generate a larger amount of facial reconstructed images in order to compare the different facial reconstruction methods.

CHANGES IN POSTURAL CONTROL DUE TO INTERVENTION IN MULTIPLE SCLEROSIS PATIENTS CAN BE DETECTED: A MODEL FOR FUNCTIONALLY IMPAIRED ASTRONAUTS

Jessie Huisinga, HPER Biomechanics Lab, University of Nebraska at Omaha, NE 68182; and Mary Filipi, College of Nursing, University of Nebraska Medical Center, Omaha, NE 68198

Measurement of postural sway during quiet standing in neurologically impaired Multiple Sclerosis (MS) patients could serve as a model of functionally altered astronauts. Preliminary evaluation of MS patient's balance is necessary to determine center of pressure (COP) measures that are sensitive enough to detect changes. Balance of six MS patients was assessed with eyes open and closed (condition) on a force platform before and after 3 months of resistance training (intervention). COP was used to calculate Root Mean Squared which showed no differences and Lyapunov Exponent (LyE) (nonlinear measure) which showed a significant effect of intervention and no effect of condition. The decrease in LyE values following intervention indicates a decrease in divergence of the sway path and possibly less random movements. Consideration of analysis methods could affect the ability to sufficiently measure postural control changes in MS patients due to treatment and in astronauts due to space flight.

GAIT CHANGES FOLLOWING AN ACUTE PERIOD OF ISCHEMIA IN HEALTHY YOUNG INDIVIDUALS

Sara A. Myers and Nick Stergiou, HPER Biomechanics Laboratory, University of Nebraska at Omaha, NE 68182

Astronauts during space missions are mostly stationary. Literature has shown that this increases their risk to develop vein thrombosis, manifested by insufficient blood flow to the lower extremities and ischemic pain. For astronauts to be able to walk after prolonged space missions, it is important to understand possible functional changes caused by acute periods of ischemia. One of the ways to understand the effects of ischemic pain on ambulation ability is to induce lower extremity vascular occlusion. We investigated gait adaptations of healthy young individuals while walking following induced lower extremity vascular occlusion. Our results indicated that an acute period of ischemia resulted in more variable gait patterns compared to the natural (pre-ischemia) walking condition. These findings suggested that decreasing blood flow, even in healthy individuals could increase the risk for gait related injuries. Development of in-flight interventions should be considered to preserve physical function of astronauts during space flights.

STUDIES ON THE DISTRIBUTION OF THE *PARMOTREMA PERFORATUM* GROUP IN SE OKLAHOMA, EASTERN AND CENTRAL TEXAS, WESTERN LOUISIANA, AND WESTERN ARKANSAS

Rebecca Moshman and Robert Egan, Department of Biology, University of Nebraska at Omaha, NE 68182

Mass collections were made of the *Parmotrema perforatum* group at numerous localities in Oklahoma, Texas, Louisiana and western Arkansas. When TLC analyses revealed up to six species present at a single locality, we decided to quantify the joint occurrence of these taxa. We cleaned each thallus of substrate and calculated for biomass of each species at each locality, and the data were analyzed for each site by taxon, reproductive mode, chemical profile, and local vegetation type. Individual species showed some geographical pattern trends. *Parmotrema subrigidum* occurs most densely in the pinelands area of eastern Texas. In southern Texas, only *P. subrigidum* is present, while *P. preperforatum* is most

abundant in the post oak savanna in central Texas and does not occur in the hill country or north into Oklahoma and Arkansas. *Parmotrema perforatum* is most abundant in the northern areas. In the hill country, post oak savanna, and pinelands, *P. perforatum* occurs in percentages from 15%- 27%. *Parmotrema hypotropum* is widespread: most abundant in the hill country (66-100%) and also accounts for a substantial portion of biomnass in the post oak savanna. *Parmotrema louisianae* was found only at three localities in the pinelands, most abundantly in western Louisiana. *Parmotrema hypoleucinum* occurs in small percentages in the hill country and post oak savanna. Its highest abundance was in the pinelands of Caddo Parish, Louisiana(25%). Unexpectedly, *Parmotrema hypoleucinum* was not found in the Texas coastal counties but increaseed in abundance to the north. In the analyses by vegetation types, the Texas hill country is dominated by *P. hypotropum* while the post oak savanna of east central Texas is dominated by *P. subrigidum* and *P. preperforatum*. The east Texas-western Louisiana pinelands are again dominated by *P. subrigidum* with *P. louisianae* more common in Louisiana. In the "Ozark" type forests to the north, *P. perforatum* dominates. Chemically, only the alectoronic acid-containing species demonstrated a geographical preference, becoming 100% dominant (as *P. subrigidum*) in coastal areas. We could find no distinct pattern to the distribution of primary (apotheciate) or secondary (sorediate) taxa. East Texas and western Louisiana are biodiversity "hot spots" for the *Parmotrema perforatum* group. All six taxa occur together at one locality in western Louisiana. It is vital that individual thalli in collections from this region be carefully tested to ensure accurate identification.

IDENTIFICATION OF GEOLOGICAL STRUCTURES FROM LINEAMENTS ON REMOTELY-SENSED IMAGES OF THE BLACK HILLS-PINE RIDGE REGION

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

This study was undertaken with the goals of (1) identifying lineaments and trends in the region between the Black Hills and the Pine Ridge using data from the Shuttle Radar Topography Mission (SRTM) and Landsat TM and (2) ground truth these findings to determine if remotely-sensed lineaments represent geological structures. The study area is bounded by latitude 41.5N to 44.5N and longitude 100.0W to 105.0W with Chadron, Nebraska, near the center at 42.8N 103W. Aspect analysis revealed three predominant trends: north, northwest-to-southeast, and northeast-to-southwest. The source of the strong northerly trend was identified as the dominant north-facing escarpment of the Pine Ridge. Major rivers in the study area flow in a southwest to northeast direction with tributaries joining the river at sixty to ninety degree angles, which represent the majority of northwest-to-southeast and northeast-to-southwest aspect trends. Lineaments were identified east and north of Chadron, as well as north of Harrison, Nebraska. One lineament has been positively identified as a normal fault located east of Chadron. Identification of trends and lineaments continues. Additional field work will be required to ground truth large numbers of suspect geological features derived from remotely sensed data.

ASSESSING WATER CLARITY OF NEBRASKA RESERVOIRS USING SATELLITE REMOTE SENSING

Jack Dohrman, School of Natural Resources, University of Nebraska–Lincoln, NE 68583

Field techniques for measuring water clarity can be time consuming and costly over a large geographic region. Satellite remote sensing has the potential to offer a more cost-effective means of assessing lake water clarity over a large geographic region. The goal of this project is to determine how effectively satellite remote sensing can assess lake water clarity in Nebraska. NASA Landsat-7 ETM+ satellite images will be digitally processed to extract lake water clarity information and those results will be compared to field samples collected independently from this study. Landsat images will be acquired within 7-10 days of field sampling to maintain a strong relationship between the two.

USING REMOTE SENSING TO QUANTIFY EROSION RATES OF FOSSIL TRACKWAYS AT TOADSTOOL GEOLOGICAL PARK

J. Zwiebel, M.B. Leite, H.E. LaGarry, B.H. Breithaupt, and N.A. Matthews, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

Fossil trackways at Toadstool Geological Park of northwestern Nebraska are eroding faster than they can be studied. While new trackways are appearing through erosion of overlying rock, this occurs at a much slower rate than the loss of exposed trackways. Latex peels made of some of the trackways in 1995 offer a means of observing changes through time. We made a photogrammetric study of some of the trackways in 2007 in order to quantitatively show the erosion occurring over the 12 year span. Applying remote sensing GIS analysis at the outcrop scale—at millimeter resolution—has produced preliminary results that can quantitatively show erosion rates. Comparing trackways using hillshade, contours, and cross sections is a very effective method of examining this data. This method is also able to quantify rates of vandalism and latex shrinkage. In combination these analyses provide not only invaluable information for future studies at Toadstool Geological Park, but also quantitative measurements that can be applied at other trackway sites.

DEVELOPING A HIGH-PRECISION, LOW-COST FIELD INSTRUMENT FOR MONITORING THE PIGMENT CONTENT AND COMPOSITION IN GRAIN AND FRUIT CROPS

Arthur Zygielbaum, Donald Rundquist, and Anatoly Gitelson, School of Natural Resources, University of Nebraska–Lincoln, NE 68178

Significant research has gone into the development of a multispectral index which can be used to accurately retrieve the concentration of pigments in the leaves of plants. In the past, measurements have been made using expensive hyperspectral radiometers and then extracting only the wavelengths of interest. Progress has been made in the development of an inexpensive handheld multispectral device which can accomplish the same function. In addition, experiments were conducted with a simple light-sealed container to be used to measure pigment concentrations in grapes. Although development of the handheld device is not complete, appropriate near infrared LED emitters have been identified following unsuccessful testing with more commonly available LEDs. Despite the early stage of development, strong commercial interest has been expressed in the device by a major producer of vegetation sensing instruments.

INTERACTIVE CLASSROOM MATERIALS ON LIGHT

Christopher M. Siedell, Kevin M. Lee, and Andrew Frederick, Center for Science, Mathematics, and Computer Education, University of Nebraska–Lincoln, NE 68588

Change is taking place in science classrooms across the country as instructors and administrators discover that interactive and peer oriented instruction can enhance and outperform the traditional lecture approach. At UNL, many large lecture halls have been equipped for voting clickers and their use is becoming increasingly common. Having students vote on a multiple choice question gives the instructor an immediate sense of students' understanding, and allows attention to be focused where most needed. The ClassAction project is a digital collection of conceptual questions tailored for this purpose. ClassAction takes advantage of the flexibility that a computer based project allows: most questions have multiple variations, and many feature animations and dynamic illustrations. Each module is accompanied by relevant simulations, graphics, outlines and tables for providing feedback. This presentation will focus on the newly developed Light module of the ClassAction project.

STIMULATING STUDENT INTEREST IN AEROSPACE THROUGH THE CONVERSION OF A T-29 BACK INTO "FLYING" CLASSROOM

Evan Killeen and John McLean, Department of Education, Strategic Air & Space Museum, Ashland, NE 68003

The Strategic Air & Space Museum, the NASA Nebraska Space Grant, and other donors partnered to complete the "T-29 Flying Classroom" project. Once used as a classroom to train U.S. Air Force navigators, the T-29 aircraft is a classroom once again. The Museum was able to outfit computers at each learning station. The stations consist of a computer featuring two flat screen monitors and the latest flight simulator software. The Museum's Education Department will utilize the "Flying Classroom" during its Flight Camps, Top Gun Weekends, and Summer Camp programs to stimulate student interest in aerospace curriculum and careers. Students will learn the principles of flight and the basics of maneuvering, landing, and take-off. An estimated 480 students, ranging in age from 8 to 17, will be served through this program in 2008. Each student will receive an average of 4 hours of programming in the "Flying Classroom."

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

CONSTRUCTION AND UTILIZATION OF AN ELECTRIC FIELD MILL TO MEASURE THE ELECTRIC FIELD OF THE EARTH

Heather Finney, Department of Physics, Hastings College, Hastings, NE 68901

Earth has an electric field which is produced and influenced by complex processes that occur within the distinct layers of the Earth's atmosphere. To measure the electric field, an electric field mill was constructed. In addition to measuring the field during fine weather conditions at varying times throughout the day, the electric field was measured during different weather patterns. This provided for the analysis of the role atmospheric conditions have in influencing Earth's electric field.

MACROSCOPIC SCATTERING: RIGID BODY IMPACT OF A BASEBALL BY A BAT

Josh Tomayer, Department of Physics, Hastings College, Hastings, NE 68901

In recent years, many physicists have been conducting experiments on particle scattering trying to find the structure of the atom, but very few experiments deal with macroscopic objects. We will describe and plan an experiment on the scattering of a baseball by a baseball bat to determine how the speed and spin of the outgoing ball depends on the scattering angle. Measurements of the tradeoff between the speed and spin for a baseball impacting a baseball bat will be presented. In the experiment, we will place our attention on the direct observable parameters. Also, we would like to determine the amount of back-spin that can be administered to a baseball by striking it at different points. The results we hope to obtain will be preliminary in which the experiment will use minimal ball speeds than those of the actual game.

THE DESIGN, CONSTRUCTION, AND ANALYSIS OF AN ACOUSTIC LEVITATION APPARATUS

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

Sound is all around us, but what is sound? People most often experience and attribute sound to its source by means of simply hearing it. Thus, sound is often not thought of as having a physical presence. An acoustic levitation device can give us an insight into what sound really is. The device which was constructed was designed in such a way to easily explore the physics of sound and levitation of small masses using a piezoelectric sound source.

INVESTIGATION OF MAGNETIC DAMPENING ON A NON-FERROMAGNETIC AIR TRACK

Geoffrey Bergman, Department of Physics, Hastings College, Hastings, NE 68901

Eddy currents as an electrical phenomenon are found in a wide variety of magnetic applications ranging from the separation of aluminum cans from other recyclables, to magnetic levitation. Specifically, these currents can be used for the braking of roller coasters and trains with no mechanical wear. An apparatus was constructed using a Pasco air track and tested by placing strong Neodymium Iron boron magnets (NdFeB) on the air cart in order to observe the effect of magnetic braking at varying initial velocities. Experimental data including velocity, induced current, displacement, time, and mass were all determined. Using the above variables, the dampening value was calculated and thus, the magnetic dampening force was determined.

EXAMINATION OF SPECIES DIVERSITY WITHIN *TRYPANOSOMA* OF AUSTRALIAN FRESHWATER TURTLES

Ashley Freyre and Scott Snyder, Department of Biology, University of Nebraska at Omaha, NE 68182

Members of the genus *Trypanosoma* are obligate haemoflagellate parasites found worldwide in all classes of vertebrates. The majority of the nearly 500 described species infect the blood and tissue fluids of their hosts. Although globally distributed, most research has focused on the few medically important trypanosomes, and relatively little is known about the remainder of genus, including Australian turtle trypanosomes. To address this limited understanding, we seek to elucidate trypanosome species diversity and prevalence in three genera of freshwater turtles collected at six sites in Australia. Conventional light microscopy and Polymerase Chain Reaction (PCR) will be employed to determine trypanosome prevalence in the turtles. Trypanosome species diversity will be addressed using DNA sequencing, which will provide data to reconstruct evolutionary relationships and quantify genetic variability.

POPULATION GENETICS OF *SPIRORCHIS SCRIPTA* (DIGENEA: SPIRORCHIIDAE) IN FRESHWATER TURTLES

Dominique Freyre and Scott Snyder, Department of Biology, University of Nebraska at Omaha, NE 68182

Turtle blood flukes infect the circulatory systems of turtles worldwide and are known to cause disease. *Spirorchis scripta* is the most common turtle blood fluke in North America, with populations found in numerous localities east of the Rocky Mountains. However, very little is known about the genetic structure of most parasite populations, including that of *S. scripta*. The population genetics of *S. scripta* will be investigated through DNA sequencing, using both mitochondrial DNA and ITS ribosomal DNA, to generate comparative sequence data. These data will allow for the depiction of relative relationships among parasite populations, as well as the assessment of genetic variability among parasite populations. Such investigations will be used for identification of phylogeographic patterns and novel evolutionary insights.

LESSONS LEARNED FROM A NASA/NSF SPONSORED ONLINE EARTH SYSTEM SCIENCE COURSE FOR TEACHERS

Neal Grandgenett, Bill Schnase, and Steve Hamersky, Department of Teacher Education; and Robert Shuster, Department of Geology, University of Nebraska at Omaha, NE 68182

This presentation describes the evolution of an online, NASA/NSF funded Earth System Science Course for Teachers. It is being facilitated in a partnership between the UNO Departments of Teacher Education and Geography/Geology. UNO is also participating with 40 other universities across the country to develop new online course instructional modules. This national coalition of 40 institutions is called the Earth System Science Education Alliance (ESSEA) and UNO's efforts have included conducting a new online middle school course, as well as previously offering ESSEA independent study courses. Educational impact is being monitored in several ways, including teacher perceptions, teacher projects and dialogue, and teacher pretest and posttest scores on selected content-related tests. This presentation will also describe the evolving plans for the expansion of these online learning environments as well as several new instructional modules. UNO also recently hosted the national ESSEA conference and this presentation will briefly describe that event.

ANTHROPOLOGY

TEMPORAL INSANITY: WOODLAND ARCHAEOLOGY AND THE CONSTRUCTION OF CHRONOLOGY

Erin Dempsey, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

This paper will bring to light the problems existing in the current, working chronology employed in Woodland Period archaeology and determine how, possibly, these problems can be alleviated. I assert that creating new chronologies that speak to specific research questions and doing away with a static and unchanging culture-historical perspective in Woodland Period archaeology will help archaeologists better investigate how people lived and interacted during this time and, more importantly, how they facilitated and experienced cultural change in the Eastern Woodlands of North America. By lifting the framework culture history has superimposed on the archaeology of woodland peoples (i.e. Adena, Hopewell, Fort Ancient, and early Late Woodland), it may be possible to see cultural patterns that were previously truncated, altered, or overshadowed. I hope that this new treatment of chronology as an indicator of change through time will help archaeologists achieve a greater understanding of cultural patterns in the Woodland Period and place activities such as earthwork and mound construction, ritual, and habitation in a broader context than culture history currently allows.

CLUES TO THE RELATIONSHIP OF THE RIVERBANK SITE TO OTHER OHIO HOPEWELL SITES THROUGH INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS ON POTTERY

Amanda Landon, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

A recent excavation at the Riverbank Site (33RO1059) in Hopewell Culture National Historic Park recovered materials that were consistent with a Hopewell occupation. One of the objectives of this excavation was to determine the relationship between this site and surrounding Ohio Hopewell sites. In order to further this objective, fifteen shards from the Riverbank Site were sent for instrumental neutron activation analysis (INAA) at the University of Missouri Research Reactor (MURR), the results of which were added to the results from other Ohio Hopewell sites through the results of the ceramic analysis.

TAPHONOMY OF GUNS

Andrew LaBounty, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

In archaeology, taphonomy has emerged as an important area of study regarding faunal remains. However, the understanding of how an object can transition from life to the archeological record, and then into the hands of researchers, is critical to the interpretation of any artifact. This paper will extend the principles of taphonomy to firearms in order to examine how they are deposited and differentially preserved in a variety of circumstances. Such circumstances include both subsistence and battle scenarios, as well as the events that occur throughout the gun's transition from tool to studied artifact. Issues of failure, maintainability, salvage, cultural behavior, and metallurgy will be addressed, and individual sites will be presented as case studies.

"CHARGING THESE ENTRENCHMENTS AGAINST MODERN RIFLES IS TERRIBLE": THE ARCHAEOLOGY OF HUMAN BEHAVIOR IN COMBAT: EL CANEY, CUBA, JULY 1, 1898

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The Santiago campaign of 1898 occurred during a time of transition, when American Army battle tactics were adjusting to the new realities of industrialized warfare. The archaeological traces of that campaign should reflect these new patterns of behavior. Using the historical documentation of the institutional debates that took place among Army strategists in the late nineteenth century, the tactics manuals they developed to meet these new challenges, and soldiers' accounts of their actions in combat at El Caney, Cuba, on July 1, 1898, this paper will generate a series of archaeological expectations for the El Caney battlefield based on an understanding of human behavior under fire in the last years of the nineteenth century.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION A

NKT CELLS: FRIEND OR FOE?

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Recent data suggest that not just cholesterol but inflammation may be a major contributor to the development of atherosclerosis and its fatal consequences, coronary heart disease, so much so that plasma levels of markers of inflammation (e.g., CRP) are now a part of the diagnostic panel of tests performed for cardiovascular patients. Inflammation is a host defense reaction to infectious and non-infectious tissue destructive processes and is brought about by chemical mediators secreted by cells of both the innate and adaptive immune systems. Our previous data showing decreases of high density lipoprotein (HDL, the so-called "good cholesterol") and massive increases of the pro-atherogenic very low (VLDL) and low density (LDL) lipoproteins, the so-called "bad cholesterol", 24-48 hr following induction suggested that perturbations of lipids and lipoprotein metabolism are a part of the inflammatory response. The molecular basis for these changes is presently unclear. In order to understand mechanisms for these changes, genetically engineered mice were used. These mice are described in another presentation in these meetings. Natural killer (NK) cells are among the first responders of the immune system and NKT cells are a distinct subset of T lymphocytes. Activation of their TCR results in the

production of pro-inflammatory and anti-inflammatory cytokines. The adoptive transfer of NKT-rich splenocytes (from Vα14Jα18/Vβ8 transgenic mice) increased atherosclerosis in LDLR$^{-/-}$ mice compared with recipient of NKT-deficient (from *CD1d* gene knockout mice) splenocytes possibly due to disregulation of members of the tumor necrosis factor cytokine family and their effect on hepatic lipase, an enzyme related to HDL and VLDL metabolism[3]. Endogenous inhibition of LIGHT signaling resulted in decreased plasma lipids, decreased VLDL, and increased hepatic lipase. Analysis of the lipoproteins from these genetically modified transgenic and/or gene knockout mice by size (fast phase liquid chromatography) and density (ultracentrifugal flotation) revealed decreases of HDL and increases of VLDL containing apoB100, the major apoprotein of LDL in Lck mice (LIGHT transgenic in the LDL$^{-/-}$ background). A new peak with a particle size and density larger and lighter than HDL but denser than LDL were observed. These particles contained only apoE but no apoA-I and apoB, therefore neither a HDL nor LDL. ApoE is an apolipoprotein that functions in the elimination of cholesterol while apoA-I is the major apoprotein of HDL. High levels of apoA-I are inversely correlated to the development of atherosclerosis. Taken together, these results suggest that LIGHT and related cytokines produced by NKT cells regulate plasma lipoprotein metabolism with hepatic lipase as the major mediator, and that these NKT-produced cytokines are a major contributor to the role of the adaptive immune system and inflammation on dyslipidemia and atherogenesis. Similar lighter density, apoE-containing particles have been observed in patients with type III hyperlipidemia (characterized by elevated triglyceride- and cholesterol-rich lipoproteins and susceptibility to early development of atherosclerosis). NKT cells and their products may give insight into the molecular mechanisms of atherogenesis precipitated by repeated inflammatory challenges.

GENETICALLY ENGINEERED MICE AS MODELS FOR ATHEROSCLEROSIS

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Genetically engineered mice are valuable models for human pathologies including atherosclerosis. The results included in this abstract were obtained during a summer internship at the University of Chicago where the role of the immune system in atherogenesis was being studied using genetically engineered transgenic and gene "knock out" mice. The objectives of this presentation are to describe a method of genotyping progenies of parental crosses of these genetically engineered mice for the transgene or "knock out" gene of interest and to examine the significance of these mice in the investigation of the role of the immune system and inflammation in atherosclerosis. The mice used included those deficient for the receptor for low density lipoprotein, the so-called "bad cholesterol", (LDLR$^{-/-}$), mice transgenic for the invariant receptor of natural killer (NK) cells (Vα14Jα14 iTCR), mice deficient for the MHC-like antigen presentation molecule to which NK cells respond (CD1d$^{-/-}$), mice deficient for a member of tumor necrosis factor family of cytokines called LIGHT (LIGHT$^{-/-}$), and mice deficient for the lymphotoxin-beta receptor (LTβR$^{-/-}$) that binds LIGHT as a ligand. These mice were mated with LDLR$^{-/-}$ mice producing the trangene/knockout Vα14Jα14 iTCRtgLDLR$^{-/-}$ progeny, and the double knockout (CD1d$^{-/-}$ LDLR$^{-/-}$, LIGHT$^{-/-}$ LDLR$^{-/-}$, and LTβR$^{-/-}$ LDLR$^{-/-}$) progenies. The basis of these investigations are the recently published findings that adoptive transfer of NKT-rich splenocytes (from Vα14Jα18/Vβ8 transgenic mice) increased atherosclerosis in LDL$^{-/-}$ mice compared with recipient of NKT-deficient (from *CD1d* gene knockout mice) splenocytes possibly due to disregulation of members of the tumor necrosis factor (TNF) cytokine family and their effect on hepatic lipase, an enzyme related to the metabolism of the anti-atherogenic high density lipoprotein (HDL, the so-called "good cholesterol") and the pro-atherogenic very low density lipoproteins (VLDL). The rationale for the use of these mice crosses are as follows. Unlike the wild type mice which do not develop atherosclerosis, the LDLR$^{-/-}$ mice develop atherosclerosis when fed a high-fat-high-cholesterol Western Type Diet. NK cells are the first

responders to pathogenic invasion, their activation induce production of cytokines involved in the inflammatory process. LIGHT (Homologous to Lymphotoxins, exhibits Inducible expression, and competes with HSV Glycoprotein D for HVEM on T cells) is a newly identified member of the TNF family of cytokines which acts as a co-stimulatory molecule to T cells including the T cell subset, NKT. The T cells receptor transgenic mice in the LDL receptor deficient background ($V\alpha14J\alpha18iTCRtgLDLR^{-/-}$), and the double knockout $CD1d^{-/-}$ $LDLR^{-/-}$, $LIGHT^{-/-}$ $LDLR^{-/-}$, and $LT\beta R^{-/-}$ $LDLR^{-/-}$ mice enable the examination of pro-atherogenic signaling pathways between NKT and dendritic cells, and between NKT cells and hepatocytes, whether atherosclerosis will develop in the presence or absence of the gene encoding the ligand or the receptor involved in the immune signaling pathway related to inflammatory responses, with and without the feeding a Western Type Diet. This will allow the molecular dissection of the now prevalent notion that inflammation, not just cholesterol, is the basis for the development of atherosclerosis and its fatal consequence, coronary heart disease.

THE EFFECT OF SODIUM AND GLUCOSE TRANSPORTERS ON PLASMA GLUCOSE CONCENTRATIONS

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Glucose is the main source of energy during normal metabolism. It is the end product of the digestion of carbohydrates such as sucrose or table sugar. After digestion, glucose is transported from the lumen of the gut into the blood vessels of the intestinal villi. This absorption process is facilitated by glucose transporters from two gene families, the facilitated glucose transporters (GLUT) located on the luminal pole and the sodium-coupled glucose cotransporters (SGLT) on the basolateral pole of the intestinal brush border cells of the villi. This aim of this project is test whether the ingestion of glucose with salt would result is a higher level of glucose concentration in the plasma compared to glucose alone. Six healthy college students, 3 males and 3 females between the ages of 18-25 were recruited as volunteers for this study. Health was determined as having no pertinent medical conditions and no history of glucose intolerance or diabetes. Plasma glucose levels were measured using commercially available testing kits (Accu-check) after a 12 hour fast in the three day testing periods. Baseline levels were obtained on day 1 by measuring the glucose levels for 1 hour at 5 and 10 minute intervals. On the 2nd day, baseline level were again obtained at 15 and 5 minutes before a 30-second ingestion of sucrose alone after which plasma glucose levels were measured for 1 hour at 10 minute intervals. The time of the appearance of peak glucose levels were recorded. On the 3rd testing period, baseline glucose was again obtained at 15 and 5 minutes before the ingestion of NaCl capsules followed by the sucrose solution. Plasma glucose levels were measured every 5 minutes until the peak level was obtained and every 10 minutes afterwards until the levels returned to baseline. The results showed an increase in plasma glucose concentration in all the subjects from M±SD of 89.2±7.0 mg/dl to a peak of 144.5±22.4 mg/dl at 40 minutes after ingestion when both the glucose and NaCl taken, higher than those that ingested sucrose alone (88.2±7.4 to a peak of 129.3±15.2). The females tended to have a higher mean than the males. Although these changes showed trends, the data did not reach statistical significance which could be attributable to the small number of subjects. Further studies with a larger number of subjects are needed to confirm these results which have important implications in hydration therapy and in the pathogenesis of type II diabetes. A three- to four-fold higher levels of SGLT1 and GLUT5 has been reported in these patients.

CREATION OF GALECTIN-3 MUTANTS DEFICIENT IN LACTOSE BINDING AFTER SITE-DIRECTED MUTAGENESIS

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Galectins are members of the lectin family that share similar carbohydrate recognition domains. Previous studies by Rini *et al* (JBC, 273: 13047-52) characterized the X-ray crystallographic structure and hydrogen bond interactions in the carbohydrate binding site of Galectin-3 when bound to lactose. Nickel *et al* (JCB, 171: 373-81) created point mutations in Galectin-1 that caused β-galactoside binding deficiency. The present study has aimed at creating point mutations in Galectin-3 at sites responsible for carbohydrate binding. After insertion of the Galectin-3 cDNA into the pUC18 vector, point mutations in the carbohydrate recognition domain of Galectin-3 were created through site-directed mutagenesis. The four amino acids targeted for mutation had been shown by Rini *et al* to be responsible for lactose binding. They also shared identity with amino acids in Galectin-1 that, when mutated by Nickel *et al*, made Galectin-1 unable to bind lactose. Following characterization of the lactose-binding properties of the mutant Galectin-3 molecules, each Galectin-3 mutant will be expressed in eukaryotic cells to determine the effects of the changes in carbohydrate binding on the biological properties of Galectin-3.

RECEPTOR SUBTYPES INVOLVED IN LUNG FIBROBLAST-MEDIATED COLLAGEN GEL CONTRACTION STIMULATED BY LYSOPHOSPHATIDIC ACID AND SERUM

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Previous studies showed that the lipid mediator lysophosphatidic acid (LPA) stimulates lung fibroblast responses relevant to repair and remodeling, including contraction of collagen gels. Pharmacological probes were used to examine the LPA receptor subtypes involved in gel contraction and to test the contribution of LPA and its receptors to gel contraction stimulated by serum. HFL-1 human fetal lung fibroblasts cast into collagen gels were cultured for 24 hr to develop tension. Gels were then released in the presence of LPA, serum, and/or LPA receptor-selective drugs, and gel contraction was monitored over 6 hr. Stimulation by LPA was blocked by the LPA1+3 antagonist Ki16425. Gel contraction was stimulated by both the LPA1-preferring agonist NAEPA and the LPA3-preferring agonist OMPT, both of which were blocked by Ki16425. The LPA2-preferring agonist FAP12 was much less effective. Stimulation by fetal bovine serum was similar to that by LPA and was also blocked by Ki16425. Thus activation of either LPA1 or LPA3 is necessary and sufficient for LPA stimulation of gel contraction, and LPA1 and/or LPA3 also mediate the gel contraction in response to serum.

REDUCING BOTTLENECKS IN PROTEOMICS DATA ANALYSIS

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A number of software packages are available to analyze the data produced by mass spectrometry experiments one of which is *X!Tandem*. Unfortunately, the use of *X!Tandem* is, in general, a very manual process with the results of multiple mass spectrometry experiments each having to be submitted manually. As mass spectrometers can produce data very quickly, this limitation results in a bottleneck in the analysis of data. In addition, the output of *X!Tandem* often contains extraneous data which makes it difficult to interpret. We have developed a computer program, *Eilig*, that takes data produced by a liquid chromatography tandem mass spectrometer (LC-MS/MS) and submits it directly to *X!Tandem*. The results from *X!Tandem* are parsed and configured by *Eilig* to provide the user with clean, relatively noiseless, and easy-to-interpret data. *Eilig* is written in a combination of *AutoIt Script* and *Perl* and provides the ability to submit multiple mass spectrometry files to *X!Tandem* at once thus speeding up the analysis process. During my talk, I will discuss the nature of the liquid chromatography tandem mass spectrometry experiment and the analysis performed by *X!Tandem*. I will also discuss the architecture of *Eilig* and will conclude by demonstrating the use of *Eilig* on example data.

A CLOSER LOOK INTO THE rRNA GENE COMPLEX OF PATHOGENIC MEMBERS OF ACTINOBACTERIA

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Internal Transcribed Spacers (ITS) are highly variable regions within the rRNA gene complex in the genomes of any organism. These are of special interest for the development of PCR-based molecular diagnostic tools. As a first step in the development of genus-specific PCR primer sets for amplification of the ITS region from *Mycobacerium*, we developed a computational tool to automate the analysis of multiple genomic sequences. We report the analysis of the rRNA complex from nineteen organisms belonging to the family Actinobacteria. This family consists of gram-positive bacteria species that are pathogenic to humans and commonly found in the flora of human lungs. *Mycobacterium*, *Corynebacterium*, *Nocardia*, *Rhodococcus* and a few species of *Streptomyces* are representative members of Actinobacteria whose genomes have been sequenced. Our results show that there are multiple copies of this genomic target within each genome and evidence for possibly incorrect annotation of some of the genomic sequences from different resources.

ROLE OF HUMAN N-CADHERIN PROMOTER SEQUENCES IN REGULATING N-CADHERIN GENE EXPRESSION.

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Cadherins are a family of calcium dependent transmembrane cell adhesion proteins that form homodimers in adherens junctions. Regulation of N-cadherin expression is of particular interest because N-cadherin can become misexpressed in epithelial tumors regardless of whether E-cadherin is still expressed and is linked to increased motility and invasiveness. Transient transfections of luciferase reporters with three promoter fragments spanning +10 to -214bp, +1 to -462bp and +10 to -1975bp have indicated that the -462bp fragment consistently serves as a minimal essential promoter. Reporter data on the largest fragment shows that it consistently promotes less reporter expression than the -462bp fragment. Additionally, when an AP-1 consensus site at -1896bp, is cloned onto the -462bp fragment, expression of the luciferase reporter is restored to levels similar to or exceeding the -462bp fragment alone. This data suggests that the AP-1 site is relevant to N-cadherin expression and that there may be a repressor element located between -462bp and -1896bp. TGFβ1 stimulated MCF10A cells undergo the epithelial-to-mesenchymal transition (EMT) in which cells decrease E-cadherin expression, increase N-cadherin expression and adopt mesechymal form and function. This process is similar to metastasis of epithelial tumor cells and AP-1 is a target of TGFβ1 signaling. Stable MCF10A luciferase transfectants were stimulated with TGFβ1 and tested for changes in luciferase expression. Stimulated cells had more normalized luciferase activity from the -462bp fragment and -462bp+-1896bp AP-1 site than unstimulated cells. We are also currently designing primers to amplify the putative repressor region and test the ability of this fragment to repress expression of a luciferase reporter. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

STABILITY OF A FOREIGN PROTEIN IN CHIMERIC CVB3: POTENTIAL VECTOR FOR GENE DELIVERY

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Group B, serotype 3 of Coxsackievirus (CVB3) is the leading cause of myocarditis and pancreatitis. Recently, an evolved form of this virus has been documented in a human case. The virus has evolved to form 5' terminal deletions making the virus non-virulent and stable, which make it a suitable candidate to be evaluated as a potential vector system for gene therapy delivery. The hypothesis was that a foreign protein, murine interleukin-4 (mIL-4), could be stably expressed in tissue culture using CVB3 as a vector system. cDNA from CVB3/28 (wild-type) and mIL-4 were used to construct a chimeric virus that was transfected into HeLa cells (control) and mouse heart cardiomyocytes (MHC; experimental). MHC cells are the main target of CVB3/28 since it is a cardiovirulent strain. Viral progress was evaluated by assaying for cytopathic effect on HeLa indicator cells and reverse-transcription polymerase chain reaction to detect deletion of both the inserted protein and bases at the 5' end. Chimeric virus was detected through passage 10 in MHC cells, was non-infectious, and retained the insert, suggesting this vector system may be an effective delivery system. HeLa cells deleted the insert and showed cytopathic effect when infected,

suggesting virulent activity in these cells. Constructing successful chimeric viruses with foreign protein inserts may lead to further development of CVB3 as a possible gene therapy vector system for a variety of diseases. 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 STUDIES OF BOVINE LEUKEMIA VIRUS

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Bovine leukemia virus (BLV) is a retrovirus of cattle that is closely related to the human T cell leukemia virus (HTLV). It is well-documented that HTLV causes activation of T cells in its human host, but the situation for BLV is much less clear. Like HTLV, however, BLV induces cancer of the lymphocytes in a low percentage of hosts, and many infected animals develop a persistent lymphocytosis. In order to study the effects of BLV on host cells, we have developed an in vitro model in which persistently BLV-infected FLK cells are used to infect other cell types. For example, feline CC81 cells form multinucleated syncytia upon exposure to BLV. We are currently using a CC81 cell syncytium-forming assay to test bovine serum, plasma, antiviral drugs, and other compounds for their ability to inhibit BLV. Thus far we have shown a dose-dependent inhibition of BLV replication by bovine plasma, as well as by the antiviral drugs AZT and ribavirin. We are currently testing additional compounds, and developing additional methods for measuring the production of BLV antigen, as well as the expression of BLV-specific mRNA, to corroborate these results.

In addition to the ability of BLV to cause syncytia, lymphocytes isolated from BLV-infected cattle will spontaneously proliferate when cultured in vitro. Since this phenomenon is not well understood, we are interested in studying the proliferation of cells exposed to BLV in vitro. Therefore, in a second set of experiments, supernatants from BLV-infected FLK cells were added to uninfected bovine peripheral blood mononuclear cells (PBMC), and cell proliferation was measured by a BrdU incorporation ELISA. After 48 hours in culture, the FLK/BLV supernatant-treated PBMCs proliferated at a rate similar to those treated with the mitogens ConA and PHA. In further studies we are attempting to elucidate the specific component of the virus itself, or perhaps a non-viral factor produced by BLV-infected cells, that is responsible for this enhanced cell proliferation. Supported by NIH grant number P20 RR016469

INFLUENCE OF EXERCISE TRAINING ON GENE EXPRESSION IN DIABETIC RATS

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The goal of this research was to determine if exercise training has an impact on the expression of genes that are affected by diabetes mellitus. Sixteen female Long-Evans rats served as subjects. Diabetes was induced in half the rats by streptozocin injection, and half the rats exercise-trained by swimming one hour per day for at least four weeks. Fourteen genes whose expression is affected by diabetes were selected for study based on their likelihood of also being influenced by exercise training in brain, cardiac muscle, kidney, liver, and skeletal muscle tissue by RT-PCR technique. Comparing trained control rats to trained diabetic rats, gene expression was altered in 13 of the 14 genes, while when comparing either sedentary diabetic rats to sedentary control rats or sedentary diabetic rats to trained diabetic rats, gene expression was altered in only 9 of the 14 genes examined. Genes for sterol regulatory element binding factor 1 in liver and kidney tissue, adrenergic receptor α1a in kidney tissue, and mitogen-activated protein kinase 14 in cardiac muscle tissue were most often down-regulated, while genes for glucagon receptor 1 in brain tissue, superoxide dismutase 2 in liver tissue, adrenergic receptor α1a in heart tissue, and adrener-

gic receptor β3 in skeletal muscle tissue were most often up-regulated. Genes for angiotensinogen in brain tissue and angiotensin 1 converting enzyme in cardiac muscle tissue were most often unchanged. These results emphasize the complex interactions of disease states and lifestyle choices on gene expression in that a change in expression of a gene by one factor (diabetes) may be exaggerated, reversed, or negated by another (exercise training). The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

UP-REGULATION OF PRO-INFLAMMATORY CYTOKINES BY THE AORTIC ENDOTHELIAL CELL LINE SVEC4-10EE2 IN RESPONSE TO ALCOHOL METABOLITES

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Atherosclerosis is a disease affecting arteriole blood vessels characterized by a chronic inflammatory response. It is also referred to as a hardening of the arteries as plaque formation increases. Malondialdehyde (MDA) is a product of the oxidation of unsaturated fatty acids and is present in atherosclerotic lesions. Acetaldehyde (AA) is a common product from the metabolic break-down of ethanol. Both MDA and AA are very reactive and can bind (adduct) to various proteins forming antigenically distinct products, MAA adducts. Given that MAA-modified proteins are able to induce pro-inflammatory cytokines/chemokines and bind certain scavenger receptors in sinusoidal endothelial cells (SECs), there also appears to be a mechanism by which vascular endothelial cells lining the aorta bind modified proteins and up-regulate certain pro-inflammatory mediators. Due to the difficulty of obtaining and culturing aortic endothelial cells, a vascular endothelial cell line SVEC4-10EE2 was used to set the parameters for future atherosclerotic studies. It was the purpose of this study to examine which pro-inflammatory mediators are involved following MAA-modified protein binding to a vascular endothelial cell line SVEC4-10EE2. RT-PCR was performed on cell lysate looking for increased expression of various cytokines/chemokines and protein was evaluated using enzyme-linked immunosorbent assay (ELISA). SVEC4-10EE2 cells bound MAA-modified proteins and increased mRNA expression of MCP-1, IL-6, TNF-α, and smooth muscle actin (SMA). Interestingly, low levels of LPS had no synergistic effects on MAA-Alb stimulation. MAA-Alb alone increased the expression of mRNA with only background levels following incubation with Alb. Increased secretion of these cytokines was demonstrated for MCP-1 and IL-6 following incubation with MAA-Alb. However, TNF-α secretion was not detected following MAA-Alb incubation, possibly indicating a problem in the transcription of mRNA to protein or its release from the cell. The studies using the SVEC4-10EE2 cells stimulated with MAA-modified proteins demonstrated that it is possible to assess the interaction of MAA-modified proteins and cellular responses. Also, MAA-modified proteins are possibly involved in atherosclerotic disease. In summary, these studies have prepared the parameters for future studies with isolated aortic endothelial cells and their interaction with MAA-modified proteins resulting in damage to the aorta.

EFFECT OF CARBON CHAIN LENGTH AND NUMBER ON THE LIPID OXIDATION ACTIVITY OF URANIUM

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Uranium enters the environment from mining, industrial processes, nuclear power use, and military use. Unless it is enriched, the chief hazard from uranium is chemical toxicity. Part of uranium's toxic effect is due to the oxidation of lipids and other cellular components. Several studies have examined the effect of uranium salts on lipid oxidation, however, when uranium enters the environment, it will

eventually enter the biosphere and undergo some type of biological transformation. Biological transformation is often the result of some type of carbon chain being attached to the uranium atom; presumably this will affect the toxicity of uranium. Altered toxicity, in the case of uranium, suggests altered ability to oxidize lipids. This study sets out to examine the effect of various uranium metallorganic compounds on lipid oxidation in the brain and kidney.

Metallorganic uranium compounds were synthesized by reacting uranyl acetate with either ethanolamine, diethanolamine, triethanolamine, laurylamine, para-aminobenzoic acid, or gluconic acid. This process produced uranium compounds with carbon chains varying from 2 to 12 carbons with varying weights and properties.

The LD50 and LD100 was established for each compound by injecting the compound in increasing concentrations into mice.

Equimolar amounts of each compound were then injected into mice so that 33mg/kg of uranyl molecules was administered to each animal. The animals were allowed to survive for 24 hours. The animals were then sacrificed and the brains and kidneys collected. Lipid oxidation was measured for brains and kidneys using the thiobarbituric acid method. Protein content was determined using the Coomassie blue method.

Oxidation of brain lipids increased as the number of carbons increased, regardless of the number of chains or the number of carbons in each chain, until a total of 12 carbons were attached to the uranium atom. If the number of carbons exceeded 12 then amount of lipid oxidation that occurred quickly fell toward the same activity as uranium acetate.

Oxidation of renal lipids seemed to follow a different course, nearly the opposite of brain lipids. Oxidation activity declined up to 6 carbons in a chain and increased again when carbons were added. Overall lipid oxidation decreased as the total number of carbons increased.

The effect of carbon chain length and number appeared to increase the LD100 for any particular compound. This appears to argue that lipid oxidation of the brain or the kidney may not be the defining mechanism for acute toxicity. These data also suggest that the kidney and brain metabolize uranium compounds in dramatically different manners.

CHANGES IN *GST* GENE EXPRESSION IN LARGE CAGED POPULATIONS OF *DROSOPHILA MELANOGASTER*

Anjeza Pashaj, Kimberly A. Carlson, Kylee Gardner, and Darby J. Carlson, Department of Biology, University of Nebraska at Kearney, NE 68849; and Lawrence G Harshman, School of Biological Sciences, University of Nebraska–Lincoln, NE 68588

Microarray studies have recently identified detoxification genes as an overrepresented class of genes among those differentially expressed as a function of age in model species for genetic studies. One such family of detoxification enzymes are the glutathione S- transferases (GSTs). GSTs are found in all organisms, with orthologs shared by humans and *Drosophila melanogaster*. In this study, we investigate the abundance of mRNA corresponding to specific *GST* genes. Large caged populations (15,000) of *D. melanogaster* were sampled over a period of 89 days and the levels of GST mRNA analyzed. A time course experiment was performed to analyze the expression levels of *GST* mRNA on days 5, 19, 31, 43, 61, and 75. Total RNA was extracted for each time point and was used for real time qRT-PCR. The precision and cost effectiveness of qRT-PCR allows many samples to be analyzed. The long-term goal is to identify candidate genes for longevity in laboratory and natural populations. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

CHANGES IN GENE EXPRESSION PROFILES RELATED TO MORTALITY OVER THE LIFE SPAN OF LARGE CAGED POPULATIONS OF *DROSOPHILA MELANOGASTER*

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Aging is characterized by a decline in many aspects of organism function. Genomic technologies, such as microarrays, allow for a global analysis of gene expression during the aging process. The objective of this study was to perform transcriptome analysis using cDNA microarrays to determine the differentially regulated genes in large caged populations of genetically related *Drosophila melanogaster*. It addresses the question of whether there is consistency in the gene expression patterns in replicate populations. Moreover, it investigates gene expression in very old individuals made possible by the large starting size of each cohort. Two cages of 10,000 flies (5,000 females and 5,000 males) were established and samples collected at 0%, 10%, 30%, 60%, and 90% population mortality. This microarray study includes very old flies; it is the first *D. melanogaster* microarray study of aging to include this class of flies. Total RNA was extracted from females and cDNA microarray analyses performed. Two hundred and ninety-five genes exhibited a statistically significant change in gene expression from samples compared to the 0% sample. Of these, 205 were found to be significantly differentially expressed across all time points. Cluster analysis was applied to these genes to identify sets of genes with a similar pattern of altered gene expression. Gene ontology analysis was used to identify the probable function of the 205 genes. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

CO-EVOLUTION IN *DROSOPHILA MELANOGASTER*: THE EFFECT MALES HAVE ON LIPID CONTENT IN EGGS.

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It has been shown that in *Drosophila melanogaster,* male fruit flies influence how much lipid is deposited in the eggs. Males want the females to increase the amount of lipid in the egg to increase chance of survival of their offspring. If females deposit too much lipid it may lessen their own chance of survival. The males and females in a strain of Drosophila will co-evolve together to reach a balance. This balance may be disturbed in a variety of ways. Tests have been done with flies subjected to starvation selection compared to control flies. Tests were also done to compare mating males and females from starvation and control lines. These tests showed the male influenced how much lipid was deposited by the female.

An experiment was performed with *Drosophila melanogaster* to see whether or not lines of related flies have evolved enough to alter the amount of lipid the female flies deposit in the eggs when mated with a male from a separate line. For my experiment six lines were tested including three lines of starvation selected flies, ST1, ST2, and ST3 and three control lines of flies SC1, SC2, SC3. Males were mated to females from different lines within each group, for example ST1 female mated to ST2 male. All combinations were mated within both ST and SC groups. Then the total lipid content of the eggs from the female ovaries was analyzed, and two replicate samples from each vial were tested. Then the eggs were compared by the total lipid content between the SC and ST lines as well as whether mating the slightly different lines within each group raises the lipid content compared to mating within the strain. Data was collected from mating the flies at various intervals after starvation, including after starvation, after 1 period of relaxation and after several periods of relaxation. If the lipid content is significantly higher, this would indicate that the lines have evolved to be distinct in regards to the male and female balance of the amount of lipid deposited.

BIOLOGICAL AND MEDICAL SCIENCES
SESSION C

PLASTICITY IN REPODUCTIVE EFFORT IN THE BURYING BEETLE *NICROPHORUS PUSTULATUS*: EFFECTS OF COMPETITION AND BODY SIZE

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Burying beetles use small carrion as a food resource for their offspring. Carrion is a high quality resource, yet rare and unpredictable in occurrence. With increasing population density, contest competition for carrion becomes stronger. As strength of competition increases, female body size becomes more important for reproductive success, because large beetles are more likely to successfully defend carrion against competitors than small beetles. We investigated whether female reproductive effort in offspring size and number differed based on both intrinsic (body size) and extrinsic (competition based on population density) differences among females. Female reproductive effort in offspring size and number was plastic and conditional on both extrinsic and intrinsic factors. Offspring number (i.e. brood size) decreased significantly with increasing population density, while offspring size (i.e. mean larval mass per brood) increased as population density increased. Population density did not affect variation of larval mass within broods. Small females reared larger broods with smaller larvae than large females. The variation of larval mass within broods of small females, however, was larger than within broods of large females. These results suggest that all females, independent of body size, solve the trade-off between offspring size and number in favor of offspring size with increasing strength of contest competition. Independent of strength of competition, small females, however, seemed to pursue a bet-hedging strategy by producing larger broods with on average smaller, but in size more variable larvae.

GENE EXPRESSION ASSAYS OF LIGNIN BIOSYNTHESIS IN SWITCHGRASS STEMS

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Switchgrass is characterized as a warm-season perennial grass. It is able to tolerate diverse environments having a range that extends from Quebec to Central America. With every passing day, the U.S. has a growing dependence on foreign oil and because of this dependence we are turning to alternative fuels. Among these are biofuels, while bioenergy crops won't replace oil they could greatly reduce our dependency. Switchgrass has the potential to have a great impact on bioenergy. It however has significant challenges. One of these is the presence of lignin in its cell walls. Lignin presents a problem because it can not be broken down into a form useable for bioenergy through current processes at an efficient cost. My project was designed to examine the level of lignin biosynthetic gene expression in switchgrass stems, varying in ages and strains, by semi-quantitative PCR. The levels of caffeic acid-o-methyltransferase (OMT), cinnamyl alcohol dehydrogenase (CAP), and cinnamoyl CoA reductase (CCR) are all important for the lignin pathway to continue, and will inform us about how much lignin is being synthesized. RNA has been extracted from all of the samples and assays of gene expression are currently being performed. We will present and analyze our findings to date. This project was supported by NIH grant P20 RR016469 from the BRIN program of the National Center for Research Resources and the University of Nebraska-Kearney Department of Biology.

NEW HOST AND GEOGRAPHIC DISTRIBUTION RECORDS FOR HELMINTH PARASITES IN THREE SPECIES OF BATS (CHIROPTERA: VESPERTILIONIDAE) FROM THE PINE RIDGE OF NEBRASKA

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Three species of vespertilionid bats including, four big brown bats (*Eptesicus fuscus*), four western small-footed myotis (*Myotis ciliolabrum*), and six little brown myotis (*Myotis lucifugus*) were collected between July and October 2007 from two sites on the Pine Ridge escarpment in Dawes County, Nebraska, and examined for helminths. Of the 14 bats, 10 (71%) were infected with one or more parasites as follows: 3 of 4 (75%) *E. fuscus*, 3 of 6 (50%) *M. lucifugus*, and 3 of 4 (75%) *M. ciliolabrum* harbored the lechithodendrid trematode, *Paralecithodendrium swansoni* (Macy, 1936) Lotz and Font, 1983; 1 of 4 (25%) *E. fuscus*, 1 of 6 (17%) *M. lucifugus*, and 1 of 4 (25%) *M. ciliolabrum* were infected with a plagiorchid trematode, *Plagiorchis vespertilionis* (Müller, 1780) Braun, 1900; and a single *E. fuscus* (25%) harbored third-stage larval spirurid nematodes, *Physaloptera* sp. This is the first time *P. vespertilionis* and *P. swansoni* have been reported from *M. ciliolabrum*. In addition, *E. fuscus* is a new host for *Physaloptera* sp., and *P. swansoni* is now documented in Nebraska for the first time.

COPPERHEAD TRANSLOCATION IN NEBRASKA: A COMPARISON BETWEEN TRANSLOCATED AND RESIDENT SNAKES

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Translocation can be used to relocate threatened animal populations and mediate isolation between populations. In Nebraska, the copperhead (*Agkistrodon contortrix phaeogaster*) has a limited range and is found mainly on privately owned land. The species is listed as needing conservation and may be a suitable candidate for translocation. The current study used radiotelemetry to investigate the spatial ecology and behaviors of six translocated copperheads and six resident snakes on the same plot of land over the 2007 field season. There was no overall statistical difference between the total distances moved or average between-observation movements of translocated and resident snakes, although translocated snakes moved a greater distance in July than resident snakes. Qualitatively, translocated snakes seemed to make more random movements while resident snakes appeared to move in more purposeful directions. Additionally, all translocated snakes survived the season, appeared to eat, and found known den sites for the winter. The data suggest that translocation may be a viable conservation technique to use with copperheads.

ISOLATION OF MICROORGANISMS FROM AN ALKALINE LAKE ECOSYSTEM THAT SECRETE FERULIC ACID ESTERASES ACTIVE AT HIGH pH.

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The hydrolysis of lignocellulose to fermentable sugars requires chemical decomposition of lignin prior to enzymatic hydrolysis of cellulose and hemicellulose. Ferulates are molecules that cross-link lignin to the complex polysaccharides and retard disruption. To break this linkage requires an esterase, which few organisms are known to produce. Thus, few enzymes have been identified. Ferulic acid

esterases active at alkaline pH may reduce the cost of cellulosic ethanol production by complementing alkali decomposition processes being currently developed. The purpose of this research was to identify novel sources of these needed enzymes. A diffusion assay developed by our group was used to screen for bacteria from two little studied and highly alkaline lakes located in the Sandhills of western Nebraska. An enrichment step was first completed using pH 9 AYMM with ethyl ferulate, a lignin model compound. After incubation for fourteen days, isolates that produce ethyl ferulate esterase were identified by plating serial dilutions onto medium containing ethyl ferulate. The presence of an esterase is detected by a change in the medium color. Nine colonies were selected with two distinct colony morphologies. Ferulic acid esterase activity was quantified by growing isolates on AYMM plates containing ethyl ferulate at pH 6, 7, 8, and 9. Zones of clearing and the diameter of the colony were measured, and ratios were calculated (zone/diameter). These ratios were compared for the isolates. Of the nine isolates tested, two ratios were apparent, supporting colony morphology data that there were two distinct isolates. Currently the isolates are being identified by 16S rDNA sequencing. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

A POSSIBLE CAROLINIAN RELICT FLORA IN THE NEBRASKA SANDHILLS

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Despite its relatively recent origin, the Nebraska Sandhills have a surprisingly high diversity of vascular plants. Three floristic elements contribute to this diversity: a southwestern (Great Plains) element which is most fully expressed on the upland dunes, a northern (Cordilleran-Arctic) element most diverse in peatlands, and an eastern (Carolinian) element predominately of mesic habitats. The northern and eastern elements include a number of species that are disjunct from their main geographic ranges. The boreal species associated with Sandhills fens have been the focus of attention in recent years, but the disjunct eastern species have received little attention. Recent floristic work in the eastern Sandhills has uncovered two patterns of geographically disjunct species. The first is demonstrated by a group of near-disjunct species that reach the edge of their ranges in the Osage Plains (and sometimes also the Smoky Hills) of Kansas, and which are widespread in the Sandhills and Platte River valley. The second centers around a small group of species recently discovered in the Sandhills, including *Rhynchospora capitellata*, *Xyris torta*, *Oenothera perennis*, *Viola lanceolata*, and *Brasenia schreberi*. These species, which are currently known in the Sandhills only from the headwaters of the Cedar and Elkhorn River drainages, are otherwise essentially absent from the Grassland Biome, with their closest approach in the Ozark Highlands of southern Missouri. These patterns suggest that some of the diversity of the Sandhills flora might be attributable to the persistence of relict floras that pre-date stabilization of the dunes.

EXTRACTION AND PRELIMINARY ISOLATION TECHNIQUE FOR ANTIMICROBIAL BIOACTIVE CONSTITUENTS OF GREAT PLAINS *BIDENS* (ASTERACEAE)

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According to the work of Sukup, Johnson, and Weedon, there are antimicrobial compounds within the Great Plains species of *Bidens*, a common genus of shorelines and wet places, and *Bidens comosa* (A. Gray) Wieg. has the greatest potential for the identification of these bioactive compounds. In order to identify the bioactive compounds that may be found in *Bidens comosa*, it was necessary to extract and isolate them. The procedure was designed with two major components, the first of which was to mimic standard extraction and isolation techniques for antimicrobial compounds found within members of the *Bidens* group, the second was to create a test technique that would insure that the com-

pound of interest was retained in an active form throughout the isolations. This was accomplished by testing at each step of the procedure against Methicillin Resistant *Staphylococcus aureus* Rosenbach (MRSA). If the plant material failed to kill the bacteria, it was determined that the active component was not maintained in this solution or solution subset.

This extraction and primary isolation technique allows high amounts of information to be gathered about bioactive compounds in plant species that have not been heavily studied. This process also allows for secondary procedures to be designed with some idea as to the general structural characteristics of the bioactive compounds and some general information about the stability of said compounds.

ANALYSIS OF LEGHEMOGLOBIN TRANSCRIPT LEVELS IN PARTRIDGE PEA TISSUES

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Partridge pea (*Chamaecrista fasciculata*) is a native prairie legume that is important in land restoration and increasing the quality of forage for wildlife. It is also a symbiotic nitrogen-fixing plant that carries out a mutualistic relationship with *Rhizobium* spp. The result of this symbiosis is a novel structure called a nodule. Within this, the rhizobia inhabit the plant cells and reduce atmospheric nitrogen to form ammonium using the enzyme nitrogenase. The activity of this enzyme quickly degrades if exposed to oxygen. To allow the nodule interior to remain aerobic, leghemoglobin is used to simultaneously lower oxygen levels and to ferry oxygen to the rhizobia. Recently, our lab cloned the first leghemoglobin cDNA from partridge pea. For this project, we collected various partridge pea tissues and extracted total RNA from each. We utilized primers made from cDNA sequences to construct semiquantitative RT-PCR assays for leghemoglobin and a control cDNA (GAPDH) to test our RNAs. We will present our current results in the presentation. This project was supported by NIH grant P20 RR016469 from the BRIN program of the National Center for Research Resources and the University of Nebraska-Kearney Department of Biology.

KINETIC STUDIES ON *ARABIDOPSIS THALIANA* dUTPASE

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Deoxyuridine 5'-triphosphate nucleotidohydrolase (EC 3.6.1.23; dUTPase) catalyzes the hydrolysis of dUTP to dUMP and pyrophosphate. Hydrolysis of dUTPase is very important for the synthesis of thymine nucleotides and also has an essential role in maintaining dUTP level low enough to prevent the uracil miss-incorporation into DNA (Berner, 1999). Enzyme kinetic is the measurement of rate of chemical reactions that are catalyzed by enzymes and is measured as Michaelis constant (K_m). K_m is the substrate concentration at which the reaction velocity is half maximal (Voet *et al).* We have conducted series of experiments to determine the Michaelis constant (K_m) for *Arabidopsis thaliana* dUTPase. Experiments were conducted at various temperatures; and concentration of enzyme and substrate, activities were measured by monitoring change of pH due to release of diphosphate with cresol red as an indicator on the UV spectrophotometer (Nord, 1997).

BIOLOGICAL AND MEDICAL SCIENCES
SESSION D

CONSTRUCTION OF A MUTANT FORM OF TIMP-2 TO EVALUATE MMP-INDEPENDENT AND MMP-DEPENDENT FUNCTIONS OF TIMP-2 ON NEURAL CREST MIGRATION

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Tissue inhibitor of metalloproteinase-2 (TIMP-2) is best known for its ability to inhibit matrix metalloproteinases (MMPs), which are extracellular proteolytic enzymes required for cell migration. TIMP-2 is also known to have MMP-independent functions that affect cell behavior. Previous work from our lab showed that chick embryos in which TIMP-2 has been knocked down have arrested neural crest (NC) cell migration, but it is unknown if this is due to TIMP-2's interaction with MMPs or an MMP independent function. To test this directly, we created a mutant form of the gene for TIMP-2, called TIMP-2^{C98S}, which retains MMP-independent functions but cannot bind to MMPs. To determine if TIMP-2's role in NC migration is MMP-dependent or MMP-independent, we are using *in ovo* electroporation to see if TIMP-2^{C98S} can rescue NC migration defects in embryos in which wildtype TIMP-2 has been knocked down.

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EXPRESSION OF α_3 INTEGRIN IN AVIAN EMBRYOS DURING THE STAGES OF CARDIAC NEURAL CREST MIGRATION

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Cardiac neural crest (NC) cells emigrate from the dorsal neural tube between the mid-otic placode and third somite. These cells migrate dorsolaterally under the ectoderm and into the branchial arches. From there, they eventually invade the developing heart and take part in angiogenesis, heart septation, and neurogenesis. TIMP-2 is a multifunctional protein that was originally described as an inhibitor of extracellular proteases called MMPs. TIMP-2 is expressed by migrating cardiac NC cells and is required for them to reach the branchial arches. However, previous work from our lab suggests that *in vitro*, TIMP-2's role in cardiac NC cell migration does not involve MMP inhibition, but rather a direct interaction with α_3 integrin on the cell surface. To see if a similar interaction is plausible *in vivo*, we have been characterizing the temporal and spatial expression patterns of α_3 integrin in embryos during the stages when TIMP-2 is expressed. Here we report that α_3 integrin is expressed weakly in cardiac NC cells and strongly in the overlying ectoderm. This suggests that TIMP-2/ α_3 integrin interactions might be taking place on these populations of cells and contributing to TIMP-2's role in cardiac NC cell migration.

This work was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources, and by the American Heart Association Heartland Affiliate Grant Number 0555683Z. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH or AHA.

INFLUENCE OF EXERCISE TRAINING AND DIABETES ON ADRENERGIC AND CHOLINERGIC RECEPTOR SENSITIVITY IN RAT VASCULAR TISSUE RINGS

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The goal of this research was to determine if exercise training, diabetes mellitus, and/or a combination of the two influence the responsiveness of rat vasculature to autonomic nervous system neurotransmitters. Thirty-six female Long-Evans rats served as subjects. Diabetes was induced in half the rats by streptozocin injection, and half the rats exercise-trained by swimming 1 hour per day for at least 4 weeks. Two sections of the aorta were removed from 20 rats and 2 sections of the superior vena cava were removed from 16 rats. Superior vena cava tissue in rats is unique in that, near its union with the heart, this vessel is comprised of cardiac muscle tissue. Dose-response curves to acetylcholine and epinephrine were then generated. Aortic rings from sedentary control rats were significantly less responsive to acetylcholine at doses $1x10^{-8}$ through $3x10^{-5}$ while aortic rings from sedentary diabetic rats were significantly less responsive to epinephrine at doses $1x10^{-7}$ through $3x10^{-4}$ than aortic rings from other rats. Superior vena cava rings from sedentary and trained diabetic rats were significantly less responsive to acetylcholine at doses $1x10^{-8}$ through $3x10^{-4}$ while superior vena cava rings from sedentary control and diabetic rats were less responsive to epinephrine within doses $3x10^{-7}$ through $3x10^{-5}$ than superior vena cava rings from other rats. These results suggest that both training state and presence of diabetes affect responsiveness to acetylcholine in the aorta, but in the vena cava the presence diabetes independent of training state is the main factor determining responsiveness. Moreover, responsiveness to epinephrine is dependent on the presence of diabetes in the aorta, but in the superior vena cava training state is more influential than diabetic state in influencing responsiveness. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

DETECTION OF COLOSTRUM ANTIBODIES AGAINST *CLOSTRIDIUM PERFRINGENS*

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Clostridium perfringens is a highly pathogenic bacterium that can infect calves at a very young age, well before vaccination against the disease. It has been previously suggested that vaccination of cows against *Clostridium perfringens* might result in the presence of anti-*Clostridium* antibodies in the colostrum. To determine whether calves might receive passive immunity to *Clostridium perfringens* from their mothers, IgA antibodies were isolated and concentrated from the colostrum of the mother cows. These IgA antibodies were then tested using Western blot analysis to determine if the antibodies were able to react against a HRP conjugated anti-Bovine anti-IgA antibody. Next, the antibodies will be tested to determine if they react against *Clostridium perfringens*. A positive reaction would suggest that the calves receive passive immunity to *Clostridium perfringens* from their mothers. In order to validate the results, PCR analyses of the samples will be done to assure that the bacteria present are indeed *Clostridium perfringens*.

EVOLUTIONARY RESPONSES OF TOLERANCE RANGES TO UNVARYING CONDITIONS: A STUDY EXAMINING pH ADAPTATION IN *ESCHERICHIA COLI*

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To be successful, organisms obviously must be able to do well under environmental conditions they experience regularly. In addition, however, continued survival of populations requires that they be able to survive conditions that may occur infrequently. Thus the tolerance range of a population can be an important component of long-term fitness. A number of aspects of the abiotic environment may potentially influence the evolution of the tolerance range, but one factor that may be of particular importance is the degree of environmental variability, or lack thereof, that a population experiences. Our lab has been using populations of a model organism, *Escherichia coli*, evolved under differing pH conditions to investigate questions related to adaptation to the abiotic environment. Replicate asexual populations of *E. coli* were used to found populations that then evolved for 2000 generations; these populations lived in media that had one of several possible constant pH values or that cycled among these pH values. One aspect of our post-evolution studies is to examine how particular environmental conditions may cause tolerance ranges to change. Last year we reported on populations that evolved in pH conditions shifted from the ancestral state, but the current experiments ask instead how tolerance range may change when a population continues to evolve under constant condition for thousands of generations. The genotype used to begin our experiments (the "ancestral line") had previously lived in a medium of pH 7.0 and has a tolerance range for survival from pH 4.8 to 8.4. We allowed six replicates of this initial population to evolve for an additional 2000 generations at pH 7.0 (the "evolved lines"); previous work with the evolved lines showed that fitness at pH 7.0 increased in most cases, so evolutionary responses to the environment continue to occur. Our hypothesis is that the lack of exposure of the evolved lines to variable conditions will result in a contraction of their tolerance ranges. Such a pattern would tend to make populations more susceptible to extinction should conditions change. To date, our results indicate that tolerance range has not changed during this period of evolution, but not all conditions have yet been tested. Still, if this pattern holds, it suggests that populations may be able to improve fitness in their "home" environments without necessary trade-offs in fitness in other environments.

ACTIVATED MICROGLIA STIMULATE NEURONAL SURVIVAL AND NEUROGENESIS FOLLOWING DAMAGE

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Central nervous system (CNS) immune activity plays a fundamental role in the proper function of the nervous system. Microglia, the resident immunocompetent and phagocytic cells of the central nervous system, were once primarily associated with detrimental inflammation in the CNS. Emerging evidence suggests that, given the specific activator(s), microglia function to support neuronal survival, differentiation and potentially regeneration. Little is known about whether activated microglia are capable of producing neurotrophic effects in damaged neurons and what signaling mechanisms underlie these processes. To address this question, we hypothesized that microglia enhance neuronal survival, proliferation and differentiation by activating specific intracellular signaling pathways. To test this hypothesis, we developed an *in vitro* model system of primary neuronal cultures which are mechanically disrupted using the stylet transaction protocol. Microglia are cultured on transwell inserts and suspended above damaged and undamaged neuronal cultures. In our co-culture experiments, soluble cues from

activated microglia enhance neuronal survival 1.7 times that of control conditions. Enhanced cellular proliferation is observed in damaged areas of neuronal cultures exposed to activated microglia. Immunocytochemical analysis of proliferating cells indicates that these cells express the neuronal progenitor proteins nestin and alpha-internexin. A sub-population of these cells is also immunopositive for glial fibrillary acidic protein (GFAP). Quantitation of immunopositive cells shows a 2.6 fold increase in nestin expressing cells, a 3.4 fold increase in GFAP expressing cells, and a 6.5 fold increase in alpha-internexin expressing cells as compared to controls. Further, the expression of the mature neuronal protein NeuN is increased 4.4 fold above controls in neuronal cultures exposed to activated microglia. Western blot data confirm immunocytochemical data. Preliminary evaluation of underlying signal transduction mechanisms demonstrates that upregulation of pAKT and activation of the PI3K/AKT signaling pathway is likely associated with enhanced neuronal survival, neurogenesis and differentiation in damaged neuronal cultures following exposure to secreted cues form activated microglia. Microglial RNA and conditioned media have been collected for real-time RT-PCR and ELISA analysis, respectively. mRNA and conditioned media will be analyzed for the regulation of neurotrophins BDNF and GDNF, anti-inflammatory mediators IL-10, PGE_2 and TGFβ, and the pro-inflammatory cytokine, TNFα.. Epigenetic change in activated microglia and neurons will be assessed by investigating differential methylation and acetylation of histone proteins. Increasing our understanding of the mechanisms by which activated microglia stimulate neuronal survival and neurogenesis may aid in the development of methodologies to promote such activity during neurodegenerative disease or following traumatic injury.

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 19-23 nucleotide non-coding RNAs that form protein effector complexes and regulate gene expression. Processing of functional miRNAs and siRNAs requires the RNase III type endonuclease Dicer. Dicer is thus a key enzyme in both RNA interference (RNAi) and miRNA function. Our understanding of the role of small regulatory RNAs in the development and function in central nervous system (CNS) is increasing although incomplete. Small regulatory RNAs have been implicated in neurogenesis, neuronal differentiation, neuroplasticity, neurodegeneration, and stress responses. In order to address specific questions concerning the role of small regulatory RNAs in neurogenesis, differentiation, and neurodegeneration, conditional Dicer null mutants under the control of developmentally regulated neuronal promoters have been generated. One such promoter is the gene *atonal/Atoh1* which encodes the basic helix-loop-helix (bHLH) protein Atoh1. Atoh1, formerly Math1, is expressed in and regulates neurogenesis in neuronal progenitor cells of the dorsal spinal cord, granule cell progenitors of the cerebellum, Merkel cells in the skin, and hair cells of the auditory and vestibular systems. Atoh1 mutant mice demonstrate a loss of cerebellar granule cells. Atoh1-Cre Dicer null animals, while born viable, begin to demonstrate ataxic behavior and tremors by ~2 weeks of age and exhibit severe seizures and death by ~4 weeks of age. Because of the specific behaviors observed in Atoh1-Cre Dicer null animals and previous data showing the loss of cerebellar granule cells in Atoh1 mutants, we have begun to characterize the role of small regulatory RNAs in neurogenesis and potential neurodegeneration by assessing cellular abnormalities in the cerebellum. Immunohistochemical analyses demonstrate the role of Dicer in the regulation and maintenance of neuronal and glial cell number and cellular organization. Further, neuronal and glial cell death and microglial activation have been investigated. These initial studies establish a foundation for further work directed at increasing our understanding of the role of small regulatory RNAs in neurogenesis, neuronal diffentiation, and neurodegeneration in the CNS.

EXERCISE TRAINING NORMALIZES ACE AND ACE2 IN THE BRAIN OF RABBITS WITH PACING INDUCED CHRONIC HEART FAILURE

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Activation of the renin-angiotensin system (RAS) and elevated Angiotensin II (Ang II) in the brain play a critical role in increased sympathetic nerve activity in chronic heart failure (CHF). Exercise training (EX) has been shown to normalize sympathetic outflow. Angiotensin-converting enzyme (ACE), which synthesizes Ang II, may play a role in sympatho-excitation. ACE2, a homologue of ACE, metabolizes Ang II to Ang 1-7 which has antagonistic effects to Ang II. Little is known about the regulation of ACE and ACE2 in the brain and the effect of EX on the enzymes. This study aimed to investigate the regulation of ACE and ACE2 in the cortex, cerebellum, medulla, and hypothalamus in rabbits with a pacing induced CHF and EX model. Experiments were performed on four groups of New Zealand White rabbits: sham, sham + EX, CHF, and CHF + EX (n=5/group). Punches of cardiovascular regulatory nuclei in the brain such as the paraventricular nucleus (PVN), nucleus tractus solitarii (NTS), and rostral ventrolateral medulla (RVLM) (n=2/group) were also measured. Western blot analysis and double immunofluorescence were performed to measure and localize protein expression of ACE and ACE2. ACE protein expression in the cerebellum, medulla, and hypothalamus was significantly higher in CHF rabbits compared to sham (1.0±0.2 to 2.2±0.1 in the hypothalamus, $P<0.05$). EX normalized this upregulation compared to CHF (0.5±0.1 to 2.2±0.1 in the hypothalamus). ACE2 protein expression significantly decreased in CHF. EX also normalized ACE2 in the PVN, NTS, and RVLM (0.03±0.02 CHF to 0.8±0.3 CHF + EX in the RVLM). Immunofluorescence indicated that ACE is present in vascular endothelial cells as well as neurons. The results suggest that activation of the central RAS system in CHF involves an increase in ACE and decrease in ACE2 in regions of the brain that regulate autonomic function. Furthermore, they indicate that EX can be used as a possible therapeutic modality to normalize expression of ACE and ACE2 in CHF.

CONSTRUCTION OF A NON-POLAR MUTATION IN *HRPG*, A POTENTIAL REGULATORY TYPE III SECRETION CHAPERONE IN *PSEUDOMONAS SYRINGAE*

Elizabeth Kurien, and Karin van Dijk, Department of Biology, Creighton University, Omaha, NE 68178; and Matthew R. Zeleny and James Alfano, School of Biological Sciences, University of Nebraska–Lincoln, NE 68588

The gram-negative bacterial plant pathogen *Pseudomonas syringae* pv. *tomato* DC3000 uses a type III secretion system (TTSS) to inject effector proteins into plant cells. Effector proteins are thought to travel this pathway in a largely unfolded manner and a set of customized cytosolic chaperones (TCC for Type III chaperones) are essential for secretion of a subset of the effectors. Chaperones are removed from their effectors before their translocation into host cells by the ATPase that is part of the Type III injectosome. The translocated effector proteins collectively allow for bacterial pathogenesis. Both chaperone and effector proteins within the TTSS are encoded by a *hrp/hrc* (hypersensitive response and pathogenicity/hypersensitive response and conserved) gene cluster. This *hrp/hrc* gene cluster is activated by an alternate sigma factor, HrpL. *hrpL* transcription is activated by both HrpR and HrpS collectively. A reported negative regulator HrpV has been identified to interact with HrpG, a putative chaperone, as well as with HrpS, which is an activator for *hrpL*. These interactions may suggest that HrpG is a positive regulator for the TTSS by binding with HrpV and releasing it from HrpS to allow HrpS to bind with HrpR. When unbound, the HrpR-S complex promotes the activation of *hrpL* to up-regulate the

transcription of the TTSS. Our yeast two-hybrid (Y2H) assays confirmed these interactions in DC3000. Additionally, we have found that HrpG interacts with AvrPtoB, a known effector protein, indicating that HrpG is potentially a chaperone with regulatory function.

To start investigating the potential regulatory function of HrpG we have taken a mutagenesis approach. Since *hrpG* is part of a multi-gene operon we made a construct to introduce a non-polar *hrpG* mutation in the genome. The construct contains an *nptII* cassette flanked by genomic DNA upstream and downstream of *hrpG*. This construct has been place in a broad host-range vector and introduced by electroporation into DC3000 cells. As *nptII* encodes for kanamycin resistance, the recombination of this mutation in the genome can be selected for by selecting for kanamycin resistance. This mutant will be tested for its ability to function in pathogenicity assays as well as hypersensitive response (HR) assays. The HR assay is an indicator of a functional type III secretion system. A reduced HR triggered by the *hrpG* mutant in assays with non-host *Nicotiana tabacum* cv. *Xanthi* plants would indicate that effector proteins are not secreted in wildtype amounts without HrpG, which would support HrpG as a positive regulator. These experiments will help to determine if HrpG is involved in regulating the cascade to activate the TTSS.

CD 38 REGULATION IN HUMAN ASTROCYTES: ROLE OF MAP KINASE PATHWAY

Jeffrey J Belmont, School of Biological Science, University of Nebraska–Lincoln, NE 68588-0118; and S. Banerjee and A. Ghorpade, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha, NE 68198-5800

CD 38 is a 45kDa ectoenzyme that acts as a catalyst for the synthesis and degradation of cADPR, a key regulator of calcium ion homeostasis and release. Because of this role in influencing calcium ion levels, CD 38 is important to many physiological functions and has been looked at to determine its role in certain disease processes. One such area of interest is in neurodegeneration. In previous studies performed by our lab using IL-1β activated human astrocytes, CD 38 was found to be very highly up regulated. CD 38 has also been shown to be influenced by mitogen activated protein kinase (MAPK) pathways in human airway smooth muscle cells (Deshpande, et al. 2005). To determine the role that MAPK have on CD 38 regulation in IL-1β activated human astrocytes, this lab experimented using particular MAPK pathway blockers to determine if there was any effect in the levels of CD 38 that were expressed. The data from these results using real time- PCR indicate that IL-1β activated astrocytes incubated with MAPK blockers had significantly less CD 38 expression than IL-1β activated astrocytes not incubated with MAPK blockers. We thus conclude that MAPK play an important role in human astrocyte CD 38 regulation, and possibly in certain neurodegenerative disorders.

CHEMISTRY AND PHYSICS
CHEMISTRY

ELECTRON STIMULATED DESORPTION OF WATER FROM A STEPPED NiO SURFACE

Michael A. Stutzman and M.A. Langell, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Metal oxides have many applications that are determined by their adsorption properties and surface reactivity; for example, they are used extensively as partial oxidation catalysts. Nickel oxide, in particular, has a simple surface structure that can be oriented in a vicinally stepped surface motif. The stepped surfaces model surface defects, which control many aspects of oxide surface reactivity. Water is a common contaminant species on metal oxide substrates and results in surface hydroxylation under ambient conditions. This makes the kinetic information gained from the TPD, temperature programmed desorption, of water on stepped NiO surface valuable information in determining effects of real world issues on a catalyst.

TPD is a technique in which adsorbates are detected as they desorb from a solid surface as the temperature of the solid is increased at a known rate. TPD can be used to find mechanistic and thermodynamic properties of surface reactions that are relevant to a number of important heterogeneous processes. However, the instrumentation used to carry out these experiments produces an electron beam on the surface. This electron beam can in turn also cause desorption from the surface. This process is known as electron stimulated desorption. This talk will focus on the attempt to regulate this occurrence by placing a potential on the mass spectrometer keeping stray electrons from bombarding the surface and therefore reducing the effect of electron stimulated desorption.

$Ni_{x-1}Cu_xO$ ROCKSALT SOLID SOLUTIONS: A UNIQUE ENVIRONMENT FOR Cu^{2+}

Jesse N. Voelker, K.J. Gaskell, A. Starce, and M.A. Langell, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Solid solutions of $Ni_{x-1}Cu_xO$ were prepared by thermal dissolution and were found to form when $0 < x < \sim 0.3$. X-Ray Diffraction (XRD) and Auger analysis by X-ray Photoelectron Spectroscopy (XPS) show that the copper is found to have an octahedral coordination, which is an unusual chemical environment for Cu^{+2}. Placing copper in an environment such as this can potentially result in new and interesting catalytic and magnetic properties.

TRANSITION METAL OXIDE SURFACES

Marjorie Langell, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Transition metal oxides (TMOs) are ubiquitous in nature, both as bulk materials and as thin films that form at the surface of transition metals. Their surface characteristics, thus, control the structure and reactivity of many heterogeneous processes, including those relevant to heterogeneous catalysis, corrosion, solid state sensors, and magnetic/electronic device applications. Research in our group has focused on the surface crystallographic and electronic structure and on the chemical reactivity of the cubic transition metal oxides: MnO, FeO, CoO and NiO, and on their mixed metal oxides $M'_xM_{1-x}O$ (M', M = Mn, Fe, Co, Ni, Cu, Zn). Surface properties have been studied with a variety of electron spectroscopies and other surface-sensitive techniques. In this talk, the surface structure and chemical reactivity of these materials will be discussed, with a focus on CoO(100), NiO(100) and on mixed-metal systems $M'_xNi_{1-x}O$ (M' = Co, Zn). In this discussion, a brief introduction to a number of surface analytical techniques will be provided, including that for Auger electron spectroscopy (AES), x-ray photoelectron spectroscopy (XPS), high resolution electron loss spectroscopy (HREELS) and low energy electron diffraction (LEED).

ANALYSIS OF COPPER CLADDING OF A SUNKEN SHIP

James D. Carr, Department of Chemistry, and Brent M. Wilson, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

For hundreds of years, wooden seagoing ships were protected from damage by seaworms and barnacles by sheathing the hull of the ship with copper foil. In approximately 1850 ships were clad with brass, an alloy of copper and zinc, instead of pure copper. A small piece of metallic foil from a ship sunk off the coast of eastern England in Filey Bay was obtained for chemical & metallurgical analysis in hopes of learning more about the history of the ship from which it was taken. Analysis of this sample by x-ray fluorescence and by atomic absorption and inductively coupled plasma mass spectrometry showed the presence of copper and zinc and no other metals. Examination by scanning electron microscope (SEM) also showed copper and zinc but was able to examine inclusions and grain boundaries. The results of these measurements will be presented and their historical import will be discussed.

DESIGN OF COLORIMETRIC DRUG SENSORS

Andrea E. Holmes, Jordan Groathouse, Mike Guericke, Marcus Anderson, Casey Gustafson, Katie Wilcox, Christa Flitcroft, and Jacob Francis, Department of Chemistry, Doane College, Crete, NE 68333

We worked primarily toward the design of sensors for abused drugs such as cocaine and methamphetamine by 1) developing molecular color sensors from aptamers (oligonucleotide-based binders) that change color in the presence of small quantities of drugs, 2) testing the utilization of circular dichroism (CD) spectroscopy as a technique for discriminating between the enantiomers of chiral drugs that are often abused, and 3) developing a solid matrix that allows the new chemical sensors to be attached to a solid support for actual use outside the laboratory in a field test product. The work may eventually lead to new drug-detection tools for forensic scientists and others. No deviations occurred from the proposed project.

Oligonucleotide-based binders (aptamers) were tested as sensors for cocaine, 9-tetrahydrocannabinoldate (THC) from marijuana, and date-rape drugs like flunitrazepam or gamma-hydroxy butyric acid (GHB), and methamphetamine. Organic dyes that form strong complexes with binding aptamers were found using a combinatorial 96-well plate approach. Strong binding of dyes like cyanine dyes, Methylene Blue, Reactive Green and Alizarin Yellow was determined by UV-Vis Spectroscopy. The use of porphyrin supramolecular host-guest complexes and circular dichroism was used to distinguish between D- and L-methamphetamine.

"Sol-gels" were used to change the solution chemistry to the semi-solid state. The sol-gels were synthesized with colloidal silicates that formed a porous hard gel and were used to incorporate the aptamer-dye complexes, allowing for the attachment of the new molecular sensors to a solid base. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

DOCKING STUDIES OF BINDING MODES FOR PROTEIN KINASE INHIBITORS

Haizhen Zhong and Jenna Stang, Department of Chemistry, University of Nebraska at Omaha, NE 68182

Dysregulation of protein kinase activity has been found in different types of cancer, which characterizes uncontrolled proliferation of tumor cells. Small molecules that bind to these tyrosine kinases can inactivate the kinases and inhibit tumor growth. This paper will present the binding mode studies of ABL protein and its ligands (imatinib and dasatinib) using the induced-fit docking method. The docked ligands

also include a library of tyrosine kinase inhibitors. Differences in the hydrophobic and hydrogen bonding interactions between different binding modes will be presented. This paper will also present kinase inhibitor design based on the interactions between ABL protein and ligands using the core-hopping docking method.

ENTRAPMENT OF PROTEINS IN HYDRAZIDE-ACTIVATED SILICA FOR HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY

Abby Jackson, Hai Xuan, and David S. Hage, Department of Chemistry, University of Nebraska-Lincoln, NE 68588

One desirable feature in protein immobilization for binding studies is to have the protein in a final form that closely mimics the behavior of its native form. In covalent immobilization methods, decrease or complete loss of activity can often occur as a result of multisite attachment and random orientation. The goal of this study was to develop and optimize a new immobilization method involving the physical containment of a ligand in a porous support. This approach was tested and evaluated for use in high-performance affinity chromatography by using oxidized glycogen plus hydrazide-activated silica for entrapment and human serum albumin (HSA) as a model ligand. Both the specific activity and association equilibrium constants for HSA were measured by performing frontal analysis using S-Warfarin as the binding agent. Both values were in good agreement for values previously reported for covalently immobilized HSA.

DRUG-PROTEIN DISSOCIATION RATE MEAUREMENTS USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY AND PEAK PROFILING

John. E. Schiel, C. M. Ohnmacht, E. Papastavros, and D. S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Human serum albumin (HSA) is a serum protein responsible for binding and delivering a wide range of drugs and hormones in the body. Information on the rates at which these interactions occur is valuable in understanding the pharmacokinetic behavior of drugs and in developing assays for the measurement of free drug fractions. A new approach was developed for examining these rates by using high performance affinity chromatography and a peak profiling method. The peak profiling method involved the measurement of peak variances of a retained drug and non-retained species on an immobilized HSA column over a broad range of flow rates. An equation was derived to provide a linear transform of this data and make it possible to obtain the rate constant for drug dissociation from HSA. Proof of principle for this methodology was provided by observing an HSA/L-tryptophan dissociation rate constant in good agreement with literature values. Application of this method to other solutes, including some that involve multi-site interactions with HSA or require corrections for non-specific binding to the chromatographic support (*e.g., imipramine and propranolol*), have recently been studied. Plate height theory was used with a newly derived multi-site binding equation to simulate the peak profiling conditions. Comparison of experimental and theoretical results indicates accurate rate constants can be obtained for systems with a high degree of nonspecific binding and a broad range of affinities for HSA. The techniques used in this work are relatively fast and can be applied to a broad range of drugs or small solutes that bind to HSA, as well as in work with other transport proteins or binding agents.

INVESTIGATING PROTEIN-HYDROXYAPATITE INTERACTIONS AND THEIR ROLE IN COLLAGEN MINERALIZATION

Casey L. Gustafson, Kaylee R. Troxel, Helen A. Kraye, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Non-collagenous matrix proteins are known to exert influence on the mineralization of collagen matrices as mineral crystal growth initiators, growth promoters, morphology guides and growth inhibitors. The intermolecular interactions between these matrix proteins and hydroxyapatite crystal surfaces are believed to be the mechanism of bone mineral regulation. However, bone mineralization events at the molecular level remain poorly understood. Efforts to identify and characterize a recently discovered non-collagenous protein, serum calcification factor (SCF), will be presented. It has been demonstrated that SCF is capable of initiating mineralization of isolated types I and II collagen. Further evidence suggests that this mineralization process is delayed in the absence of other necessary matrix components. Efforts to characterize the interaction of glutamate and aspartate homopeptides of different lengths with the hydroxyapatite surface will also be presented. Glutamate-rich sequences in bone matrix proteins have been shown to promote crystal growth *in vitro*, while aspartate-rich sequences have shown the ability to strongly inhibit crystal growth. The use of circular dichroism and NMR to characterize the structure of the peptide and its interactions with the crystal surface will be discussed. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

STRUCTURE AND MECHANISM OF THE *GLMS* RIBOZYME

Juliane K. Soukup[1,2], G.A. Soukup[2], J. Souchek[1], K. Klawuhn[1] and J.A. Jansen[1], [1]Departments of Chemistry and [2]Biomedical Sciences, Creighton University, Omaha, NE 68178

The self-cleaving *glmS* ribozyme is a mechanistically unique functional RNA among both riboswitches and RNA catalysts as its catalytic activity provides the basis of genetic regulation and depends upon glucosamine-6-phosphate (GlcN6P) as a coenzyme. A substantial body of biochemical and biophysical data relating the structure and function of the *glmS* ribozyme has been amassed, in our laboratory and others, in a relatively short period of time since its discovery. However, a precise and comprehensive mechanistic understanding of coenzyme function in *glmS* ribozyme self-cleavage has not been elaborated. Careful consideration of the available biochemical and biophysical data relating the structure and function of the *glmS* ribozyme necessitates that general acid and general base catalysis in a coenzyme-dependent active site mechanism of RNA cleavage are inherently interdependent. We propose a comprehensive mechanistic model wherein the coenzyme, GlcN6P, functions both as the initial general base catalyst and consequent general acid catalyst within a proton-relay thus fulfilling the apparent biochemical requirements for activity. This analysis in combination with other considerations regarding the effects of coenzyme binding on riboswitch structure and function suggests that the development of *glmS* ribozyme agonists as prospective antibiotic compounds must satisfy strict chemical requirements for binding and activity.

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DFT STUDIES OF THE FREE ENERGY, ENTHALPY, AND ENTROPY OF ANION BINDING OF TETRA-OXOCYCLOHEXADIENYLIDENE PORPHYRINOGEN IN SOLUTION

Paul A. Karr and Brian Jundt, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787; and Amy L. McCarty, Melvin E. Zandler, and Francis D'Souza, Department of Chemistry, Wichita State University, Wichita, KS 67260-0051; and Katsuhiko Ariga and Jonathan P. Hill, International Center for Young Scientists, National Institute for Materials Science, Namiki 1-1, Tsukuba 305-0044, Ibaraki, Japan

Synthetic tetrapyrrole macrocycles have become one of the most extensively studied classes of compounds not just because of their importance as model compounds for biological processes but also as catalytic, electronic, and optical materials. Five years ago, my collaborators synthesized and studied a new class of porphyrinogen, viz., tetra-oxocyclohexadienylidene porphyrinogen (OxP), its N-benzylated, and N-naphthylmethyl analogs. These porphyrinogens were found to be electron deficient as compared to the parent porphyrin and the redox processes for the N-benzylated derivatives were found to be better defined than the parent porphyrinogen. Both X-ray structural and density functional theory (DFT) molecular modeling studies revealed severe distortion of the porphyrinogen macrocycle. These properties of porphyrinogens suggested that they could act as anion receptors. In the present DFT study, anion binding is modeled by B3LYP/3-21G(*) model chemistry coupled with self consistent reaction field polarizable continuum model (SCRF-PCM) solvation method as implemented in the Gaussian 03 software suite. OxP, $[OxP:F]^-$, $[OxP:Cl]^-$, $[OxP:NO_3]^-$, $[OxP:H_3C_2O_2]^-$, $[OxP:ClO_4]^-$, $[OxP:H_2PO_4]^-$, and $[OxP:PF_6]^-$ are completely optimimized in *Ortho*-Dichlorobenzene, using solvent parameters developed in our laboratories, and frequency calculations performed to obtain thermodynamic data and to verify optimization to a stationary point on the Born-Oppenheimer potential energy surface.

CHEMISTRY AND PHYSICS
PHYSICS

HIERARCHICAL MODELING OF PROTEIN FOLDING AND AGGREGATION

Patricia Soto, Department of Physics, Creighton University, Omaha, NE 68178

Proteins are at the heart of the molecular machinery that sustains the living cell. A wealth of evidence indicates that the inherent conformational motions of protein molecules are essential to their function. Indeed, fine-tuning of these conformational motions with the cell milieu, within a relatively narrow range of a few kBT, allows proteins to perform a vast variety of fundamental biological tasks across a broad range of time and length scales. Once proteins are synthesized in the ribosome as a linear chain of covalently linked amino acids, they self-organize into a biologically active three-dimensional structure. This efficient conformational search, optimized by evolution and regulated both by the specific sequence of amino acids and the cell environment, is known as "protein folding". Under pathological conditions in the cell, however, some proteins are unable to fold to their functional state or to remain in their marginally stable folded conformation. They adopt, then, an alternate incorrectly folded structure that cannot be degraded by the cell. Clinical evidence associates this process of aggregation with a number of debilitating diseases such as Alzheimer's, Parkinson's, Huntington's and spongiform encephalopathies. Quantitative description of the thermodynamics and kinetics of protein (mis)folding and aggregation would be possible, in principle, if the Hamiltonian describing the interactions between protein, solvent and surrounding molecules were solvable. In practice this is not feasible given the huge number of relevant degrees of freedom to consider. The quest is to characterize the molecular events that lead to protein (mis)folding and aggregation. In the talk I will discuss examples that illustrate the use of computational methods to tackle this challenging problem. As a case study I will refer to mechanisms of fibrillogenesis inhibition against Alzheimer's disease.

USER INTERFACES FOR THE STAR SLOW CONTROLS SYSTEM

A.U. Abeysekara, T.S.McShane, M. Cherney, and Y.N. Gorbunov, Department of Physics, Creighton University, Omaha, NE 68178

STAR (Solenoidal Tracker At RHIC), located at Brookhaven National Laboratory, studies relativistic heavy-ion collisions. The Slow Controls system monitors and controls the STAR detector's 40,000 operating parameters. The experiment takes data for between 13 and 30 weeks in a typical year. STAR is operated by 400 physicists who normally come to Brookhaven for a week of data taking. The user requirements and current state of the user interface will be presented. Upgrade plans will also be discussed.

DYNAMIC LIGHT SCATTERING IN PHOSPHATE GLASSES

Roberto L. Fabian Jr. and David L. Sidebottom, Department of Physics, Creighton University, Omaha, NE 68178-0114

One active field of condensed matter physics in recent years has been the study of phosphate glasses. There are several kinds of phosphate glasses that depend on the ratio of their bridging oxygen, from a network of P_2O_5 to a chain of metaphosphate- MPO_3. More recently, we, the condensed matter group of Creighton University, studied two kinds of phosphate glasses: P_2O_5 and the metaphosphate using Photon Correlation Spectroscopy. It is our desire to continue to study the unusual behavior of these glasses; we will prepare ultraphosphate glasses solution of different composition as point to understand the molecular dynamics of shifting from a network phosphate glasses to a chain of metaphosphate. We will report the latest development on this study.

GLASS FORMING DYNAMICS OF AQUEOUS MALTOSE FROM DYNAMIC LIGHT SCATTERING

Mark Durante and David L. Sidebottom, Department of Physics, Creighton University, Omaha, NE 68178-0114

We report results of a photon correlation spectroscopy study of the glassforming dynamics in aqueous maltose solutions of varying concentration. These measurements represent a companion study to earlier measurements conducted in aqueous glucose wherein two distinct relaxations were observed: a q-independent, viscoelastic (alpha) relaxation occurring at short times and a q-dependent 'ultraslow' mode associated with the quasi-diffusional motion of glucose clusters at long times. We find that the maltose solutions also display two distinct relaxations. However, both are q-dependent and neither appear consistent with the viscoelastic alpha relaxation. We discuss the possible origins for these two quasi-diffusional modes.

LASER MONITORING SYSTEM FOR ALICE

Benjamin Rizzo, Department of Physics, Creighton University, Omaha, NE 68178

The ALICE (A Large Ion Collider Experiment) detector on the LHC (Large Hadron Collider) at the European Center for Nuclear Research (CERN) is being developed to study heavy ion collisions. Momentum of charged particles coming from these collisions are determined from the radius of curvature of the tracks they leave in ALICE's TPC (Time Projection Chamber) and the ITS (Inner Tracking System). The ITS and the TPC must work in tandem in order to detect particles with low transverse momentum. The alignment of the ITS with respect to the TPC is therefore necessary for an accurate measurement of the radii for these low momentum particles. The development of ITSAMS (ITS Alignment Monitoring Software) software used for the alignment of the ITS will be presented.

LATEST RESULTS IN THE DIRECT DETECTION OF NEUTRALINOS

Stephanie J. Schuk, Department of Physics, Creighton University, Omaha, NE 68178

This talk will present an overview of different experiments currently working to directly detect non-baryonic dark matter. First a background on why detecting neutralinos is important to better understanding dark matter will be discussed. Also we will review how experiments can physically detect WIMP particles. Then there will be a discussion of each of the experiments and the techniques each of them employ. The conclusion of my talk will discuss the future of these experiments and which ones have the best possibility of detecting neutralinos.

PHOTO- AND BIO-PHYSICAL CHARACTERIZATIONS OF LIPOPHILIC DYES FOR NEURONAL TRACING

Jeff Tonniges, M. Hansen, and M. Nichols, Department of Physics; and B. Fritzsch, Biomedical Science Department, Creighton University, Omaha, NE 68178; and Brian Gray, Molecular Targeting Technologies, Inc., West Chester, PA 19380

The nervous system consists of billions of cells interacting with one another through complex networks of neuronal circuits. Understanding what controls neural network development, how networks are affected by genetic defects or disease processes, and how to repair/regenerate circuits requires the ability to dissect the anatomy and physiology of nerve cell connections. Typical dyes bind to cellular proteins, but many mutations lead to reduced expression of these proteins. One solution to this problem

is the use of lipophilic dyes. Our goal is to image multiple neuronal processes using rapid and discrete labeling with multiple dyes that are fully separable spectrally and/or temporally. By combining two-photon and confocal microscopy, the excitation wavelengths can be extended from the UV to near infra-red. We will report measurements of the two-photon cross sections of three novel lipophilic dyes. Additionally, recent experiments to investigate the mechanisms of cellular dye transport in living cells will be discussed.

This work was supported by a N.I.H. SBIR II grant MH079805 and by P20 RR016469 from the INBRE program of the NCRR.

ANALYSIS OF A LOW STATISTICS SAMPLE

Eric S. Watson, Department of Physics, Creighton University, Omaha, NE 68178

A study of the production of D^* mesons in proton-proton collisions at the STAR experiment yields a low statistics signal. In large statistics samples, the methods for obtaining the expected bounds on a single measurement knowing the mean and those used to obtain the bounds on the expected mean from a single measurement can be used interchangeably. This is not the case for small samples. A method for obtaining bounds on an expected mean based on a single measurement for this low statistics sample is presented.

NONLINEAR FIT ANALYSIS OF X-RAY DETECTION EFFECIENCY USING EXCEL AND MATHEMATICA ROUTINES

Hans T. Wrage and S.J. Cipolla, Department of Physics, Creighton University, Omaha, NE 68178-0114

Atomic energy transitions of electrons are studied using x-ray fluorescence (XRF). Analysis of the cross section of the emitted x-rays yields information on the atomic structure and inner shell processes. Measurement of these x-rays, however, must take into account the detector efficiency. Because the detector efficiency is proportional to energy, samples with an agreed upon energy response are used to fit to a model of detector efficiency. The fit equation is nonlinear and consists of three coefficients. Nonlinear least squares fit routines from Excel and Mathematica are compared. The success of the fit is made by comparing the coefficients with expected physical quantities, and in the statistical significance of the fit to the data.

DIFFUSION OF FLUORESCENTLY-LABELED LIPOPHILIC DYES

Maria Hansen[1], Jeremy Duncan[2], Bernd Fritzsch[2], Michael Nichols[1,2], and Brian Gray[3]. [1]Department of Physics, and [2]Department of Biomedical Sciences, Creighton University, Omaha, NE 68178; and 3Molecular Targeting Technologies, INC., West Chester, PA 19380

Fluorescently labeled lipophilic dyes are used as molecular probes in the microscopic study of complex biomolecular assemblies. In order to trace the nueral circuitry that wires the brain, several spectrally discrete dyes must be used. This presentation will address the imaging techniques that have been used to develop a new set of neuronal tracer dyes with well matched rates of diffusion. An analytical comparison of techniques will be discussed and results for these prototyped dyes will be presented.

This work was supported by an N.I.H. SBIR II grant and by P20 RR016469 from the INBRE Program of the National Center for Research Resources.

EARTH SCIENCES

THE PEOPLE, PLANET, AND PROSPERITY COMPETITION AT CHADRON STATE COLLEGE

Jennifer L. Balmat, R. Pinkelman, P. Johnson, D. J. Schweitzer, and M. B. Leite, StreamTeam Leadership Group, Chadron State College, Chadron NE 69337

An interdisciplinary research group known as the "StreamTeam" was established at Chadron State College in response to wildfires that swept through the watershed of Chadron Creek in summer 2006. The project received funding through phase I of the Environmental Protection Agency's People, Prosperity and the Planet (P3) program. Our study design is called "Shared Hierarchy of Experiential Learning," or SHEL. This model brings together various diverse stakeholders in the watershed's resources, including students, landowners, economic organizations, federal, state, and city organizations, and non-government organizations. By collecting data on the environmental, social and economic benefits of the Chadron Creek watershed, participants begin to understand their own roles in protecting these resources. The SHEL model is realized through communication and mutual learning among the stakeholders. Our intent is to create a synergy that empowers all participants to adopt proactive roles in the conservation of their shared resources. An important goal of this project is to stimulate the spawning of new "stream teams" in other watersheds, further disseminating the shared learning concept.

A HISTORICAL PERSPECTIVE OF CIVIC WATER PROJECTS, CHADRON, NEBRASKA

Daniel J. Schweitzer and J. R. Hyer, Department of History, Chadron State College, Chadron NE 69337

Beginning in August 2007, we analyzed primary and secondary sources relating to the history of civic water projects in Chadron, Nebraska for both historical and social trends. The purpose of this investigation was twofold: (1) to determine historical trends in city water planning and (2) to ascertain coterminous civic opinions as much as is possible, given the dearth of public opinion referendums or polls. To this end, we examined both factual accounts of Chadron's water history and newspaper editorials and articles, with special emphasis on the chronological interplay of editorials and major alterations to the city's waterworks and the agenda setting function of media. Preliminary findings demonstrate that Chadron's water plan has, historically, been haphazard at best, with little attention to future implications of the building materials employed, increases in water use, or the effects of natural or manmade disasters on community water supplies. Instead, community involvement has been limited to a highly reactive method of problem solving. The community seems to have focused predominantly on the issues at hand, with the (minimum) of 17 saloons in the year of Chadron's founding (1885) being replaced by major and largely unsuccessful well digging efforts between 1885 and 1887. During this three year period, Chadron's newspapers chronicle 55 well digging efforts. After the first city waterworks was erected in 1887, there are no references to well digging projects until the construction of a city well field was proposed in 1967. Following the Chadron fire in early 1887 that destroyed some $25,000 in property, interest in water use became predominately concerned with fire danger, which peaked the same year with five fires and eight editorials on fire danger and the necessity for a stable water supply. After this time, the interest in water use stemmed from economic benefits, including the necessity of water for the railroad depot and agriculture. The theme of economic development was continued until the completion of the current city waterworks, which signaled the end of regular media interest in the water supply issue until the recent droughts. This is a repetition of the dearth of media interest that followed every major addition to the city waterworks, despite the retrospective obviousness of the inefficacy of many of them and the resultant city indebtedness. We will be performing ongoing analyses of media interest in water supply issues, especially as relating to economic factors, and will continue to examine trends in water use concomitant with availability.

CHEMISTRY OF WATER QUALITY IN CHADRON CREEK WATERSHED

Rebecca Pinkelman, A. Fischer, and Z. Varpness, Department of Physical and Life Sciences, Chadron State College, Chadron NE 69337

In our model of assessing a watershed, water quality plays an important role in indicating the health of the watershed and the ecosystem inside the watershed. Poor water quality, such as toxins in the stream, affects the quality of plant and aquatic life, and thus has an impact on life in general within the watershed. It is also an indicator of the composition of the soil, bedrock, and any pollutants in the soil or water. This can be accomplished by analyzing the water looking at dissolved oxygen, pH, conductivity, total dissolved solids, and temperature. Preliminary data from the Chadron Creek watershed shows good water quality, which is an indicator of a healthy ecosystem within the Chadron Creek watershed. The Dawes County Complex fire has had little or no measured impact on the water quality of the stream.

ANALYSIS OF FECAL COLIFORM BACTERIA IN CHADRON CREEK

Muriah L. Messersmith, Daniel S. McDermott, Jacob A. Brummer, Anya M. Cox, Leigha M. Curtiss, Amber L. Schauer, and Ann M. Buchmann, Chadron State College, Chadron, NE 69337

Chadron Creek watershed is a crucial source of fresh water for Chadron, Nebraska, and the surrounding area. Microbial contamination of Chadron Creek was assessed using fecal coliform bacteria as an indicator organism. Fecal coliforms are bacteria which pass through the fecal excrement of humans, livestock, and wildlife. The most common species of fecal coliforms is *Escherichia coli* (*E. coli*). While the presence of some fecal coliforms in surface water is normal, presence of high numbers of fecal coliforms might indicate contamination. Fecal contamination levels were determined by acquiring water samples from seven different sites along Chadron Creek using *E. coli* as an indicator species. At each site, samples were taken from an upper, middle, and lower stream locality with three replicates per sub-site, yielding a total of nine samples per site. Sterile water was used as a control. Preliminary results indicate that much of the Chadron Creek watershed has low fecal coliform levels; however, some sites exhibited relatively high coliform levels, indicating possible localized contamination of Chadron Creek. Fecal coliform levels will be assessed seasonally to obtain a more complete analysis of the fecal coliform contamination of Chadron Creek.

ECONOMIC IMPACT OF THE SPOTTED TAIL WILDFIRE ON CHADRON, NEBRASKA

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Analysis of the impacts of the 2006 Spotted Tail Wildfire on the Chadron Creek Watershed was generated in attempt to test the impacts on the quantity and quality of water and quantity of tourism after the fire. Models were constructed on the quality and quantity of water to determine the correlation between the water supply available for households and businesses and characteristics of the water supply. Linear regression analysis time series models were utilized based on data collected on private wells and the variables correlated with them. Data were utilized to determine the impact of the fire, pre and post, on the quality of usage water for the City of Chadron water treatment plant. Tax revenue was viewed to help calculate the change in the cost of tourism. We created several models that examined the change in the number of visits, quantity of tourism to have the area, as well as lodging and sales tax. These analyses have important implications for accessing Chadron's economic position after the fire.

MACROINVERTEBRATE ASSESSMENT OF CHADRON CREEK, NEBRASKA

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Chadron Creek is the primary water source for Chadron, Nebraska, originating in the Pine Ridge region and draining into the White River. This stream is part of an interdisciplinary study of the watershed's resources. This biological assessment was performed in an effort to describe its macroinvertebrate community to aid in the assessment of the overall health of the stream and to provide a baseline record for long term monitoring. On November 11, 2007, aquatic macroinvertebrates were collected using a D-frame kick net using the multihabitat approach and subsampled using the fixed count method. The preliminary data shows 31 distinct families of macroinvertebrates. The dominant family present overall was Chironomidae. There are 21 families present at the stream's headwaters and only 12 families at the most downstream study site. This decrease in the number of families maybe a general indicator of disturbance. The downstream study site also has no stoneflies (Plecoptera), or mayflies (Ephemeroptera), which is most likely an indicator of disturbance within the stream. There are several sediment tolerant families present indicating increased sedimentation in the streams lower reaches compared to the headwaters.

RANGELAND AND UPLAND FOREST HEALTH EVALUATION OF THE CHADRON CREEK WATERSHED, DAWES COUNTY, NEBRASKA

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The objective of this portion of the study was to determine the rangeland and upland forest health of the Chadron Creek watershed. In determining the rangeland health we used USDA/NRCS Rangeland Health protocols, and ecological site descriptions. Observations indicated a majority of the ecological sites to be loamy overflow. The USDA/NRCS Rangeland health evaluation rubrics to evaluate the health of the sites to determine if there were none to slight, slight to moderate, moderate, moderate to extreme, or extreme deviations from what would be expected for the site in high health. A modified step-point procedure was also employed to determine basal cover and estimate plant community frequency. After collecting the data it was concluded that the overall Rangeland health to be in a high seral stage with little to no deviation from a native or desired plant community for most of the watershed, with the exception where Chadron Creek crosses under US Highway 20 where we observed a great deal of disturbance. The modified step-point we determined the major plant species to be smooth brome, Kentucky bluegrass, and various wheat grasses at all sites. Common Stand Exam assessment of the upland forest followed USFS NRIS protocols for species, DB, height, height to crown, wildlife use, down woody form, and tree damage. Primary species were ponderosa pine with a few hardwoods. Most trees were 10 – 60 years old and showed only minor damages.

THE FISHES OF CHADRON CREEK, DAWES COUNTY, NEBRASKA

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During November, 2007, eight designated sites along the length of Chadron Creek, Dawes County, Nebraska, were sampled for fish. Chadron Creek begins near the top of the Pine Ridge, about 19km south of Chadron. A backpack electroshocker was used at each site to collect specimens in a 50m section of the stream, from the headwaters to near the lower reaches of the watershed. Fish were placed

in 10% formalin and later transferred to 50% isopropanol. Specimens were identified to species in the laboratory. The following seven species of fish (one non-native, six native) within three families were collected: SALMONIDAE, brown trout (*Salmo trutta*); CYPRINIDAE, creek chub (*Semotilus atromaculatus*), longnose dace (*Rhinichthys cataractae*), brassy minnow (*Hybognathus hankinsoni*), fathead minnow (*Pimephales promelas*), flathead chub (*Platygobio gracilis*); CATOSTOMIDAE, white sucker (*Catostomus commersoni*). The purposes for conducting this survey was three-fold: (1) to report, for the first time, a baseline inventory of the fishes that inhabit Chadron Creek, (2) use this inventory to characterize existing biotic communities and identify those species that may be rare or uncommon within the region, and (3) use the presence of certain fish species as biological indicators in an effort to evaluate the health of the Chadron Creek watershed. Based on our preliminary results, we can conclude that this ecosystem is "healthy" and supports a thriving population of S. trutta within the Chadron State Park boundaries. In addition, none of the fish species collected are considered threatened or endangered, although the state ranked S1 mountain sucker (*Catostomus platyrhynchus*), previously known from northwest Nebraska, could possibly be found in the Chadron Creek watershed. A comparative approach will be done using sample data from other P3 (Sustainability of Natural Resources in the Chadron Creek watershed) members, including those on water chemistry, macroinvertebrates, the amount of fecal-coliforms present, and the geology of the area. In order to provide additional supportive data, future plans are to sample these same sites a minimum of three times during 2008.

PRELIMINARY GEOLOGY OF THE CHADRON CREEK WATERSHED, DAWES COUNTY NEBRASKA

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Based on detailed 1:24000 geologic mapping and recent detailed lithologic descriptions, we described and interpreted the geology of the Chadron Creek watershed in north-central Dawes County, Nebraska. Chadron Creek provides a portion of the water supply for the city of Chadron. In June 2007 Chadron Creek went dry in places for the first time in recorded history. Chadron Creek is fed by springs originating in the Monroe Creek Formation of the Arikaree Group. Chadron Creek then flows over strata of the Monroe Creek Formation and the West Ash Creek beds, which are part of the High Plains Aquifer, and the White River Group, which is an aquitard for the region. The bedrock underlying the Chadron Creek valley is filled with 5-12 meters of middle and late Holocene sand and silt alluvium and comprises terraces 0-3. The bedrock within the Chadron Creek watershed is highly jointed and faulted. These joints and faults potentially transmit water between the bedrock and alluvium. Additional work is required to better understand these groundwater and geology interactions. This work was funded by the Environmental Protection Agency's People, Planet, and Prosperity Competition and the Chadron State College 2011 Fund.

DISCHARGE OF CHADRON CREEK, DAWES COUNTY, NEBRASKA

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Chadron Creek begins in southern Dawes County and runs 19 km northward to its confluence with the White River. Over the last two years we have measured discharge at eight sites on Chadron Creek in seasonal sampling events. Simple measurements were taken using a tape measure, meter stick

and electronic flow meter. This work on calculating discharge was done with three purposes in mind: (1) to provide, for the first time, streamflow and discharge data for Chadron Creek, (2) to look at downstream changes in discharge and relate those changes to groundwater sources and sinks, and (3) to make an accessible, simplified resource by which landowners without scientific training can accurately monitor the health of a stream or watershed. We found that Chadron Creek is a gaining stream until about one quarter of its length downstream. In its upper stretch the stream reaches a maximum discharge of about 0.1 m3/sec. In the summer of 2007 discharge in the lower three-quarters of the creek decreased gradually to zero. Springs have been observed at least seven different locations along Chadron Creek. We observed an increase in discharge below springs. Based on our collected data and observations made in the field, Chadron Creek is in danger. During the summer of 2007 the creek dried up about 1500m from its confluence with the White River. Anecdotal evidence of historical flows suggests that complete drying up of parts of the creek is unusual. Further study is needed to determine the factors behind recent low flows, especially to elucidate the relative contributions of evapotranspiration and infiltration. We will sample the same sites a minimum of three times during 2008 to provide further data. This work has been done as part of an interdisciplinary research project titled "Sustainability of the Natural Resources of the Chadron Creek Watershed," sponsored by the U.S. Environmental Protection Agency.

THE DIRTY CREEK TRACKWAYS: A NEW VERTEBRATE TRACKWAY SITE FROM THE OGALALA NATIONAL GRASSLAND IN NORTHWESTERN NEBRASKA

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Based on 1991-2006 detailed 1:24,000 geologic mapping and pedestrian surveys of vertebrate fossil resources of the Ogalala National Grassland in northern Sioux and Dawes counties, Nebraska, we describe the newly recognized Dirty Creek trackway site. The Dirty Creek trackway site was discovered and documented in 1994 by Wells and revisited in 2007 by LaGarry and Martin. The Dirty Creek trackways are exposed on the upper surface of the caprock of a low butte composed of ~12 m of volcaniclastic silty claystones, limestones, and volcanic ash of the Big Cottonwood Creek Member of the Chadron Formation. The caprock consists of ~0.5-2 m of crossbedded fluvial sandstones of the "Toadstool Park channel complex" (TPCC) of the Orella Member of the Brule Formation. The TPCC is of Oligocene (Orellan, 33.5-32 Ma) age. Both invertebrate and vertebrate traces were observed. Invertebrate traces are common and consist of linear and convolute worm and insect burrows. Vertebrate trackways are also common and consist of isolated tracks and short trackways of 2-4 tracks. The vertebrate tracks are typically tridactyl and have a foot pad characteristic of mammals. Diagnosis is difficult because most of the tracks were impressed into soft sediments and have abundant extramorphological features. Based on our preliminary descriptions, these tracks closely resemble tracks of common Oligocene rhinoceroses (e.g., *Hyracodon*, *Subhyracodon*). This work was funded by 1991-1995 Challenge Cost-Share Agreements with the Nebraska National Forest (user no. 2033), the University of Nebraska-Lincoln Conservation and Survey Division STATEMAP Project, Chadron State College, and The Mammoth Site of Hot Springs, South Dakota.

A BIOSTRATIGRAPHIC RANGE EXTENSION FOR THE LEPTAUCHENINE OREODONT *SESPIA* IN NORTHWEST NEBRASKA

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Fossil bones and teeth of the leptauchenine oreodont genus *Sespia* have been recovered from the Piney Hollow and Canyon Drive A vertebrate fossil localities on the Chadron State College (CSC) campus. These localities occur in volcaniclastic siltstones of the uppermost Whitney Member of the Brule Formation and yield Oligocene fossils referable to the Whitneyan North American land mammal age (NALMA). Fossils from these localities were collected mostly in situ ~ 2.9 m below the contact between the Whitney Member and the overlying "brown siltstone" (=Sharps) beds, and ~ 5 m below the Nonpareil Ash. Prior to this report, the Nonpareil Ash was the lowest known occurrence of *Sespia*. The occurrence of *Sespia* below the "brown siltstone" beds of the Brule Fm. extends the biostratigraphic range of the genus beyond its established origin in the Arikareean NALMA (30.5-19 Ma) into the Whitneyan NALMA (32-30.5 Ma). Oreodonts within the subfamily Leptaucheniinae appear to be the dominant vertebrate representatives in these sites. All specimens were measured and compared to referred specimens in published works on oreodont taxonomy and phylogeny and interpreted with consideration of modern taxonomic reevaluations. The CSC campus localities have produced multiple individuals of both *Leptauchenia* and *Sespia*, and ongoing studies will clarify the distinctions between these taxa in Whitneyan faunas. In addition, extending the biostratigraphic range of *Sespia* into the Whitneyan NALMA supports other evidence for the proposed origins of dwarfed leptaucheniines in the Great Plains region.

ESTIMATED LIFETIME OF THE HIGH PLAINS AQUIFER IN BOX BUTTE COUNTY, NEBRASKA

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The estimated lifetime of an aquifer is a projection of the amount of time that an aquifer within a given region can support past usage trends. Commonly used figures for predevelopment saturated thickness derive from the best available estimate of values prior to changes caused by groundwater pumping. According to the United States Geological Survey (USGS), in 1997 the saturated thickness of the High Plains Aquifer in Box Butte County, Nebraska, ranged from 100-400 feet. During the ten years since that time, the Upper Niobrara White River Natural Resources District (UNWRNRD) and the USGS have recorded annual water table decline rates of 1-5 feet per year. Because the saturated thickness measurements are 10 years old, declines of 10-50 feet have already occurred leaving the estimated saturated thickness in 2008 at 90 - 350 feet. If historic rates of consumption continue, the estimated remaining lifetime of the High Plains Aquifer in Box Butte County, Nebraska is 50-90 years. This would , however, leave the aquifer completely dry. Isolated areas within the aquifer experiencing decline rates in excess of 5 feet per year will have a shorter lifetime if past usage trends continue. The estimated lifetime of an aquifer provides a basis for understanding and managing a limited resource. This projection provides a timeframe for implementation of management technique changes that may prolong the life of the groundwater resource, and identifies locations that will need to promote economic changes that will lead to sustainable use of the available resource.

MICROBIAL MEDIATION OF URANIUM AND ARSENIC CONCENTRATIONS IN NEBRASKA PUBLIC WATER SUPPLY WELLS

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Nebraska public water supply (PWS) wells currently contain dissolved uranium concentrations above the federally mandated maximum contaminant level (MCL) of 30 ppb (parts per billion) and dissolved arsenic concentrations above the 10 ppb MCL. Both uranium and arsenic are known to cause various forms of cancer in humans. Removal of the trace metals from groundwater systems may cost hundreds of thousands of dollars per town to achieve compliance with the MCLs. Variations in total uranium concentrations in PWS wells in Nebraska indicate a relationship to the duration and rate of pumping. Although total arsenic concentrations show some variability over a temporal scale, the relationship to pumping activity is not as clear. Total uranium and arsenic concentrations in well precipitates are more strongly bound to organic material than exchangeable metals, the accumulation of which are facilitated by the dynamic environment generated during pumping. These organometal complexes facilitate sorption of uranium and arsenic species. We hypothesize that the chemical reactions contributing to the uranium and arsenic concentration variations observed in these PWS wells are mediated by the microbial populations present within the groundwater. Previous studies have shown that iron and sulfur bacteria present in aquifer systems affect the redox state of both uranium and arsenic species. Variable pumping conditions create an environment that is conducive to the growth of these microorganisms in and adjacent to the PWS wells. Microbial populations were characterized using culture techniques and DNA methodology on groundwater samples and well screen precipitates collected from pump intakes. Samples cultured with selective media yielded microorganisms representative of Fe oxidizing, Fe reducing, and S reducing bacterial groups. PCR was used to probe for domain affiliation of resident microbes and genes permissive to redox reactions involving uranium and arsenic. Gene sequencing was performed to provide a broader map of microbial diversity within and around selected PWS wells. Management of high uranium and arsenic concentrations in PWS wells may be enhanced by a thorough understanding of groundwater microbial communities and their ability to influence the behavior of uranium and arsenic.

HISTORY AND PHILOSOPHY OF SCIENCE
TEACHING OF SCIENCE AND MATH
APPLIED SCIENCE AND TECHNOLOGY

A COMPARISON OF THE HIPPOCRATIC OATH (MEDICAL ETHICS) AND BIOETHICS

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The Hippocratic Oath is an oath traditionally taken by physicians pertaining to the ethical practice of medicine. It is widely believed that the oath was written by Hippocrates, the father of medicine, in the 4th century BC, or by one of his students. It is thus usually included in the Hippocratic Corpus. Classical scholar Ludwig Edelstein proposed that the oath was written by Pythagoreans, a theory that has been questioned due to the lack of evidence for a school of Pythagorean medicine.

Several parts of the oath have been removed or re-shaped over the years in various countries, schools, and societies as the social, religious, and political importance of medicine has changed. Most schools administer some form of oath, but the great majority no longer use the ancient version, which praised Greek deities, advocated teaching of men, and forbade general practitioners from surgery, abortion, and euthanasia.

Bioethics appeared following World War II as several major issues involving medical research and the delivery of health care arose. These including concerns about medical experimentation and informed consent. The most significant disregard of ethical issues was apparent in the Nazi medical atrocities prosecuted in the Nuremberg Trials in 1948. In the United States, the Tuskegee and Willowbrook experiments and the resultant concern for research subjects prompted Congress to create the National Research Act. President Nixon signed the act into law on July 12, 1974, thus creating the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research.

Bioethics, it would seem, was the result of the government's desire for ethical unanimity among researchers, the intellectual community, the government, and the public at large.

AN ETHICAL DISCUSSION OF EMBRYONIC, FETAL AND POST-NATAL ANIMAL-HUMAN HYBRIDS

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Crossing the human species interface has fascinated individuals for centuries. In ancient Egypt, Greece and Rome, for example, sphinxes (human-lion mixtures), centaurs (human-horse mixtures), fauns (human-goat mixtures) and minotaurs (human-bull mixtures) were accepted as being special and endowed with specific powers. Although they were not considered as being human part of the human race, they were neither seen as being entirely animal.

In this regard, it should be emphasized that the process of interspecies mixing does actually happen in nature. For example, animal-animal mixtures such as mules are derived from interbreeding between two different species. In this case a mule, chromosomes from a horse and a donkey are brought together through the fusion of horse and donkey gametes in fertilization to produce an animal whose every cell contains genes from both parental species.

With respect to animal-human mixing, no evidence of any entities being born has ever been recorded but new developments in crossing the species barrier may no longer limit animal-human mixtures to the domain of mythology.

In September 2007 the Human Fertilization and Embryology Authority (HFEA), the United Kingdom's fertility regulatory body, indicated that it would authorize the creation of human-animal embryos.

The world discussion was extensive with a very informed debate of the potential ethical considerations. In contrast to the international press, the British media avoided any extensive discussion regarding the ethical considerations of the elaborate claims made by the scientific community.

Can we expect similar movements in the U.S. scientific community? The Dickey-Wicker amendment, included in the Labor, Health and Human Services appropriations bills enacted each year since 1995, prevents federal funding of research in which a human embryo is destroyed, subjected to substantial risk or harm, or created for research purposes.

In June of 2007, a proponent of research cloning, sent a bill (H.R. 2560) directly to the House floor. The proposal, very similar to the current British policy, allowed cloning of human embryos for research without limit. The bill was defeated.

Due to the reactions of the Human-Animal Hybrids a bill, The Human-Animal Hybrid Prohibition Act (S.2358) was introduced in November 2007. The bill would prohibit creating human-animal hybrids by any of several methods.

OUTREACH TO NATIVE AMERICAN COMMUNITIES: AN ETHNOBOTANY CURRICULUM

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The mission of UNMC includes programs to increase appreciation and knowledge of science and reach out to underserved communities. We have established a partnership with schools on six Indian Reservations in Nebraska and South Dakota to help fulfill this important task. Our outreach has included in- service teacher workshops and summer science experiences for Native students.

Inclusion of culturally relevant and scientifically accurate information enhances the experience of students from these remote areas. As part of this effort we developed and piloted an ethnobotany curriculum during a summer science camp. The curriculum comprised plants that are native to the Plains and were used by indigenous peoples and early settlers. The program includes a booklet with drawings of the plant, its common name, scientific name, and name in the Lakota or Dakota language, if known. (Similar booklets in other native languages will be made available to Native Americans belonging to other groups.)

To help students learn the names in both English and Lakota/Dakota, we developed a two piece puzzle game with unique interlocking pieces. One piece contains the English name while its counterpart has the name in Lakota/Dakota. To enhance the learning of these plants, their uses, current and past, and their names we have also devised a bingo like game that includes cards containing facts about plants.

This curriculum was tested with students during a summer camp on the Yankton and Santee Indian Reservations. The summer experience included a field trip to identify the plants in the wild. We realize that will not be possible in most school settings. However, showing students the connections between, science, social studies and culture added a dimension to student learning that we had not originally considered. The other learning highlight was watching students connect "book" learning with actual field experience.

JEOPARDY - COLLEGE STYLE

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How exactly can one get every student in a class involved during an exam review session? The fact is that if a traditional question and answer approach is used, only the motivated students who have prepared questions ahead of time can ask them and thus benefit from the review. What about the other, less-motivated and less-prepared students? Ordinarily they will show up, but because they came unprepared, will usually not take away much information that is useful to them.

Here is presented a different, unique take on the approach to exam review sessions, a way that will involve *each and every* member of the class. The basic format of the gameshow 'Jeopardy' is used to present relevant questions to students who are split into teams, and who are encouraged to interact with each other to obtain the correct answers. This simple and effective method encourages interactivity between the students on each team, between students on different teams, and between the students and the instructor. One more thing - it's a learning experience that is a lot of fun!

DATA ANALYSIS IN APPLIED SCIENTIFIC RESEARCH: EXAMPLES OF QUALITATIVE TECHNOLOGY INNOVATION

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Qualitative data analysis is routinely utilized in the analysis of scientific data where it is not possible to conduct data analysis by traditional convention. However, the analysis of qualitative data by software application is a relatively new technological innovation. A synthesis of qualitative data analysis utilizing three different qualitative data analysis software programs is conveyed. The works cited result from original author/student research, each in a unique area of investigation. Through the review of these studies it is intended that applications in other areas of data analysis, where the meaning of qualitative data output, are enhanced through application of software technology.

CRITICAL TASK MANAGEMENT AND ERROR IDENTIFICATION IN A HIGH RISK TECHNOLOGY ENVIRONMENT

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This study provides a pilot test of critical task management and measurement of error identification in a complex environment. Utilizing baseline research in the area of cognitive awareness, a scenario based common testing routine is administered by multiple researchers using standardized measures. Subjects are presented with common and ordinary tasks in a computer simulation of a high risk environment. Identification and response to simulated equipment failures are monitored on a separate display not visible to the subject. In addition to precise measurement of reaction time, an assessment of the subject's response to the critical situation will be evaluated and recorded. This research design proposal is under review by the joint University of Nebraska at Omaha / University of Nebraska Medical Center Institutional Review Board.

COLLEGIATE ACADEMY
BIOLOGY
SESSION A

A COMPARISON OF CYTOTOXIC LYMPHOCYTE STIMULATION USING DENDRITIC CELL PRIMING THAT HAVE BEEN PRIMED BY LYSATE OR TEXOSOMES

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The purpose of this experiment is to compare the method of using lysates to prime dendritic cells which in turn present to cytotoxic lymphocytes to target mantle cell lymphoma cells in comparison to texosomes as the priming agent. We will isolate the texosomes and create the lysate from three cell lines, MDA-231, Granta-519 and JVM-2. We will then culture the cells and prime the dendritic cells. When the CTL's are primed we will label our cell lines with radioactive Chromium-51 and run a Chromium Release Test to test for chromium release in the supernatant of the lysed cells. The amount released in different dilutions will tell us how well each method worked. We can then interpret this information and make decisions on whether to continue using texoxomes or lysate methods to try and find a better treatment option for MCL patients.

DEVELOPMENT OF AN IMMUNOFLUORESCENT ASSAY USING RECOMBINANT PROTEINS EXPRESSED IN INSECT CELLS FOR THE SCREENING AND CONFIRMATION OF HUMAN HERPESVIRUS-8 ANTIBODIES

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Human herpesvirus-8 (HHV-8) or Kaposi's sarcoma-associated herpesvirus (KSHV) has been linked to all forms of Kaposi's sarcoma (KS). It has also been detected in primary effusion B-cell lymphomas (PEL) and in multicentric Castleman's disease (MCD). Most current serological assays to detect HHV-8 antibodies have low concordance amongst themselves. To establish a sensitive and specific testing strategy to screen for HHV-8 antibodies, three HHV-8 proteins, ORF65, ORF73 and K8.1A, were expressed using baculoviral vectors in insect cells and incorporated into an monoclonal-enhanced immunofluorescence assay (mIFA) termed Sf9 3-antigen mIFA. The results with this mIFA were compared to those obtained with a standard mIFA utilizing a HHV-8 infected B-cell line (BC3 mIFA). Test sera were obtained from patients diagnosed with KS, HIV-1 infected patients at high risk for HHV-8 infection, and healthy controls from a local blood bank. The combined use of both assays had a sensitivity of 94% and a specificity of 96% in detecting HHV-8 infected individuals. The performance of these two assays when used together indicates that they may be useful for reliable detection of HHV-8 IgG antibodies in the general population. 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 POTENTIAL UPF1 KINASES IN *SACCHAROMYCES CEREVISIAE*

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Nonsense-mediated mRNA decay (NMD) functions in cells to degrade mRNAs containing a premature termination codon, in order to protect these cells from the potentially harmful effects of a truncated protein. Additionally, NMD is also known to regulate certain wild-type mRNA transcripts. Post-translational modifications of the proteins required for NMD are important for coordination of the sequential steps involved in this process. Upf1, one of the proteins required for NMD, must be

phosphorylated for mRNA decay by the NMD pathway. SMG-2 is the kinase responsible for phosphorylating Upf1p in *Caenorhabditis elegans* and humans. SMG-2 is regulated by two additional proteins that are required for NMD, Upf2 and Upf3. Currently a homolog of SMG-2 has not been identified in *Saccharomyces cerevisiae*. In order to identify this kinase, we have selected seven (7) kinases as possible candidates for Upf1 phosphorylation: Cka1, Mec1, Mip6, Pro1, Tao3, Tor1, and Tor2. We chose these kinases based on sequence homology to SMG-2 and their known cellular functions. For each kinase of interest, we have a mutant that does not make the kinase. The mutants will be transformed with *FLAG-UPF1* and *FLAG-upf1*$_{C65S}$, an allele that encodes a upf1 protein whose phosphorylation is mis-regulated and that does not interact with Upf2. Upf1 phosphorylation will be analyzed in the mutants by Western blotting and polyribosome profiles for differences.

THE CCR4-NOT CO-ACTIVATOR HAS POST-TRANSCRIPTIONAL FUNCTIONS IN GCN4P REGULATED GENE EXPRESSION

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Cells respond to modifications in their environment by changing what genes are expressed. Gene regulation in eukaryotes begins at the initiation of transcription, continues through the export of the messenger RNAs out of the nucleus and persists through the translation of messenger RNAs into proteins in the cytoplasm. When the yeast *Saccharomyces cerevisiae* is starved for amino acids, the cell generates a signal that leads to an increase in the level of Gcn4p, a transcriptional activator protein that regulates the expression of genes involved in amino acid biosynthesis. Therefore, yeast cells that cannot obtain amino acids from their environment modify their gene expression to produce their own amino acids. This involves decreasing bulk translation of proteins, while maintaining the translation of Gcn4p target gene messenger RNAs when the cell is experiencing starvation. Much research has focused on how Gcn4p activates its target genes, but it is not clear how the Gcn4p genes are repressed after the yeast cell is no longer starving. The CCR4-NOT complex is a co-activator necessary for Gcn4p to fully transcribe its target genes. Our data show that the CCR4-NOT complex also plays a role in Gcn4p target gene expression beyond that of transcriptional activation. The project described was supported by Grant Number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH) and "Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NCRR or NIH.

STRUCTURAL CHARACTERISTICS OF A COXSACKIEVIRUS B3 GENOME CONTAINING A SINGLE BASE MUTATION

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Coxsackievirus B3 (CVB3) is attributed to a wide range of infections from relatively minor gastrointestinal illnesses to paralysis, birth defects, pancreatitis, and potentially fatal heart conditions. CVB3 is a member of the Picornaviridae family of which poliovirus is the most recognized. The CVB3 genome is a single-stranded positive sense RNA that is organized into four sections: a highly structured 5' nontranslated region (5' NTR), a single open reading frame encoding a polyprotein, a 3' nontranslated region, and a poly A tail. There are seven secondary structure domains of the 5' NTR labeled I-VII as defined by long range base pairing interactions. Within the 742 bases of the 5'NTR, domains II-VI fold

into an internal ribosome entry site (IRES) that recruits ribosomes. Research has shown that sequence changes in the 5' NTR can reduce viral multiplication and abrogate virulence. For example, a single base mutation at position 234 in the 5' NTR from a uracil to a cytosine results in a non-virulent form of CVB3 called CVB3/0. This investigation compares the structure of the mutant 5' NTR in the strain CVB3/0 to the wild type 5' NTR in the strain CVB3/28 using chemical modification techniques. CVB3 RNA was chemically modified with DMS, CMCT, and kethoxal and then analyzed using primer extension techniques to examine the RNA structure. Results for the 290 to 315 nucleotide stem loop of domain IV indicate there are no observable structural alterations in the mutant 5'NTR as previously believed. Examination of the remaining domains is underway. Experimental results indicate that there may be a structural difference between domain III of the cariovirulent and noncardiovirulent viruses in the 180 to 190 nucleotide region of the 5' NTR. The ultimate goal of this study and of our laboratory is to identify structural differences in virulent and non-virulent CVB3 genomes. This information will provide the basis for development of antiviral compounds that can induce CVB3 into a non-virulent form. The project described was supported by Grant Number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH) and its contents are solely the responsibility of the authors and do not necessarily represent the official views of NCRR or NIH.

ANALYZING THE STRUCTURE OF COXSACKIEVIRUS B3 GENOMIC RNA BY SITE-DIRECTED MUTAGENESIS

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Coxsackievirus B3 (CVB3) is the most prevalent contributor to viral myocarditis, causes the disease of pancreatitis, and plays a role in type I diabetes. CVB3 is a part of the Enterovirus genus and belongs to the *Picornaviridae* family. Being a picornavirus, CVB3 has a single stranded positive sense RNA genome with an RNA structure on the 5' end called an internal ribosome entry site (IRES). This RNA structure functions to recruit ribosomes for translation. When CVB3 first enters a host cell the genome acts as a template for translation to manufacture the viral polyprotein. The structure of the IRES in the 5' nontranslated region (5'NTR) controls the translation event. Following translation, genome replication also requires structures in the 5'NTR. Experiments have shown that these structural elements in the 5'NTR are responsible for the efficiency of viral multiplication and for virulence. Our lab focuses on the 5'NTR of the viral genome, and after much work, has produced a new predicted model of this region. The goal of this project is to investigate one portion of this model that proposes a long range RNA-RNA interaction. Specifically, we propose that nucleotides 113 through 118 are paired with nucleotides 561 through 566 in the 5'NTR. The hypothesis is that mutating this region will change the structure of the 5'NTR, making the virus less infectious and less virulent. DNA mutagenesis was used to change nucleotides 113 through 118 so that they will no longer base pair with nucleotides 561 through 566. The resulting mutated regions are being analyzed to determine the effects on structure and function of the genome. The project described was supported by Grant Number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH) and "Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NCRR or NIH.

ANALYZING A LONG RANGE RNA PAIRING INTERACTION IN THE 5' NONTRANSLATED REGION (NTR) OF THE COXSACKIEVIRUS B3 GENOME

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Coxsackievirus B3 (CVB3), a member of the genus *Enterovirus* and family *Picornaviridae*, is thought to be a leading contributor to several diseases, including pancreatitis, myocarditis, and even diabetes (type I). CVB3 has a single stranded RNA genome that serves as mRNA and contains an internal ribosome entry site on the 5' end that is used to recruit ribosomes for translation. The the structure of the internal ribosome entry site controls the process of translation, which is then followed by a conformational change in the RNA to promote replication of the genome. In all of these functions, specific structures in the 5' NTR are essential. Experiments have previously been done to show that the effectiveness of viral multiplication is dependent on these 5'NTR structural elements. Our lab is looking at a potential long range RNA pairing interaction between nucleotides 113-118 and 562-566, found in the IRES element of the 5'NTR. We seek to understand the 3-dimensional structure that is created from this pairing. Furthermore, we wish to evaluate the role of the long range pairing in the overall viral multiplication cycle and ultimately in the virulence of the virus. The project described was supported by Grant Number P20 RR16469 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH) and "Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NCRR or NIH.

MUMIFICATION AND PALYNOLOGY: WHAT WE CAN LEARN IN REGARDS TO TIME AND LOCATION OF DEATH

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This research is dedicated to the amount of time it takes for the mummification process to take place in piglets, while being buried in different materials such as: a tarp, a rug, a plastic bag, and a fleece blanket. These piglets were documented periodically for changes in decomposition using soil analysis and also for pollen deposition. The piglets buried in the plastic bag were expected to mummify the quickest and the organic matter in the soil was expected to increase as the piglets decompose. Acetolysis was used to process and stain the pollen for identification and imaging purposes. It has been proven beneficial to use swine in order to determine different aspects of the decomposition process, which helps death investigators to accurately determine time of death issues. Checking different types of pollen present in different regions of Nebraska has been proven very beneficial in determining location and season of death. The piglets were buried in multiple locations around Omaha, NE. They were buried in Ashland, NE; Bennington, NE; Atkinson, NE; and Valley, NE. Results regarding pH, carbon content, nitrogen content, total organic matter and the conductivity measurements of salts were recorded at four weeks and eight weeks. Results regarding pollen content was also identified and recorded. As predicted, the piglets in plastic bag were the closest to mummification.

IDENTIFYING THE TIME AND RELATIONSHIP BETWEEN DIFFERENT DECOMPOSING CADAVER MASSES AND NINHYDRIN-REACTIVE NITROGEN IN SOIL AND ITS RELEVANCE TO ESTIMATION OF POST-MORTEM INTERVAL

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Estimating post-mortem interval (PMI) can be a painstakingly hard task for crime scene investigators. Through forensic taphonomy, investigators are able to estimate the length of time of cadaver decomposition and PMI using ninhydrin-reactive nitrogen (NRN). A significant amount of NRN is released into gravesoil during decomposition, but the time required for its release and the relationship between this time and cadaver mass are unknown. I hypothesized that a linear relationship exists between cadaver mass and the time required for a significant increase in NRN gravesoil, which assists in locating sites of cadaver breakdown and estimating PMI. Swine (*Sus scrofa*) carcasses of four contrasting masses (replicated three times) due to age (neonate to adult) were placed directly on the soil during the summer and left to decompose for a period of 14 days. Soil samples were collected from under the cadaver in 24 hour intervals and analyzed for NRN. Soil analysis resulted in an NRN soil increase after 48 hours (72 hours for the neonatal specimen) and remained high for the 14 days of decay. These measurements and methods can now be used to estimate PMI based on linear graphs of time vs. NRN concentration for each cadaver mass during this time period and location.

PERFORMANCE EVALUATION OF PERSONAL WATER FILTERS IN RURAL DOMINICAN COMMUNITIES

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Sampling of aqueducts and rivers, common water sources of rural Dominican communities, has shown levels of coliform and *E.coli* bacteria above the range of potability by World Health Organization standards. The Institute for Latin American Concern (ILAC)/ Centro de Educacion para la Salud Integral (CESI) has attempted to increase accessibility of potable water to rural communities by distributing personal water filters. These gravity purification systems are constructed from two five-gallon buckets, a ceramic filter element, and a spigot. The objectives of this research were to determine the functionality of personal water filters and the potability of water filtered, and educate owners on proper filter use, maintenance, and repair. Filters were inspected for physical problems such as leaks, broken spigots, and damaged or plugged filter elements. Potability was determined by testing water samples, using the membrane filtration method, for contamination by fecal bacteria. 146 personal filters were inspected in 10 different communities. 36% of personal water filters needed repair due to physical problems. One quarter of all personal filters were not sampled due to functional problems, owner disuse, or sampling error. Of those filters sampled, 88% produced water of little or no risk, by World Health Organization standards. Personal water filters are an effective way of providing accessible, potable water to rural Dominican communities. Correct assembly of filters and education of owners on proper maintenance is necessary to ensure full functionality.

CONTROL OF PROGESTERONE SYNTHESIS: EFFECTS OF METFORMIN AND AICAR ON BOVINE CORPUS LUTEAL CELLS

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The corpus luteum (CL), a transient endocrine gland, secretes progesterone, a steroid hormone necessary for the maintenance of pregnancy. Insufficient functioning of the CL accounts for a large percentage of recurring spontaneous abortion cases. Experiments designed to understand the mechanisms that regulate CL progesterone synthesis will provide new targets for therapeutic intervention and relieve some of the socioeconomic effects of infertility in the future. Progesterone is produced by the luteinizing hormone (LH) stimulated cAMP pathway; however other cell signaling pathways may be involved, including the adenosine 5'monophosphate-activated protein kinase (AMPK)/Acetyl Coenzyme A Carboxylase (ACC) pathway. I investigated the effects of two activators of AMPK/ACC [metformin, an anti-diabetic drug that has been used to treat Polycystic Ovarian Syndrome (PCOS) and 5-amino-imidazole-4-carboxyamide-1β-Dribofuranoside (AICAR) a direct activator of AMPK] in the regulation of progesterone secretion by primary cultures of bovine corpus luteal cells. Following treatment of cells with LH in the presence or absence of metformin or AICAR, western blot analysis verified the activation of the AMPK/ACC pathway and radioimmunoassy determined progesterone secretion. Treatment with 1mM AICAR and 10mM metformin stimulated dose- and time-dependent increases in the phosphorylation of AMPKα1 on Thr172. Simultaneously, phosphorylation of acetyl-coenzyme A carboxylase at Ser79 increased. AICAR significantly ($P < 0.05$) reduced progesterone levels in the LH stimulated luteal cells, but metformin had statistically insignificant effects on progesterone secretion. The results indicate that activation of AMPK in response to AICAR reduced progesterone production through the AMP/ACC signaling pathway in bovine luteal cells. These findings provide the first steps towards elucidating the mechanisms by which AMPK influences progesterone synthesis and understanding how AMPK activating pharmaceuticals effect the female menstrual cycle and infertility.

EFFECTS OF CHELATED AND INORGANIC TRACE MINERALS ON CONCEPTION AND BIRTH CHARACTERISTICS OF BLACK ANGUS COWS (*BOS TAUSUS*)

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Bovine infertility problems account for a significant annual loss to the cattle industry. Trace mineral deficiencies can account for some of these problems. Copper, manganese, zinc, and selenium deficiencies can manifest themselves as cystic ovaries, abnormal or delayed estrus, embryonic death and abortion, retained placenta, and weak calves at birth. When a mineral is chelated it is bound by one to three amino acids. This arrangement forms a stable five member ring that protects the metal during digestion and its' small size also allows for better absorption. In the current study, chelated trace minerals were added to the diet. In this two year study, the cattle received no minerals during the first year and a balanced mineral supplement using chelated and inorganic trace minerals in the second year. During the breeding season for both years the cows were synchronized with two shots of Lutalyse and then they were artificially inseminated (AI). In the first year, 71% of the cows were successfully AI but only 48% of the cows gave birth to an AI calf. In the second year, all of the cows were successfully AI. The percentage of cows that give birth to an AI calf will be determined after births. Results will be presented.

EVALUATION OF CHLOROVIRUSES FROM ALKALI LAKES IN WESTERN NEBRASKA

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Chloroviruses are large double-stranded DNA viruses that infect endosymbiotic strains of unicellular chlorella-like green algae. These viruses are ubiquitous to freshwater systems and were found recently in certain alkaline lakes of the Nebraska Sandhills. Potassium-sodium carbonate lakes are rare and the alkali lake ecosystem in the Nebraska Sandhills is the only known system in the Western Hemisphere (Gosselin et al., 1994). The water in these lakes have a pH range of 8.5 to greater than 11. Total geological alkalinities range from as low as 40 to greater than 80,000 ppm and total dissolved salts range from 400 to greater than 40,000 ppm. Water samples collected during the summer of 2007 were analyzed geochemically for pH and ion content, as well as for viral activity using three *Chlorella* hosts, NC64A, Pbi and SAG 3.83. Following systematic purification, single plaque isolates were analyzed for genomic similarities based on restriction endonuclease sensitivity and fragment polymorphism. The initial virus collection is being categorized based on geography, geochemistry, host range, plaque morphology and restriction fragment polymorphism patterns. This research can be used to gain a better understanding of chlorovirus population dynamics and diversity in alkaline environments. The research described has been supported in part by NIH grant number P20 RR016469.

ANCIENT MARINE ALGAL VIRUSES FROM SEDIMENT CORE SAMPLES

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The dissolved organic matter of oceanic waters contains virus-like particles (VLP), estimated at 10^{31} VLPs in total. These VLPs consist of bacterioplankton viruses and phytoplankton viruses or marine algal viruses. Little is known about marine algal viruses. The *Emiliana huxleyi* virus is an example of one marine algal virus where the genome has been sequenced. Similarities in its genome and infection mechanisms place *Emiliana huxleyi* virus and other coccolitic viruses in the family *Phycodnaviridae* (the family type member is *Paramecium bursaria* chlorella virus-1, PBCV-1). An important question in evaluating the history, epidemiology and evolution of marine viruses is, does viral DNA persist in marine sediments? To investigate this question, it was necessary to develop DNA extraction and sequence determination methods. Carbon-dated sediment samples were taken from a source off the Mississippi River Delta in the Gulf of Mexico, in collaboration with the US Geological Survey Center for Coastal & Watershed Studies. DNA was extracted from samples at various core depths and amplified by polymerase chain reaction (PCR) using a combination of AVS1 and AVS3 primers. The AVS1 and AVS 3 are degenerate primers which amplify conserved *Phycodnaviridae* DNA polymerase δ-subunit genes. PBCV-1 served as a control. Following amplification of the sediment DNA, PCR products were purified, ligated into a pGEM T-Easy vector with a disruption *gene*^{gal} selection marker (Invitrogen) and transformed into *E. coli*. *E. coli* colonies from overnight cultures were selected on X-gal plates. White colonies, indicating plasmid insertion with the sediment DNA amplicon, were grown overnight in liquid culture medium, then the plasmid DNA was isolated. Plasmid DNA from several white colonies was sequenced using M13 primers

(forward and reverse sequences flanking the plasmid insertion site) at the Genomics Core Research Facility/University of Nebraska-Lincoln. The DNA sequence was evaluated by BLAST searching of the NCBI (nt) database and compared to sequences among *Phycodnaviridae*. The PBCV-1 control sequence matched exactly with the PBCV-1 genome sequence in the NCBI database. Sediment samples shared sequence similarities with other members of *Phycodnaviridae*. These results indicate that this method can detect algal virus DNA in marine sediments; however, further modifications to the method may be required. The next step is to evaluate deeper (and consequently more ancient) sediments in the core samples. Ongoing results will be discussed. This research was sponsored (in part) by a grant from the US Department of Interior, 06FLSA0082.

TAKING A CLOSER LOOK AT THE PHOTOSYNTHETIC PIGMENTS OF *HESPERIS MATRONALIS* (DAME'S ROCKET), AN INVASIVE SPECIES TO NEBRASKA

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Invasive species are known as foreign species whose introduction may cause economic and environmental problems (Plant 1). The *Hesperis Matronalis* plants can produce about 296,000 seeds per pound adding to its environmental impact. This research is to determine if the chlorophyll levels in invasive species provides it an environmental advantage over native species. Invasive species may have higher levels of chlorophyll A and B than the native species studied. Five measurements from each of four leaves were used to provide an average value. Samples were measured using a Cary UV Spectrometer at 664, 649, and 476 nms to measure chlorophyll A, B, and carotenoid levels. Once data was calculated, it was then compiled and entered into the In-Stat program for results comparing Dame's Rocket and Garlic Mustard (invasive species studied) versus Buckbrush and Bottlebrush grass (native species studied). One test compared the readings from the chlorophyll meter to the spectrometer to inform us of the accuracy between them. This data failed the reliability test; test results in one instrument being more precise than the other. The other tests investigated values of native versus invasive species. Both Chlorophyll A and B gave sufficient p values which had significant results. The carotenoids p values were not significant. Our observations suggest that the chlorophyll and carotenoid levels have little to no effect on the environmental impact of invasive over the native plant species.

AN EXAMINATION OF PHOTOSYNTHETIC PIGMENTS OF *ELYMUS HYSTRIX*, A NATIVE SPECIES TO NEBRASKA

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Elymus hystrix, more commonly known as bottlebrush grass, is a perennial grass native to the United States including the state of Nebraska. The plant is a monocot and part of the Poaceae family or grass family. When the data was collected from Fontenelle forest on the bottlebrush plant, it was noted that it grew predominantly in the same area as the invasive species Dames Rocket. Since the bottlebrush grass bloomed at a later period than the Dames Rocket it did not appear to have any effect on the grass's growth. They both grew well in the same type of light environment and both seemed to thrive there. The main objective of this study was to explore the differences in native and invasive photosynthetic pigments. The first goal was to look at the different photosynthetic pigments in bottlebrush grass. Another objective was to separate Chlorophyll A, Chlorophyll B, and carotenoids from the bottlebrush leaves. A comparison of Chlorophyll A content in bottle brush to invasive species was made. It was theorized that bottle brush leaves would show a higher concentration of Chlorophyll A. It was expected to show higher pigment values in the native species compared to the invasive species investigated. The results of the study do indicate that significant differences do occur in the native and invasive plant species we looked at. While other native plants have more photosynthetic pigments than invasive plant species, bottlebrush appears to have slightly higher concentrations of photosynthetic pigments compared to invasive species.

AN ANALYSIS OF PHOTOSYNTHETIC CONTENT OF GARLIC MUSTARD, *ALLIARIA PETIOLATA*, AN INVASIVE PLANT SPECIES IN NEBRASKA

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Garlic mustard is an invasive plant species that has grown aggressively throughout the United States affecting surrounding natural wildlife and habitats. This invasive plant species is a threat to native plant species by containing allelopathic chemicals which alter the soil fungi in a natural habitat. Garlic mustard may also contain high amounts of photosynthetic pigments that may contribute to its rapid growth. An examination of chlorophyll A, chlorophyll B, and carotenoid content was performed on two invasive plant species, garlic mustard and dame's rocket, and two native plant species, buckbrush grass and bottlebrush grass, found in Nebraska. Numerous samples from each plant species was collected and analyzed using 95% ethanol to extract chlorophyll A, chlorophyll B, and carotenoid content. Each raw sample was then placed in a CARY/UV spectrophotometer to measure their absorbance levels. The research showed that high amounts of photosynthetic content were not major contributing factors to its rapid invasion throughout Nebraska.

A COMPARISON OF PHOTOSYNTHETIC PIGMENTS IN NATIVE SPECIES BUCKBRUSH AND BOTTLEBRUSH WITH INVASIVE SPECIES DAMES ROCKET AND GARLIC MUSTARD

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Symphoricarpos orbiculatus, otherwise known as buckbrush, is an important native species to Nebraska and other states, providing wild animals with a food source and habitat. The Buckbrush population, however, is being threatened by invasive plant species, specifically garlic mustard and dame's rocket. This may be due to differences in amounts of photosynthetic pigments between the native and invasive plants. In June and July of 2007, two native species plants, buckbrush and bottlebrush, and two invasive species plants, dame's rocket and garlic mustard, were collected from Fontenelle Forest in Bellevue, NE. Small sections of leaves from these plants were then combined with 95% ethanol to extract the chlorophyll and carotenoids. This solution was then centrifuged, placed into a CARY UV spectrophotometer, and absorbencies were recorded at wavelengths of 664 nm, 649 nm, and 470 nm to measure for chlorophyll A, chlorophyll B, and carotenoids, respectively. The absorbencies values were then used in equations to calculate the chlorophyll A, chlorophyll B, and carotenoid content in units of µg/mL for each individual leaf. The statistical computer program, Instat, was used to produce a paired t-test, mean, standard deviation, and ANOVA on the compiled data from all four plants. The native buckbrush and bottlebrush plants had more chlorophyll A and B than the invasive species. The levels of carotenoids in the four plants were not significantly different. There were differences in the amounts of chlorophyll between the native and invasive species. These observations suggest that the higher amounts of chlorophyll A and B in the native plants are one explanation why they are not being completely taken over by invasive species plants.

INHIBITION OF *STAPHYLOCOCCUS AUREUS* BY *OSMORHIZA LONGISTYLIS* ROOT EXTRACTS

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Melvin R. Gilmore, in his Uses of Plants by the Indians of the Missouri River Region, described how members of the Winnebago and Omaha tribes used a poultice made from the roots of *Osmorhiza longistylis* to treat boils and wounds. We have tested alcoholic extracts made from the roots, stems, and

leaves of this plant for effectiveness in inhibiting the growth of *Staphylococcus aureus*. Cultures of *S.aureus* were incubated with the extracts for two hours and 24 hours. The leaf and stem extracts had no effect on *S.aureus* growth, but the root extract inhibited growth by 12.2% and 25% after 2hours and 24 hours, respectively. Future plans include the fractionation of the root extract by HPLC, and the assay of the fractions obtained for anti-*S.aureus* activity.

SCREENING FOR INHIBITION OF ANTIBIOTIC RESISTENCE MECHANISMS ATTRIBUTED TO PLANT EXTRACTS

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The concern for antibiotic-resistant bacteria has increased due to the extensive usage of antibiotics. The means by which bacteria can protect themselves from antibiotics can vary. The bacteria can modify the antibiotic molecule utilizing genetically coded enzymes; an efflux mechanism to pump out the antibiotics; or modifying the specific target area of the antibiotics to make the antibiotics ineffective. In this study, we researched steam-distilled plant extract's ability to inhibit the bacterial enzymes that lead to antibiotic resistance. The specific extracts examined include capsicum, lemone, cinnamon, thyme, oregano, and cedrene. Different dilutions of these extracts were combined with antibiotic-resistant *E. coli*. Tests in triplicate were run using a 96 well tray. Different combinations of extracts, antibiotics, bacteria, and a control were set up in the trays. After one day of incubation per tray, light spectrometry readings were taken and analyzed. New triplicates were performed for any extract dilution that showed significant delay of bacterial growth.

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SIGNIFICANCE OF VARIABLES FOR SHARP-TAILED GROUSE LOCATIONS AT CRESCENT LAKE NATIONAL WILDLIFE REFUGE IN NEBRASKA

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Sharp-tailed grouse (*Tympanuchus phasianellus*) populations are in decline and their conservation requires an understanding of the landscape variables which contribute to nest success or failure. Data were collected as part of a radio telemetry project with Marlin French at Crescent Lake from April-July 2007. Seven vegetation/landscape variables were measured using a Robel pole, yardstick, and 1 x .5 yd rectangle. Grouse behavior was placed into the following behavior categories: flushing, roosting, nesting, and brooding. The goal of this analysis was to ascertain which of the landscape variables varied significantly between the categories. Correlation analysis was used to determine whether any of the variables covaried with date of sighting event or with each other. General Linear Model Analysis of Variance with post hoc Bonferroni and Tukey tests were used to determine which of the variables varied significantly between which categories. None of the variables co-varied significantly with date. Only percent herbaceous and grassy cover co-varied significantly with percent canopy cover; two were removed from subsequent analysis, leaving canopy cover. Percent canopy cover and percent forbs varied significantly between flushing and nesting. 20 of 22 nests had 50% minimum canopy cover, but flushing locations had a mean of 50%. Forbs are more likely to be found at flush locations (14.8% of cover) as opposed to nest locations (4.3% of cover). Average litter depth varied significantly between roosting (4.4 cm) and brooding (2.35 cm). Average vegetation height varied between flushing (3.78 cm) & roosting (5.52 cm) and roosting & brooding (3.82 cm). The results of this analysis show that these variables are significant indicators of the likelihood of sharp-tailed grouse locations at Crescent Lake. Increasing available cover to above 50% should strongly correspond with nest increase.

EFFECTS OF *MICROCYSTIS AERUGINOSA* ON THE GROWTH AND DEVELOPMENT OF *CULEX TARSALIS* AND *DAPHNIA MAGNA*

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Microcystis aeruginosa is a form of cyanobacteria that causes large blooms in bodies of water. This cyanobacterium produces a toxin that has been shown to cause health problems for many different species, including mammals. Thus, when this cyanobacterium blooms, it makes the lakes unsafe for recreation. This study looked at the effects of the cyanobacterium on *Culex tarsalis* (mosquito) larvae and pupae and *Daphnia magna* (daphnia). Naturally occurring *M aeruginosa* was placed in containers with either *C. tarsalis* larvae, pupae, or small populations of *D. magna*. The *C. tarsalis* were largely unaffected, as nearly 100% reached adult stage, except for those in the highest concentration of *M. aeruginosa*. The *D. magna* experienced increased growth rates in high concentrations of *M. aeruginosa*. It is possible that *D. magna* benefits from *M. aeruginosa* by using the cyanobacteria as a food source. If true, then it is possible that the blooms of *M. aeruginosa* could be due to a lack of aquatic predators. The toxin levels of the water containing daphnia were tested, and the results will be presented.

THE EFFECTS OF BURN FREQUENCY ON SPECIES RICHNESS AND ABUNDANCE OF ARTHROPODS IN TALL GRASS SAVANNA

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An investigation of prescribed burning affects on the arthropod abundance and species richness of oak savannas that have experienced 30+ years of prescribed burns. Using the sweep net sampling method over three years, 3,816 specimens representing approximately 11 orders were collected. A burn gradient was used to compare abundance and species richness. Lower frequency burns increased both species richness and abundance overall in the savannas. Only one order showed an effect at that level to increased burn frequency: Orhtoptera. As burn frequency increased Orthoptera experienced a negative response to increased burn frequency. Prescribed burns are necessary to maintain savannas and prairies but do not greatly impact the arthropod populations and diversity.

A COMPARISON OF GENETIC CHANGES BETWEEN LONG TERM AND SHORT TERM MICROHABITATS WITHIN THE TALLGRASS PRAIRIE IN *ANDROPOGON GERARDII*

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Andropogon gerardii (big bluestem) is a dominant long-lived grass in the tallgrass prairie. Over time this grass has had the opportunity to adapt and evolve to many different microhabitats within the tallgrass prairie ecosystem. Because *A. gerardii* is extremely long lived, and found in different stable microhabitats within the tallgrass prairie, it is an ideal plant for use in tracking genetic changes due to natural selection. Plant samples were taken from Konza Prairie Biological Research Station, which has two unique stable microhabitats. A comparison between plants found within uplands and lowlands represented our long term microhabitat plots (in existence for several thousands of years). For our short term samples, we used plants within 1 year and 20 year burn frequencies (plots have been established for 36 years). To determine genetic differences, samples were analyzed using Amplified Fragment Length Polymorphism (AFLP). Results will be presented at the Nebraska Academy of Science.

BRINS FIRE: ONE YEAR POST WILDFIRE AQUATIC COMMUNITY RESPONSE IN OAK CREEK, AZ

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Wildfires can influence the heterogeneity and bio-diversity of aquatic ecosystems through ash deposition and increased sedimentation from run-off during post-fire storms for extended periods of time. In June of 2006 the Brins Mesa fire burned 4,317 acres in and around Oak Creek Canyon and deposited large amounts of ash, soil, and debris in Oak Creek by monsoon rains the autumn following the fire. To gauge the impact of the debris flow on the stream ecosystem, over a period of one year we measured macroinvertebrate density, biomass, and composition as well as the hydraulic properties of the stream. Our results revealed that macroinvertebrate density estimates varied significantly by site and season, with Site 1 having about 40% more during the collection period. Site 1 macroinvertebrate density varied the least, by about 38% between collections, while Site 2 and Site 3 varied by 93 and 96%, respectively. Trichoptera and Ephemoptera were abundant at Site 1 and were rare at sites 2 and 3. In contrast Chironomid (Diptera) densities at Site 2 and 3 were 75% higher compared to Site 1 indicating a compositional response to the fire impacted site. We have determined that the run-off from the Brins Fire can be detected all the way to the confluence of Oak Creek and the Verde River. Little attached filamentous algal growth was observed at any of seven collection sites in July 07 while inorganic estimates comprised more than 94% of the material collected on the cobbles downstream of the debris flows. Sustained monitoring is required to fully understand the Brins Fire and Oak Creek ecosystem interaction. We also suggest that priority be given to the riparian-upland interface (RUI) in order to protect the few riparian and stream communities left in the Southwestern United States.

ARACHNID POPULATION RECOVERY IN A RESTORED TALL GRASS PRAIRIE

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Most of the original tallgrass prairie ecosystem has been developed and replaced; remnant and restoration sites provide much of what is known about this endangered ecosystem. By understanding the rate and extent at which arachnids can reestablish themselves within a restored tallgrass prairie we can make inferences about the effectiveness of current restoration techniques. Pitfall traps were used to collect arachnid samples at Spring Creek Prairie Audubon Center located near the town of Denton, Nebraska. Four different prairie sites were sampled. Site one was an undisturbed remnant prairie section, site two was reseeded in 2005, site three was reseeded in 2006, and site four had not yet been actively restored in any way. Each site was sampled using four 50 meter transects consisting of 5 pitfall traps placed roughly 10 meters apart. Preliminary results suggest that species composition and arachnid size may significantly differ between sample sites. Full results will be presented.

LENGTH OF N-TERMINAL EXTENSION DOES NOT AFFECT PEPTIDE PRESENTATION BY MHC I

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MHC class I molecules bind intracellular peptides 8-10 amino acids in length for presentation on the cell surface as complexes (pMHC I) for immunosurveillance by $CD8^+$ T cells. Processing of extended peptide precursors occurs in both the cytoplasm, where the proteasome trims their C-terminal ends, and

in the ER, where the aminopeptidase ERAAP performs N-terminal trimming to generate the final antigenic peptides. N-terminally extended peptides transported into the ER bind to MHC I prior to trimming by ERAAP. This "template model" in which ERAAP trims only the N-terminal residues that extended out from the MHC I peptide binding cleft is supported by the experimental observation that in that absence of MHC I, ERAAP destructively trims peptides. *In vivo*, some endogenous peptide presentations are decreased in the presence of ERAAP, suggesting that such peptides are outcompeted by other extended peptide precursors for binding to MHC I and are destroyed by ERAAP. It is not known, however, what lengths of N-terminally extended peptide precursors can bind to MHC I. Our experimental goal was to determine whether variability in the length of N-terminal extension affects peptide presentation by MHC I. ERAAP-TAP double-deficient mouse fibroblasts were transfected with vectors encoding for SVL9, a fully-processed antigenic peptide, and WI9 antigenic peptides with various lengths of N-terminal extensions. ER translocation signals ensured the two peptides were coexpressed in the ER. LacZ-inducible T cell hybridoma were used to quantify the amount of SVL9 presented by MHC I on the cell surface. We found that none of the N-terminally extended WI9 peptides were able to reduce SVL9 presentation, suggesting that the peptide precursors with N-terminal extensions were unable to compete with SVL9 for binding to MHC I in the ER under these experimental conditions.

TIMING AND PRODUCTION OF A QUORUM SENSING MOLECULE IN *MYCOBACTERIUM SMEGMATIS* AS SEEN ON BACTERIAL LAWNS OF *STREPTOMYCES GRISEUS* AND *STREPTOMYCES COELICOLOR*

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Quorum sensing is a process that occurs naturally in the life cycles of many species of bacteria. It is a process that is density dependent and can be beneficial to the growth, pathogenesis, bioluminescence and/or DNA transfer of the bacteria. The quorum sensing system of many strains of *Streptomyces* is well understood and thus makes a good model for understanding similar processes in *Mycobacteria*. Because of the many similarities between *Streptomyces* and *Mycobacteria*, it is hypothesized that *Mycobacteria* exhibits a similar quorum sensing system that will interact with strains of *Streptomyces*. A growth curve was developed for the life cycle of *Mycobacterium smegmatis*, a nonpathogenic form of *Mycobacteria*, in order to determine when this molecule is produced.

THE CELLULAR LOCALIZATION AND ACTIVATION OF TOLL-LIKE RECEPTOR 3 SIGNALING IN PULMONARY MUCOSAL EPITHELIAL CELLS

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The respiratory epithelial tissue lining our airways serves as a mediator and barrier between the outside environment and the human body. Epithelial cells lining the airway have been shown to respond to the presence of microorganisms by activating inflammatory pathways via a class of proteins called Toll-like receptors (TLRs). Because airway epithelium comes in contact with numerous potential pathogens, mechanisms of TLR activation have become increasingly interesting to researchers. Confocal microscopy and immunofluorescent staining techniques were utilized to verify TLR3 protein expression in cultured human bronchial epithelial cells. Experiments performed using these techniques showed the presence of TLR3 in the cytoplasm, but not on the surface of the cells. Additional experiments were performed to evaluate effects of stimulation with a synthetic TLR3 ligand, poly I:C. Treatment of cells with poly I:C was found to induce a signal transduction cascade, measured by activation of the transcription factor

NF-κB. Results from these experiments indicate that an in vitro system has been established to investigate TLR3 signaling and its role in activating innate and adaptive immune responses in the human bronchial epithelium. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

PHYSIOLOGICAL RESPONSES OF CALU-3 CELLS TO INFECTION BY SELECTED BACTERIAL NOSOCOMIAL BACTERIA

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Nosocomial infections are secondary infections acquired during treatment in a hospital setting. The majority of nosocomial infections are caused by bacterial infections, and the four most common bacteria associated with nosocomial infections are *Entercoccus faecalis*, *Staphylococcus aureus*, *Escherchia coli*, and *Pseudomonas aeruginosa*. The goal of this project is to determine the physiological response of host tracheal cells to infection with selected bacteria, compared to that of a normal, uninfected control. The CalU-3 cell line, a human lung adenocarcinoma, was used as the host cell. Host cells were cultured for 24-48 hours or until approximately 30-50% of the plate was covered. Host cells were then infected with one of the four bacterial species (*E. faecalis*, *S. aureus*, *E. coli*, and *P. aeruginosa*). Light micrographs of all co-cultures were taken at time intervals of 0, 2, 4, 8, 12, and 24 hours. At 2 hours post-infection, ELISA was used to detect IL-8 production by the host cell in response to bacterial infection, a cellular indication of injury and/or stress. Morphological cell damage was documented using both light and scanning electron microscopy at time intervals of 0, 2, 4, 8, 12, and 24 hours post-infection. Whole cell protein extracts were prepared from host cells only, infected cell cultures, and pure bacterial cultures at 0, 2, 4 8, 24 hours. Regardless of the bacterial species used for infection, host cells experienced similar degrees of morphological damage and were dead within 6 to 8 hours. Cultures infected with gram-negative bacterial species (*E. coli* and *P. aeruginosa*) showed more IL-8 than cultures infected with the gram-positive species. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

COLLEGIATE ACADEMY
BIOLOGY
SESSION B

CLONING, OVER-EXPRESSION AND PURIFICATION OF inlB GENE/PROTEIN FROM *LISTERIA MONOCYTOGENES* FOR POSSIBLE USE IN DRUG DELIVERY

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Listeria monocytogenes is a food-borne pathogen that has an exceptional ability to invade mammalian host cells that would normally not internalize bacteria. The bacterial surface proteins Internalin A and B (inlA and inlB) play an important role by initiating phagocytosis in the host cells. This unique ability may make these proteins good candidates for drug delivery modules. To assess this possibility, the InlB gene was cloned into a his-tagged plasmid and attempts were made at isolating the overproduced protein. Successful inlB isolation would allow for future attachment to drugs of interest and evaluation of the ability of InlB to induce the phagocytosis that drug into human cell lines.

This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

INHIBITION OF LACTOSE UTILIZATION, VIA PLANT EXTRACTS, IN MICROORGANISMS OF MILK AS ANALYZED BY O-NITROPHENYL -β-D GALACTOPYRANOSIDE (ONPG) ASSAYS

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Common bacteria that can contaminate drinking milk include *Pseudomonas, Lactococcus, Lactobacillus, Campylobacter jejuni, Escherichia coli, Listeria monocytogenes, Salmonella,* and *Yersinia enterocolitica.* Certain micro-organisms cause the spoilage of milk through the fermentation of milk sugar (lactose) by the enzymes associated with the lac operon. The purpose of this project was to study test conditions that may increase the shelf life of milk via inhibition of enzymes that metabolize lactose to an acid end product. Using the natural micro-flora found in milk, O-nitrophenyl-β-D glactopyranoside (ONPG) assays were carried out in the presence of low levels of plant extracts. Tarragon, Rosemary, Cilantro, and Oregano plant extracts were assessed through ONPG assays. Initial results indicate that Cilantro significantly slowed lactose utilization by *Escherichia coli.* Tarragon, Rosemary and Oregano showed no significant results at this time. This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

***LISTERIA MONOCYTOGENES* VIRULENCE GENE REGULATION AS ASSESSED THROUGH NORTHERN BLOTTING UPON EXPOSURE TO HOTDOGS**

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Previous in house spotted arrays indicated that *Listeria monocytogenes* 4b (high pathogenicity) and ½a (lower pathogenicity) regulated a number of virulence genes similarly upon exposure to human cells grown in culture. This study was designed to examine the two serotypes' virulence gene regulation following exposure to ready-to-eat foods (hotdogs), via Northern Blot analysis. Genes identified as up or down regulated (through previous spotted arrays) upon exposure to human cells lines were utilized as probes along with constitutively expressed control genes. Results may be useful in understanding why there is variation in the pathogenic properties of these two strains of *L. monocytogenes*.

This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

***LISTERIA MONOCYTOGENES* VIRULENCE GENE REGULATION AS ASSESSED THROUGH RT-PCR UPON EXPOSURE TO HOTDOGS**

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Listeria monocytogenes is a gram positive, rod shaped bacterium with the ability to cause a serious infection called listeriosis. There are approximately 2,500 cases of listeriosis each year in the United States, generally due to the consumption of *L. monocytogenes* on "ready to eat" foods. Previous, in house spotted arrays have shown that many virulence genes show little regulation difference between the virulent 4b strain and the avirulent 1/2a strain of *L. monocytogenes* when exposed to human cells. Thus, it has been questioned whether virulence genes in strain 4b and 1/2a may react differently in foods harboring *L. monocytogenes*. Transcriptional analysis of virulence genes was assessed via RT-PCR utilizing RNA of 4b and 1/2a strains of *Listeria monocytogenes*. Results and implications of RT-PCR testing will be discussed.

This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

QUALITATIVE AND QUANTITATIVE ANALYSIS OF PBCV-1 INFECTION OF CHLORELLA USING BOTH FLUORESCENT MICROSCOPY AND FLOW CYTOMETRY

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For years it has been expected that viruses must have a sophisticated way of entering cells, commandeering their mechanisms, and spreading their own genetic information to more cells. How they do these things has been long-researched. There are many hypotheses, thoughts, and formulations that try to explain what exactly viral particles do which allows them full reign over the cells they infect. Recently, a new hypothesis has come about that tries, one more time, to unwind this elusive process of viral infection and propagation. This new idea can be described by one concept very familiar to the scientific community: oxidation-reduction. It has been proposed that host cells, after a viral particle has entered, somehow change the internal oxidation-reduction environment so as to slow down any attempt the virus makes early in the infection process to replicate and lyse the host cell. This was first hypothesized by researchers in Dr.James Van Etten's laboratory at the University of Nebraska–Lincoln, and has been heavily researched since that time. This particular study was done on Chlorella, an algal genus that is very easily grown and sustained in a laboratory environment. These Chlorella cells were infected with the PBCV-1 virus, and then viewed using traditional and fluorescent microscopy, as well as run through a flow cytometer so as to obtain quantitative data as well as qualitative data in the form of images of the Chlorella cells.

MEASUREMENT AND ANALYSIS OF PLANT HEIGHT, SECOND-STAGE JUVENILES, FECUNDITY, AND REPRODUCTION FACTORS IN SOYBEAN CYST NEMATODES, *HETERODERA GLYCINES*

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The soybean cyst nematode *Heterodera glycines* (SCN) is economically important pathogen of soybean production regions of the United States. Two experiments were conducted to evaluate efficacy of seed treatment product to manage SCN in an artificial setting. One experiment was conducted to determine infectivity rates of SCN second-stage juveniles. The other experiment was designed to determine reproduction rates of SCN by counting number of cyst produced, fecundity, and reproduction factor after 30 days. Significant differences were noticed in plant height and second-stage juveniles while there was no significant difference noted in fecundity and reproduction factors.

BROWN MIDRIB SORGHUM WITH TWO DIFFERENT GENOTYPES THAT AFFECT THE LIGNIN PATHWAY WHICH MIGHT HELP PROTECT AGAINST PATHOGENIC AND NON-PATHOGENIC *FUSARIUM* SPECIES

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Three different genotypes of sorghum were grown in two different locations within Nebraska. The genotypes were brown midrib-6 (bmr-6), bmr-12 and wild-type used as a control. The brown midrib trait results in reduced lignin content within the plant. After the sorghum seeds were harvested they were plated on DCPA and PCNB to obtain the possible fungus living on the seeds. These isolations of *Fusarium* were identified using PCR with primes EF1 and EF2. *Fusarium thapsinum*, a pathogenic *Fusarium*, was the most common species found on all three genotypes of sorghum. When the species of *Fusarium* that inhibited the bmr-6 sorghum were compared to the species on the wild type sorghum there were few differences; however, the sample size may have been too small to fully determine the effects

these genotypes have on the *Fusarium* species distribution. Sorghum of genotype bmr-12 had more *Fusarium thapsinum* species than the wild type sorghum; one would suspect the opposite result. The bmr-6 and bmr-12 genotypes both play a role in stopping part of the lignin pathway in sorghum. It is suspected that this might causes a build up of toxins within the plant, which could potentially help in protecting the plant against certain *Fusarium* species. The results show a trend that bmr-12 reduced the nonpathogenic species of *Fusarium* while the pathogenic species were able to thrive, perhaps because they are able to break down these toxins produced by the plant.

ALCOHOL ATTENUATES TRACHEAL AIRWAY SMOOTH MUSCLE CONTRACTION

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Alcohol adversely affects the lungs by increasing the incidence of bacterial infections and impairing cilia function. One clinical study showed that alcohol altered airway responses in cases involving alcohol-induced asthma. However, few studies have tested how alcohol affects airway smooth muscle (ASM) cells, the main source of airway constriction which leads to the wheezing and trouble breathing experienced during asthma attacks. We hypothesized that alcohol exposure will attenuate ASM cell contraction. Cultured bovine and rat ASM cells (BASM and RASM, respectively) were exposed to bronchoprovocant agents as well as 100 mM ethanol. Bovine and rat cells exhibited contraction when exposed to the bronchoprovocants methacholine (MCh) and serotonin (5-HT). In response to MCh, BASM cells decreased 63% in length and 65% in area, while RASM cells decreased 54% in length and 64% in area when compared to cells at baseline. Ethanol pretreatment resulted in an attenuation of contraction. Cells decreased 13%, 18% in length (BASM and RASM, respectively) and 13%, 17% in area (BASM and RASM, respectively) in response to MCh when treated with ethanol. The cells exhibited a significant decrease in contraction when exposed to ethanol, signifying that ethanol attenuates ASM contraction in response to bronchoprovocant agents. In summary, bovine and rat airway smooth muscle cells in culture contract when exposed to MCh and 5-HT, and pretreatment with ethahol blunts this contraction.

AN ANALYSIS OF INPATIENT CARE FOR CHRONIC RENAL FAILURE IN THAILAND UNDER THE UNIVERSAL COVERAGE SCHEME

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Thailand is a developing country with three medical health plans; private health insurance, social security, and universal coverage (UC) scheme. The number of patients with chronic renal failure has increased between 2004-2007 and most are under the UC. In this paper, we analyzed the quality of important care for chronic renal failure and used those data to assess the positive and negative points of the UC. We used the inpatient claim database for the fiscal year 2005 from the Central Office for Healthcare Information for the analysis. All admissions with the diagnostic codes compatible with chronic renal failure were included. All cases were evaluated for hospital admission, diagnosis, procedures, recovery, improvement rate, the total hospital charge, discharge rate, and comorbidities in chronic renal failure patients. To validate all of the data that we found, we presented the findings to a panel of medical professionals at Chulalongkorn Medical University. There were 45,326 chronic renal failure patients who accounted for 83,734 admissions in 929 hospitals. One-third of the patients had multiple

admissions and 95% had multiple co-morbidities. One thousand and sixteen admissions were recorded receiving therapeutic substances injection. Four patients had been recorded twice as dead and 423 males were admitted for labor. Hemodialysis and peritoneal dialysis were found in many admissions, although they were not covered in the benefit package. There were inaccuracies in the information about diagnosis, procedural coding, hospital charge, and discharge status in the database, whereas the patient demographic information in the database was valid.

OVER-EXPRESSION OF GLI1 IN B-CHRONIC LYMPHOCYTIC LEUKEMIA PATIENTS WITH POOR CLINICAL OUTCOME

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B-cell Chronic Lymphocytic Leukemia (B-CLL) is the most common form of leukemia found in adults. Although clinical outcome is very heterogeneous, prognostic markers could predict the progression of the disease. Among the different prognostic markers, chromosomal abnormalities including 11q23 Del, 17p13 Del and trisomy 12 are associated with poor clinical outcome. Markers associated with good clinical outcome include 13q14 Del and normal karyotype. In spite of the understanding of these prognostic markers, the mechanism of disease progression is not clearly understood. Therefore, identification of molecular targets for therapy would aid in treatment of patients with poor clinical outcome. Emerging evidence from the pathogenesis of several cancers suggests that GLI signaling may have potential in B-CLL also. Therefore, we have investigated the expression of GLI1 and associated signaling molecules in poor clinical outcome and compared them with good clinical outcome by using a micro array chip containing oligonucleotides for 10,000 genes. The over expression of GLI1 by micro array analysis was confirmed with real-time PCR. Up-regulation of GLI1 was associated with significantly shorter time to treatment compared to lower GLI1 expressing B-CLL patients suggesting the role of GLI1 in the pathogenesis of poor clinical outcome B-CLL. Furthermore, the over-expression of SUFU, BCL2, and GLI2 in the micro array data analysis were also associated with rapid disease progression. Together, these results suggest that GLI1 may be involved in the pathogenesis of B-CLL, and by further exploring these mechanisms and targeting them there may be the potential to develop efficient therapy for B-CLL. This work was supported by Lymphoma Research Foundation, New York, NY and NIH grant number P20 RRO16469 from the INBRE Program of the National Center for Research Resources.

SEASONAL COMPARISON OF VITAMIN D LEVELS IN PATIENTS WITH CYSTIC FIBROSIS

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The increasing median life expectancy of patients with cystic fibrosis has increased our awareness of the issue of vitamin D deficiency. Chronic vitamin D deficiency results in low bone mass density (BMD) and osteoporosis. Therefore, new guidelines need to be developed for vitamin D supplementation of CF patients. Vitamin D is acquired either by performed vitamin D, which is ingested, or by sunlight exposure. Performed vitamin D is not widely dispersed in the American diet and there are seasonal variants in sunlight exposure. This study's aim was defining the best time of year to check vitamin D levels in cystic fibrosis patients at the Nebraska Regional Cystic Fibrosis Center. A retrospective study was conducted with 248 patients at the Nebraska Regional Cystic Fibrosis. The study found that better

health (FEV1 and BMI) does not necessarily improve a patient's vitamin D levels. Vitamin D levels are not necessarily affected by seasonal change. Vitamin D can be checked with relative accuracy during any season.

FORMATION OF SYNCYTIA BY CAT LUNG CELL LINE AFTER CO-CULTURE WITH BOVINE LEUKEMIA VIRUS-INFECTED FETAL LAMB KIDNEY CELLS

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Bovine leukemia virus (BLV) infects up to 40% of cattle in the United States. BLV belongs to the family of C-class retroviruses that also includes human T-cell leukemia viruses 1 and 2. BLV often has no observed effect in the infected cattle, but some cases develop persistent lymphpocytosis and tumors (most commonly, but not limited to, the lymph nodes). Approximately 80 to 100 nm in diameter, BLV is coated by a lipid envelope, and uses a reverse transcriptase to transcribe the viral RNA into double stranded DNA. Once the RNA has been transcribed, integrase, another necessary enzyme, merges the newly formed DNA into the host genome, where it is replicated along with the host DNA. In vitro infection of CC81 cells with bovine leukemia virus causes the formation of multi-nucleated cells known as syncytia. Syncytia formation is very useful in the lab, due to its ability to show that viral proteins are being expressed within the cell. We compared three methods of exposure of CC81 cells to BLV: placing CC81 cells in direct contact with 1) centrifuged BLV supernatant; 2) filtered supernatant and 3) adding persistently BLV-infected FLK cells to Transwell inserts and placing the inserts in CC81 cultures. Experiments have shown that filtered, cell free supernatants either contain small amounts of virus or that the virus does not infect well in a cell-free solution. Using Transwell inserts with a pore size of 8.0 um, it was determined that low levels of FLK/BLV cells are needed to infect CC81 as long as CC81 cell concentrations are low. Previous studies have also shown that lymphocytes from BLV-infected cattle will spontaneously proliferate when cultured in vitro. In a second set of experiments, supernatants from BLV-infected FLK cells were added to uninfected bovine peripheral blood mononuclear cells (PBMC), and cell proliferation was measured by a BrdU incorporation ELISA. After culturing these cells in 96-well plates for 48 hours, BrdU ELISA was performed, and the results show that the supernatant-treated cells proliferated at a rate similar to cells treated with the mitogens ConA and PHA. Further studies should help us to define the specific mechanism(s) by which BLV infection results in cell proliferation, and perhaps even tumor formation.

THE $p16^{INK4a}$ ANTIBODY AS AN EARLY DETECTION INDICATOR OF CERVICAL INTRAEPITHELIAL LESIONS ASSOCIATED WITH THE INTEGRATION OF THE HUMAN PAPILLOMAVIRUS IN CERVICAL BIOPSIES

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In cervical tissue, the overexpression of p16 has been linked to cervical neoplasia caused by the high risk human papillomaviruses (HPV's). The goal of the study was to evaluate the effectiveness of $p16^{INK4a}$ antibody as an indicator for the detection of varying grades of cervical intraepithelial neoplasia (CIN) within cervical biopsies. Twenty-two slides of cervical biopsies were stained utilizing the p16 antibody. Of these, twenty (91%) showed specific staining associated with the overexpression of p16. The slides were also given grades of positive, equivocal, and negative depending on the staining pattern examined. Overall, p16 is a useful diagnostic aid for determining cervical neoplasia caused by the human papillomavirus in cervical biopsies.

USE OF A BALB/C-RAG2$^{-/-}\gamma_c^{-/-}$ HUMANIZED MOUSE MODEL TO EVALUATE HUMAN IMMUNODEFICIENCY VIRUS TYPE 1 IMMUNOPATHOLOGY AND THE EFFICACY OF AN HIV-1 VACCINE CANDIDATE

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For the past few decades, several models of immune-deficient mice have been developed as a convenient way to study human disease pathology outside of human subjects. This study makes use of BALB/c-Rag2-/-γc-/- mice reconstituted with CD34+ human hematopoietic stem cells isolated from human umbilical cord blood samples to study the immunopathology of a well-characterized HIV-1 virus isolate, subtype C HIV-1C1157. Here we establish the humanized BALB/c-Rag2-/-γc-/- model for the pre-clinical screening of HIV-1 vaccine candidates. A replication-deficient, recombinant DNA adenoviral vector (rAd5) containing the HIV-1 envelope proteins gp145ΔCFI and gp140ΔCFI, was administered to mice prior to viral challenge. Low non-protective levels of HIV-1 binding antibodies and Ad5 neutralizing antibodies were detected. After viral challenge a significant decline in naïve CD4+ helper T-cells and CD8+ effector T-cells was observed in the lymphoid tissue of the vaccinated group. We conclude that the engrafted human immune system did indeed have the ability to mount some humoral and cell-mediated response to the candidate vaccine, and revealed possible negative effects of the rAd5 vector for delivery of HIV-1 vaccine.

CONCENTRATION-DEPENDENT INHIBITION OF BOVINE LEUKEMIA VIRUS INFECTION BY ANTIVIRAL AGENTS

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Bovine leukemia virus (BLV) is an oncogenic, C-type retrovirus, similar to human T-lymphotropic virus (HTLV), and is transmitted primarily by the exchange of bodily fluids (such as milk). While typical BLV-infected animals are largely asymptomatic, approximately 1-3% of infected cattle develop 'enzootic bovine leukosis,' a malignant lymphoma originating from the lymphocytes, which results in considerable economic loss. Our research attempted to effectively inhibit BLV by exposing the virus to increasing concentrations of one of several antiviral agents in a syncytia-forming assay performed over a 24-hour period of time. To perform this assay, uninfected CC81 cells were co-cultured with viral-infected FLK cells in the presence or absence of each antiviral agent. The results of the assay and the subsequent effectiveness of the inhibitor were based on the quantity of syncytia (multinucleated cellular masses) formed in comparison to the control. Preliminary data using the drugs azidothymidine (AZT) and ribavirin as potential inhibition agents indicated significant inhibition of the virus, suggesting that both AZT and ribavirin may make acceptable inhibitors of BLV. This system may also prove to be a useful model for developing and testing new treatments for HTLV. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

PRODUCTION OF ANTIBODIES SPECIFIC FOR *LEPTOSPIRA CANICOLA, L. HARDJO, L. POMONA, L. ICTERO,* AND *L. GRIPPO* USING TRITON X-114 EXTRACTION AND SURFACE IMMUNOPRECIPITATION

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The goal of our study was to find ways to isolate specific bovine antibodies for five separate species of the genus *Leptospira*. Antibodies from two different lots of cattle serum were precipitated and purified. A surface immunoprecipitation was used to expose the antigen on the surface of the cells to be used for later experimentation. Another method to help accomplish our goals was a Triton X-114 extraction used to remove the leptospiral outer membrane to expose the proteins on the membrane. All proteins from the surface immunoprecipitation experiments were separated on a Nu PAGE gel. Anti-grippo antibodies, not specific for a certain species of Leptospire, were washed with other Lepto antibodies in the hope of purifying the antibodies and making them specific for *L. grippo*. A western blot test was used to separate proteins on all the surface immunoprecipitated samples to test antigens on the surface of the cell using anti-grippo specific and non-specific antibodies. The antigen could not be detected in the western blot using anti-grippo specific and non-specific antibodies. The procedure could be changed to use larger quantities of antibody to react with antigen. Such a small amount of anti-grippo antibodies were obtained from experimentation that they were insufficient to detect the Lepto protein antigens present from the surface immunoprecipitation procedure.

EVALUATION OF POSSIBLE REFERENCES FOR AN ELISA USED FOR TESTING THE POTENCY OF A VACCINE

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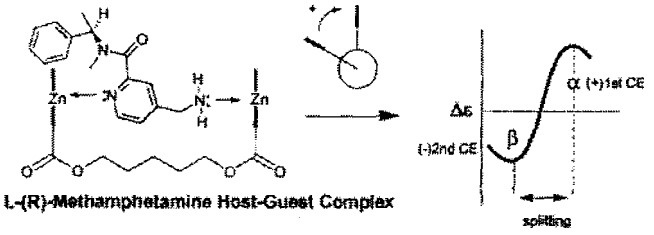
When an animal vaccine company is trying to license a new vaccine with the USDA, there are three main components that it must demonstrate: potency, efficacy, and safety. Vaccine potency refers to the amount of antigen present in a vaccine; a company must be able to show that they can consistently achieve the amount of antigen that is required for an effective vaccine, without a great deal of variation between batches (or serials) of vaccine. Typically, there is also a need to establish a reference, or a standard, for whatever test is being used to determine vaccine potency. In this study, five different serials were tested to be potential references in a bacterial potency ELISA for use in formulating an animal vaccine. The ELISA was used to find the relative potencies of the bacterial lots, and was used to plot antigen dilution curves and to compare the possible references to the old reference. The results from at least five repetitions of five different serials tested in the ELISA showed the antigen dilution curves of each serial were variable from day to day. The fifth and final serial tested, serial 2B, was statistically parallel to the old reference and higher on the dose response curve. This meets the requirements of the USDA and can now be used as the reference in the ELISA.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS
SESSION A

THE USE OF CIRCULAR DICHROISM SPECTROMETRY TO DIFFERENTIATE BETWEEN THE ENANTIOMERS OF METHAMPHETAMINE

Andrea E. Holmes, Mike Guericke, Christa Flitcroft, and Katie Wilcox, Department of Chemistry, Doane College, Crete, NE 68333

Using circular dichroism (CD) spectroscopy, our lab was able to differentiate between the two enantiomers of methamphetamine using commercially available zinc porphyrin tweezers as achiral hosts. The host-guest complex formed with D-methamphetamine produced a negative bisignate-shaped CD couplet, while the complex formed with L-methamphetamine produced a positive one. The addition of the drug-carrier conjugate to the porphyrin tweezer also prompted a bathochromic shift and change in absorbance, indicating a strong binding event. This shift was visibly detectable as well; the porphyrin tweezer was light pink in hexane before the addition of the methamphetamine-carrier conjugate but slightly yellow after the host-guest complex was formed. It is important to distinguish between the enantiomers of chiral drugs like methamphetamine because often the two enantiomers have unique physiological effects. In the future, this porphyrin tweezer technology may be used to form a sensor for the different enantiomers of methamphetamine and other chiral narcotics, and, based on experimental results, may even be used to create a colorimetric sensor for the drug.



This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

EVALUATION OF METHODS TO CAP MOLECULAR FRAGMENTS IN CALCULATING ENERGIES OF INTERACTION IN AVIAN PANCREATIC POLYPEPTIDE

Marcus P. D. Hatfield[1,2], Nicholas Y. Palermo[2], József Csontos[2], Richard F. Murphy[2], and Sándor Lovas[2]. [1]Nebraska Wesleyan University, Lincoln, NE 68504; and [2]Department of Biomedical Sciences, Creighton University, Omaha, NE 68178

The accuracy of the determination of the energy of interaction between Phe20 and the Pro5-Thr6-Tyr7-Pro8 complex inside the hydrophobic core of avian pancreatic polypeptide was investigated using three capping strategies for molecular fractionation with conjugated caps and DFT quantum chemical calculations at the BHandHLYP/cc-pVTZ level of theory. The most accurate determination resulted from acetylation of the α-amino group combined with methyl amidation of the α-carbonyl group, with relative deviations less than 10%. Combinations of hydrogenation of the α-amino group with the replacement of the α-carbonyl group with a hydrogen and the hydrogenation of the α-amino group with methylation of the α-

carbonyl group were less accurate, leading to relative deviations up to 35%. Choice of capping methods depends on the structural features of the polypeptide system, the desired accuracy, and the available computational resources. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

ELECTROGENERATED CHEMILUMINESCENT DETECTION COUPLED WITH MICROCHIP CAPILLARY ELECTROPHORESIS: A GREEN APPROACH TO SEPARATION AND DETECTION

Sarah Fredrick, Sarah Wirth, Matthew S. Burkhead, and Erin M. Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

There is an important movement to generate more environmentally conscious ways of performing chemical research. There is a wide variety ways in which this is being done. A practical application in the field of analytical chemistry is finding ways to minimize the amount of reagent used so as to produce less waste. The goal of the project of this lab is to couple the separation technique of microchip capillary electrophoresis (CE) with the detection method of electrogenerated chemiluminescence (ECL) for the separation and detection of quinolone antibiotics. The current project is working to optimize a micromolded carbon ink working electrode that is inexpensive and simple to fabricate while working to miniaturize a flow system on a chip for the carbon ink electrodes. Specifically, the parameters studied have been to increase the conductivity of the electrodes through modification or pretreatments. All reactions use tris(2,2'-bipyridyl)ruthenium(II) – tripropylamine solution to generate ECL at the working electrode. The optimized system has the potential to be miniaturized onto a microchip for portability and minimal waste.

STRUCTURAL CHARACTERIZATION AND ANALYSIS OF A PRE-QUEUOSINE RIBOSWITCH

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Riboswitches are segments of the 5'-untranslated region of certain bacterial mRNAs that sense specific ligands, change the RNA structure, and as a result modify the expression of protein encoded in the message. In this way, riboswitches act as switches that modulate transcription, translation, or RNA processing once metabolite binding occurs. The pre-queuosine riboswitch provides an essential feedback mechanism for regulating the production of the small molecule, pre-queuosine, which is an intermediate in the pathway that ultimately produces queuosine-tRNA. The presence of queuosine within the anticodon sequence allows wobble base pairing to occur, increasing the number of mRNA target codons that can be recognized. Our research aims to elucidate the structural characteristics of the pre-queuosine riboswitch in order to build a more complete picture of its role in complex biochemical pathways. We have subcloned sequences of interest into a target plasmid and via transformation into bacteria we have produced the desired riboswitch RNA on a large scale. Once we obtain full length, purified RNA, we will test a number of chemical conditions in order to optimize crystal production of the riboswitch. As our research continues, we plan to employ X-ray crystallography to obtain structural details of how the metabolite, pre-queuosine, interacts with its riboswitch RNA.

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OXIDATION REACTIONS OF INORGANIC GASES BY POTASSIUM SUPEROXIDE

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Potassium superoxide, KO_2, is a yellow paramagnetic, oxidizing agent that is used to convert carbon dioxide into oxygen and potassium carbonate. This reaction is used in space capsules, submarines, and by fire fighters to convert carbon dioxide to oxygen in devices called "rebreathers." The purpose of this research was to study the reactions of potassium superoxide and inorganic gases such as CO_2, SO_2, NO_2, NO, CO, and H_2 using 60 mL syringes. The experimental set up consists of two syringes attached to each end of a piece of glass tubing filled with KO_2. In each experiment, 60 mL of gas is passed through a glass tube containing solid KO_2. The product gas is then collected in an empty syringe connected to the other end of the glass tube. The product gases are then analyzed along with the original gas as a control.

DETERMINING OFFSETS BY A SEISMIC REFLECTION SURVEY ON THE STATE-LINE FAULT

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During the summer of 2007 a high-resolution, seismic reflection survey was done on the substructure of the Stateline fault in Stewart Valley, NV. The intent of this survey was to determinine the potential for a an earthquake. Utilizing an active vibration source called a vibrosies, seismic waves were produced and their interaction with the subsurface was investigated. Using Fourier analysis the 20-180 Hz frequency sweep was analyzed and images of the seismic signals were produced. Interpretation of these subsurface images gives information relative to fault offsets, which can estimate the earthquake susceptibility of the arca.

TWO-PHOTON EXCITED FLUORESCENCE INTENSITY-AND LIFETIME-BASED NADH IMAGING TO DETERMINE THE CELLULAR METABOLIC STATE

Meg M. Marquardt[2], LeAnn M. Tiede[1], Michael G. Nichols[1,2] and Richard Hallworth[1].
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Metabolism and mitochondrial dysfunction are thought to be involved in many different hearing disorders including noise-induced hearing loss. The electron carrier nicotinamide adenine dinucleotide (NADH) is a molecule often used to study metabolic changes as it is fluorescent in its reduce form and nonfluorescent when oxidized. Recent studies have shown that metabolic changes lead to a change in the ratio of the free to enzyme-bound fluorophore populations which result in a shift of lifetimes which can affect the intensity of NADH fluorescence emission, leading to errors in intensity-based measurements of fluorophore concentration. To evaluate the impact of these changes, we have recently employed two-photon excited NADH Fluorescence Lifetime Imaging (FLIM). Treatment with both metabolic uncouplers and inhibitors caused systematic shifts in both the lifetime and the free to bound ratio of NADH. Assessment of metabolic state by the intensity-based and lifetime-based techniques will be compared for both monolayer cultures and the hair cells of the excised organ of Corti.

Supported by NIH DC 02053, NSF-EPSCoR EPS-0346476 (CFD 47.076) and NIH P20 RR016469 from the INBRE Program of the National Center for Research Resources.

CONSTRUCTION AND IMPLEMENTATION OF PARTICLE IMPACT DAMPING FOR VIBRATION SUPPRESSION

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Unwanted vibrations occur everywhere in today's mechanical world. Constant efforts are being made to reduce or completely eliminate these vibrations. A simple approach to reducing these vibrations is particle impact damping. To assist in understanding the characteristics of a particle impact damper one was constructed and attached to a series of vibrating beams. The sinusoidal "ring down" of the beams was measured. Analysis was then done to determine the effects of particle size, particle density, cavity space, and number of particle on beam vibration.

INVESTIGATION OF THE IDENTITY AND MECHANISM OF SERUM CALCIFICATION FACTOR IN COLLAGEN MINERALIZATION

Kaylee R. Troxel, Casey L. Gustafson, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Non-collagenous matrix proteins guide and control mineral crystal growth within calcified tissues. Abnormal protein interactions in the bone mineral matrix may contribute to bone diseases such as osteoporosis. Recent studies show that a non-collagenous protein found in mammalian blood serum known as Serum Calcification Factor (SCF) is responsible for the recalcification of demineralized bone matrix. Mineralization studies have been conducted to demonstrate that SCF initiates mineralization of isolated type I and type II collagen with incubation in bovine blood serum. The results of these studies will be presented, including differences in the rate of calcium consumption between complete bone matrix and isolated collagen which suggest a role for other matrix components in the mineralization by SCF. Our attempts to isolate SCF for identification by MS will also be discussed, including a gel electrophoresis/diffusion system to separate and identify SCF. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

SELF HEALING DENTAL COMPOSITES

Josh Steere, Brittany Wertzberger, M. Latta, and S. M. Gross, Department of Chemistry, School of Dentistry, Creighton University, Omaha, NE 68178

Fracture failure is the second most cited reason for failure of composite resin restorations. Our long term goal is to produce composite resin formulas with superior physical properties and augmented clinical survival using novel technology. We propose work that will produce a self-healing so-called "autonomic" healing dental material. The specific hypothesis is that incorporating a dispersed catalyst in an acrylic resin system using a microencapsulated healing agent as a filler will generate materials with enhanced toughness characteristics. Our hypothesis is supported by preliminary success with this approach in a model dental composite using a dicyclopentadiene/olefin metathesis catalyst healing system.

β -CYCLODEXTRIN SUPRAMOLECULAR INCLUSION COMPLEXES AS DUAL GUEST HOSTS

Rachel Steadman, Department of Chemistry, Nebraska Wesleyan University, Lincoln, NE 68504; and C. J. Eckhard and Van Ngyuen, Department of Chemistry, University of Nebraska– Lincoln, NE

Cyclodextrin inclusion complexes have begun to become highly recognized and regarded for their everyday applications in the home, lab, and in industries. β-Cyclodextrin, specifically, has become well known for its uses in both research and in the pharmaceutical industry as a tool to increase stabilization against light, heat, and oxidation, to increase solubility, to mask unwanted physiological effects, and to reduce the volatility of a guest compound. Most recently, β-Cyclodextrin has begun to be used as a tool to investigate the weak intermolecular interactions in biochemical reactions that are not otherwise possible due to the size of the macromolecular biomolecules. Traditionally β-Cyclodextrin has only been used to insert two molecules of the same guest. The goal of these experiments is to see if β-Cyclodextrin can selectively choose two different guest molecules and if the inclusion complexes are photolyzable. The bulk of the research up to date has been done by attempting to insert different derivatives of coumarin, a highly useful toxin found in plants, through slow evaporation crystallization. The process consisted of placing two coumarin derivatives with β-Cyclodextrin, and applying heat to the mixture until the coumarins dissolved. The samples were then allowed to evaporate at room temperature until crystals formed. Through this process, and by varying the ratios of each compound present, several crystals were successfully formed. To date, none of the crystals that have been analyzed have contained two different derivatives. However photolysis experiments are still being run on crystal samples both in solution and in solid states to see if there is a difference between their reactions to light. In the future, the structures of the other formed crystals should be solved to see if they contain two guest molecules, and possibly an adjustment of the ratios of the experiments that did form crystals could also help precipitate the desired products. Supported by NIH grant number P20 RR016469.

ISOLATION OF NATURAL PRODUCTS FROM HERBAL SUPPLEMENTS

Brittany Van Beek and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

A resurgence of interest in natural remedies has lead to increase demand and use of herbal nutritional supplements. Unlike conventional therapeutic agents (e.g. antibiotics, painkillers, etc.), herbal supplements are currently classified as dietary supplements. As such they have minimal regulation concerning their manufacture and the efficacy of their product. Conventional methods for identification and quantification of nutriceutical components in the native herb often employ time consuming and resource intensive soxhlet extractions. Sporadic reports in the literature have suggested that ultrasonic extraction may be a viable alternative to conventional methods of extraction for nutriceutical compounds in herbal species. To date a majority of these studies have used the extraction method on native, minimally processed plant material with little to no information on commercial products. Results of an ultrasonic extraction procedure of commercial Echinacea supplements will be presented.

CONFIGURATIONAL ANALYSIS OF D- AND L-METHAMPHETAMINE BY THE EXCITON CHIRALITY METHOD

Christa C. Flitcroft and Andrea Holmes, Department of Chemistry, Doane College, Crete, NE 68333

Chiral narcotics, such as both enantiomers of methamphetamine, were derivatized with an N-Boc protected carrier. The resulting conjugate was deprotected and added to a zinc porphyrin tweezer. This complex resulted in strong binding between the porphyrin and two nitrogens of the carrier. This carrier-porphyrin complex is locked in a conformational position that produced a strong bisignate circular dichroism (CD) spectrum. The sign of the CD couplet is based on the absolute conformation of the chiral center. For example, the L-methamphetamine has an R-configuration that resulted in a clockwise twist of the porphyrin which led to a positive CD couplet. The entantiomer produced the mirror image.

The project is supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources and by the NSF (DUE-0633462).

MATERIAL PROPERTIES OF PROTEIN NANOFIBRILS

Jennie Burns, College of Arts and Sciences, Creighton University, Omaha, NE 68178

Protein fibrils are nanotubes associated to debilitating diseases such as Alzheimer's. Currently, the self-assembly and material properties of such structures are largely unknown. The investigation of these material properties, such as their elastic properties and their interaction with the surfaces of various materials, could provide vital information in understanding their self-assembly, structure, and effect on biological materials. These properties will also shed light on the common structural and mechanical principles governing all protein nanofibrils. Understanding the mechanical properties of nanofibrils also has potential applications in biomedicine and biosensors. Our study uses computational biomolecular models of short linear Alzheimer's peptides to assess these properties.

LOCALIZATION AND GENETIC ENGINEERING OF A NOVEL COILED COIL-HELIX COILED COIL-HELIX DOMAIN CONTAINING PROTEIN, CHCHD6

Shea Welsh and Sharmin M. Sikich, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

The novel protein Chchd6, which contains a coiled coil-helix coiled coil-helix (CHCH) domain, has an uncharacterized subcellular localization and function. The CHCH domain contains two cysteines within each helix structure in a C-X_9-C motif. This domain has been found in other mitochondrial proteins, namely Cox17, which is a copper binding protein thought to be required for the metallation of the Cu_A center of a mitochondrial transmembrane protein; as well as Mia40, a protein that assists in translocating proteins into the inner-membrane space. Functions of these known proteins were noted as attempts were made to define the function of Chchd6. With the intent of observing the effects of designed mutations in the sequence, a PROSITE® motif search found post-translational modification sites that offered possible mutation points. By mutating these specific sequences and observing mammalian-expressed wild-type and mutant proteins in an epifluorescent scope, it may be possible to better understand the localization of Chchd6. Sites of interest include cAMP-dependent phosphorylation sites as well as N-myristylation sites. The desired mouse ChChd6 DNA sequence was cut from the cDNA cloning vector, pDNR-LIB, and ligated into the vector pEGFP-N3, in order to express a GFP-tagged Chchd6 protein in mammalian cells for observation. With the GFP-tagged protein, we hope to determine localization of Chchd6.

This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

INVESTIGATION OF MAGNETIC DAMPENING ON A NON-FERROMAGNETIC AIR TRACK

Geoffrey Bergman, Department of Physics, Hastings College, Hastings, NE 68902

Eddy currents as an electrical phenomenon are found in a wide variety of magnetic applications ranging from the separation of aluminum cans from other recyclables, to magnetic levitation. Specifically, these currents can be used for the braking of roller coasters and trains with no mechanical wear. An apparatus was constructed using an air track, air cart and Neodymium Iron Boron (NdFeB) magnets to observe the effect of magnetic braking at varying initial cart velocities. Experimental measurements including velocity, induced current, displacement, time and mass were made. Using this data the damping coefficient was determined and thus the resulting damping force .

CONSTRUCTION AND UTILIZATION OF AN ELECTRIC FIELD MILL TO MEASURE THE EARTH'S ELECTRIC FIELD

Heather Finney, Department of Physics, Hastings College, Hastings, NE 68902

The earth has an electric field which is produced and influenced by complex processes that occur within the earth and in the atmospheric layers surrounding it. An electric field mill was constructed to measure this field. To investigate the performance of the field mill various instrument parameters were optimized. Instrument variables that were changed included: plate diameter, plate composition, plate speed, and plate segmentation. After determining the optimal configuration for the field mill, the mill was used to measure the electric field at varying times throughout the day during fair weather conditions and during times of substantial electric field variability that accompanies thunderstorms.

FRACTURE TOUGHNESS AND DYNAMIC MECHANICAL ANALYSIS OF URETHANE BASED DENTAL COMPOSITES

Brittany Wertzberger, M. Latta, and S. M. Gross, Department of Chemistry, School of Dentistry, Creighton University, Omaha, NE 68178

The objective of this study was to compare the fracture toughness of three model dental flowable composites compounded using three urethane dimethacrylate acrylates. Three composite resin formulas were compounded 50% 0.7 μ silanted glass filler and 50% resin (w/w) where the resin components were formulated as follows: 1) urethane dimethacrylate (UDMA) (FW= 470.5) 66%, triethylene glycol dimethacrylate (TEGDMA) 34% 2) dimer acid dimethacrylate (FW = 847) 33%, UDMA 33%, TEGDMA 34% 3) Polyethylene glycol extended UDMA (FW = 1,139) 33%, UDMA 33% TEGDMA 34%. Specimens were light cured in appropriate molds in three overlapping steps using a Spectrum 800 curing light @ 600 mW/cm^2. Specimens were stored in water at 37°C for 24 hours before testing. Fracture toughness (K_{Ic}) was assessed using single edge notch specimens (2.5mm (B) x 5 mm (W) x 25 mm; a/w=0.5) in 3-point bend (n=12). Data was analyzed with ANOVA/Tukey's at $p = 0.05$. The three formulas were statistically different ($p<0.0001$). Both the Dimer acid UDMA and the PEG extended UDMA oligomers increased the fracture toughness compared to the standard UDMA resin. Differences in fracture toughness between the base UDMA and the modified compounds might be attributed to the higher molecular weight of these materials. The Dimer Acid derivatized monomer is believed to perform better than the PEG extended monomer due to the differences predicted in crosslink density in the final composite. The modified UDMA resins increased the fracture toughness of a model flowable composite resin.

A METHOD FOR THE DETERMINATION OF GAUSSIAN 03 SCRF-PCM SOLVENT P ARAMETERS FOR ANY SOLVENT FOR ANY MODEL CHEMISTRY

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Modeling molecules in the solvent environment is very important for the proper investigation of several molecular properties such as solvatochromatic effects, UV/VIS spectra, REDOX potentials, and condensed phase molecualr geometries. The Gaussian 03 RevC.02 software suite has parameters for twenty-four solvents available for use with the Self Consistent Reaction Field – Polarizable Continuum Model (SCRF-PCM). One of the princpal solvents used in our laboratories is *Ortho*-Dichlorobenze, which is not one of the 24 solvents paramertized in Gaussian 03 RevC.02. The importance of condensed phase computations utilizing any model chemistry necessitated the development, in our laboratories, of a method for determing the SCRF-PCM solvent parameters (dielectric constant, molar volume, molecular radius, and density). Herein, we present the results of solvent paramertizaion for the B3LYP/3-21G(*) and B3LYP/6-31G(d,p) model chemistries and a methodology for extending solvent paramertization to any model chemistry.

LUMINESCENT CHEMOSENSORS OF TRANSITION AND HEAVY METAL DOPED ANTHRAQUINONE DERIVATIVES

Rebecca Pinkelman, Department of Chemistry, Chadron State College, Chadron, NE 69337

Luminescent chemosensors are a sensitive method of detecting transition and heavy metal ions. Some of these metal ions are essential for normal physiological functions while others are detrimental to the health and the environment. The luminescent chemosensors have an anthraquinone base and an attached macrocyle that are specific for a certain metal ion. When these chemosensors react with metal ions, high luminescence occurs. Currently there are chemosensors to detect hydrogen, transition, and heavy metals. Three new compounds with shorter macrocyles than previous anthraquinone chemosensors were attempted to be synthesized for more sensitivity for smaller metal cations. Current research to increase selectivity is aimed at improving the effectiveness of luminescent chemosensors.

THE DESIGN, CONSTRUCTION AND ANALYSIS OF AN ACOUSTIC LEVITATION APPARATUS

Christopher Kube, Department of Physics, Hastings College, Hastings NE 68901

Sound is all around us but what is sound? People often experience sound and attribute sound to its source by means of hearing it. Thus, sound is often not thought of as having a physical presence. An acoustic levitation device can give us insight into the physical nature of sound. The device consists of a piezoelectric source and reflector. System characteristics that will be measured and optimized are: cavity pressure as a function of position, reflector size, shape and position and the levitation dependence on object geometries.

THE ROLE OF POLYGLUTAMIC AND POLYASPARTIC ACID SEQUENCES IN HYROXYAPATITE GROWTH

Helen A. Kraye, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Glutamic acid-rich peptides have been shown to induce the formation of hydroxyapatite crystals *in vitro*, probably by providing nucleation sites within the bone matrix. *In vitro* mineralization studies also show that aspartic acid-rich peptides inhibit mineralization of hydroxyapatite crystals, despite the structural similarities between glutamic acid and aspartic acid residues. Using an F-MOC synthesis protocol, polyglutamic and polyaspartic acid peptide chains, of varying length, were produced using a SYNERGY 432A Peptide Synthesizer. The secondary structure determination of these peptides by CD with varying levels of Ca^{2+} ion will be discussed. We will also discuss methods of characterizing the interaction of these peptides with hydroxyapatite crystal surfaces by NMR spectroscopy. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

SYNTHESIS OF 4-(NAPHTHYLMETHYL)-L-HISTIDINE DERIVATIVES FOR STRUCTURE-ACTIVITY STUDIES OF POSITION 10 OF CGRP

Hayley Young and Martin Hulce, Department of Chemistry, and D. David Smith, Department of Biomedical Sciences, Creighton University, 68178-0323

Calcitonin Gene-Related Peptide (CGRP) is a potent vasodilator found in both the central and peripheral nervous systems. N-terminal derivatization of CGRP antagonist CGRP(8-37) together with C4 benzylation at His^{10} substantially increase binding affinity to CGRP receptors. To further investigate the structure-activity relationship of position 10 to CGRP(8-37), a synthesis of 4-(naphthylmethyl)-modified L-histidines was devised. Pictet-Spengler synthesis of diastereomeric 4-naphthylspinacines from L-histidine and naphthaldehydes provides direct access to the desired (naphthylmethyl)-L-histidines following hydrogenolysis. These histidine analogues will be suitably protected for use in solid-phase peptide synthesis.

MACROSCOPIC SCATTERING: RIGID BODY IMPACT OF A BASEBALL ON A BAT

Joshua Tomayer, Department of Physics, Hastings College, Hastings, NE 68902

In recent years physicists have conducted experiments on particle scattering in an effort to better understand the structure of the atom. However, few experiments have dealt with macroscopic objects and scattering. An experiment was conducted on the scattering of a baseball by a baseball bat to determine how the speed and spin of the outgoing ball depends on the scattering angle. Measurements of the tradeoff between the speed and spin for a baseball impacting a bat will be presented. In the experiment, the direct observable parameters of velocity in the x and y direction and angular momentum after collision were measured. The amount of backspin produced was also measured as a function of baseball strike position on the bat.

VARIABILITY IN BULLET MANUFACTURING

Jennifer R. Paulsen and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

During the last quarter of the twentieth century into the early years of the current century comparative compositional analysis bullets and bullet fragments has been regularly used in criminal proceedings. This technique was used to link defendants to crimes where the bullets at the crime scene were too degraded

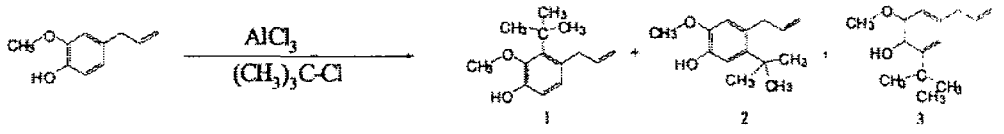
for visual analysis with comparators generated from suspects' weapons. Recently, a report generated by the National Research Council of the National Academy of Science has called into question the robustness of this form of analysis. Results of a study examining variability in physical characteristics as well as chemical characteristics of bullets commercially produced for hand-loaders will be presented.

FRIEDEL-CRAFTS ALKYLATION OF EUGENOL

Jeremy Wilmes, Vanessa Hahn, and David Peitz, Department of Physical Science and Mathematics; and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Several herbs were extracted and screened for antibiotic activity and for suppression of antibiotic resistance in bacteria. Clove oil was selected for further study because of interesting results as well as being able to be studied safely in a typical organic chemistry lab sequence. Clove oil extract was reacted in a Friedel-Crafts alkylation with *tert*-butylchloride to give a possible three products, scheme 1. The mechanism for the formation of these compounds was modeled using Spartan '06 semi-empirical AM1 and DFT computational method B3LYP/6-31G* to aid in product prediction and determination. Based upon intermediate energies, product 3, 2-*tert*-butyl-6-methoxy-4-(prop-2-en-1-yl)phenol was predicted to be the major product (99%).

Results of the reaction, scheme 1, showed three products with the correct M^+=220 and the expected M-15 as the base peak in the GC/MS. The crude products were then compared against clove oil for antibiotic activity and suppression of antibiotic resistance to several classes of antibiotics. A relative 11% mixture of the crude products in clove oil showed no change when compared to clove extracts. Further purification and complete characterization of the products is ongoing and needs be completed to get significant results for activity.



THE SWEET SPOTS AND DEAD SPOT OF A TENNIS RACQUET

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With new technology the game of tennis has become a power sport. As a result big servers are starting to dominate the game. Related to this, there are two areas on the tennis racquet where the ball should be hit to obtain the best results, i.e. maximum velocity. These areas are called the sweet spots. The location of these areas varies from racquet to racquet and is dependent on racquet design. In addition, another important area on the racquet is the dead spot. At this location minimum bounce is obtained. Measurements of bounce height, string force and racquet vibration were made to demonstrate the importance of these racquet characteristics in maximizing serve velocity and smash power.

DETECTION OF ELECTROCHEMILUMINESCENCE BETWEEN FLUOROQUINOLONES AND TRIS(2,2'-BIPYRIDYL)RUTHENIUM(II)

Matthew S. Burkhead and E.M. Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

A flow injection analysis system was used to investigate the electrochemiluminescence between tris(2,2'-bipyridyl)ruthenium(II) [Ru(bpy)] and a class of antibiotics called fluoroquinolones, focusing on enrofloxacin (enro) and ciprofloxacin (cipro). The system was then optimized for several experimental parameters in order to achieve the greatest signal-to-noise ratio possible. These parameters included the voltage applied, flow rate, pH, buffer concentration, organic modifier content, and Ru(bpy) concentration. Limits of quantification (LOQ) and detection (LOD) were calculated for enro (0.16 uM and 0.047 uM, respectively), cipro (0.56 uM and 0.18 uM). These were compared to the LOQ and LOD of tripropylamine (4.0 uM and 1.2 uM). The method was applied to a real-life sample, a pharmaceutical preparation of ciprofloxacin.

DEVELOPMENT OF A FIXED FREQUENCY AEROSOL ALBEDOMETER

Danielle Policarpio, N. Barta, R. DuVall and Jon Thompson, Department of Chemistry, University of Nebraska at Kearney, NE 68849

Aerosol particles suspended in the atmosphere can range in size from 0.01 -> 10 μm. Aerosols can adversely affect human health, degrade visibility, and potentially alter earth's radiative balance. This presentation will describe development of a new technique for the measurement of aerosol albedo at 532 nm. Aerosol albedo is the ratio between aerosol scattering coefficient (k_{scat}) and extinction coefficient (k_{ext}) and is an important parameter which helps predict whether a given aerosol cloud will lead to warming or cooling of the atmosphere. In this work, we have explored the use of cavity ring-down spectroscopy (CRDS) for measurement of aerosol extinction coefficient. Simultaneously, the light scattered from the probe beam was collected by an integrating sphere and used to determine scattering coefficient through calibration with He, air, CO_2, and 1,1,1,2,-tetrafluoroethane (SUVA or R-134a). This feature of the method is unique, as aerosol scattering and extinction can be measured simultaneously on the exact same sample. The cavity ring-down method offered limits of detection of 0.7 Mm^{-1} while detection limits of 2.7 Mm^{-1} was achieved on the scatter channel. We have applied this method to the determination of albedo of several polystyrene size standards, laboratory generated soot surrogates, and atmospheric particles at our location. This highly sensitive method is capable of monitoring particulate pollution, visibility changes, or may find use tracking changes in optical properties of aerosols as they are processed chemically in the atmosphere.

DYNAMICS OF SPEAR THROWING

James Martin, Department of Physics, Hastings College, Hastings, NE 68902

Spear throwing, as a hunting technique, was first utilized and perfected by the ancients. One of the ways that ancient people modified spear throwing by hand was by using a device called an atlatl. The atlatl enhances the throwing power of the human arm by storing energy. The atlatl acts much like a spring, storing and adding energy to the spear. The atlatl can increase spear velocity sixfold. The distance, velocity and power of a spear, when using the atlatl, will be measured and analyzed.

CONDUCTIVITY MEASUREMENTS OF IONIC LIQUID CONTAINING COMPOSITES.

Zachary P.Rosol, E. S. Sterner, E. M. Gross, and S. M. Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

Conductive polymer composites were synthesized by the polymerization of methylmethacrylate in the presence of ionic liquid solvents. Temperature dependent AC impedance measurements were performed on these composites as a function of ionic liquid type, ionic liquid concentration, crosslinker density and molecular weight between crosslinks. As expected, conductivity increased with temperature and percent ionic liquid contained in the composite. 1-butyl-3-methylimidazolium thiocyanate produced composites with a greater conductivity than 1-ethyl-3-methylimidazolium trifluoromethanesulfonimide, in spite of having a higher viscosity. The viscosity of the virgin ionic liquid could not be used to predict the order of ionic conductivity for composites made from these ionic liquids. Crosslinker density and the molecular weight between crosslinks had a limited effect on conductivity, thereby producing conductive materials with a wide range of mechanical properties. As the amount of ionic liquid in the composite decreased, it appeared that there may be an optimum crosslink density for maximum ionic conductivity. The composite with the lowest theoretical molecular weight between crosslinks had the lowest ionic conductivity.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS
SESSION B

EFFECTS OF ANNEALING ON $CuIn_{1-x}Ga_xSe_2$ NANOCRYSTALLINE MATERIALS PREPARED BY SOLVOTHERMAL MEANS

Adam T. Haussler, Anatole Mirasano, Scott A. Darveau, and Christopher L. Exstrom, Department of Chemistry, University of Nebraska at Kearney, NE 68849-1150

In these energy-conscious times, it is imperative to find renewable energy. An obvious choice is the most abundant energy source that people have, the sun. In our group's investigations of the preparation of novel photovoltaic, nanocrystalline $CuIn_{1-x}M_xSe_2$ (M = Ga, Al, B) materials, post-reaction annealing has been found to dramatically impact the purity of the product materials. Following the solvothermal reaction of $CuCl_2$, $InCl_3$, $GaCl_3$, and Se in order to form nanocrystalline $CuIn_{1-x}Ga_xSe_2$ (CIGS), the material was isolated and deposited on a molybdenum surface with a spin coater to create a thin film that was annealed under different temperature (250-900 °C) and pressure (0.001-25 Torr) conditions in a custom-built physical vapor deposition apparatus. Films were then analyzed by micro-Raman spectroscopy before and after annealing. Prior to annealing, Raman analysis showed unwanted species of CuSe and Cu_2Se at 255-260 cm^{-1}. The annealing process facilitates the mixing and reaction of these species with remaining In and Ga. After annealing, Raman spectroscopy revealed that these unwanted compounds were less abundant or eliminated, and the intensity of the CIGS phonon signal (172-182 cm^{-1}) was greater. Effects of specific temperature/pressure conditions and film thickness as controlled by the spin coater will be discussed.

SYNTHESIS OF MONOSUBSTITUTED 1,2,3-TRIAOZLES FROM TANDEM DEPROTECTION/'CLICK' REACTIONS

Matthew E. Keeney and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

1,4-Disubstituted-1,2,3-triazole rings can be synthesized efficiently using Cu-catalyzed Huisgen 1,3-dipolar cycloaddition reactions (commonly termed 'click' reactions). The 1,2,3-triazole ring is an aromatic heterocycle that is isolectronic with imidazole. As monosubstituted imidazoles are important nucleophiles in both biological and abiological environments, it is of synthetic interest to develop new routes to monosubstituted 1,2,3-triazoles deriving from 'click' preparations so that the chemical and physical properties of such molecules can be compared with their imidazole counterparts. The goal of this project was to develop a decarboxylation strategy for synthesizing monosubstituted 1,2,3-triazoles. For this purpose, propiolic acid was reacted with various azides under modified 'click' reaction conditions, and the resulting products were analyzed by ^{1}H NMR spectroscopy. Details of this approach and its success in producing monosubstituted 1,2,3-triazole products will be presented.

THE DIELS-ALDER REACTION AND THE DIFFICULTIES ASSOCIATED WITH AN ACTIVATED DIENEOPHILE

Travis Reed, Megan Kehrli, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, Nebraska 68787

A research based organic chemistry laboratory sequence (involving primarily sophomore students) is being developed in conjunction with our undergraduate research program (primarily Jr. and Sr. students). Clove oil extract, primarily eugenol, was selected because it has an interesting history and can be studied safely in a typical organic chemistry lab. The Diels-Alder reaction was selected because the reaction can be modeled with Spartan '06, and the product gives a good drug score with the OSIRIS Property Explorer at the organic chemistry portal http://www.organic-chemistry.org/.

The reaction transition states and products (4/8 possible stereoisomers) were modeled using Spartan '06 semi-empirical AM1 and DFT computational method B3LYP/6-31G*. Both theories predict the endo transition state to be lower in energy, but differ on the endo/exo product energies, however in all instances the energy differences are less than 6 kJ/mol.

The Diels-Alder reaction was carried out under various conditions with two main approaches: 1. the solvent free refluxing of eugenol and cyclopentadiene and 2. the use of Lewis acid catalyst in THF solvent. The best results to date are with solvent free reflux at 150 °C for 24 hrs to give a relative yield, by GC/MS, of 30% of the Diels-Alder product, 4-(bicyclo[2.2.1]hept-5-en-2-ylmethyl)-2-methoxyphenol. To purify the product, chromatography (TLC and Column) conditions using a 30% (v/v) mixture of ethylacetate/hexane on silica gel was used to isolate the desired product which was the first substance off the column. It was characterized by ATR-IR spectroscopy (3X diamond) and GC/MS.

SYNTHESIS OF CARBOXYLIC ACID FUNCTIONALIZED MULTIDENTATE 1,2,3-TRIAZOLE CHELATORS VIA THREE-STEP ONE-POT TRANSFORMATIONS

Michael G Keeney and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

The conjugation of peptides to organic chelators capable of coordinating metal ions is a means by which to interface the self-assembling, optoelectronic or magnetic properties of organometallic units into biological environments. Bidentate and tridentate organic chelators such as 2,2'-bipyridine and 2,2'-6',2"-

terpyridine have been successfully used for this purpose, but their practical usefulness can be limited by their synthetically demanding functionalization necessary for peptide attachment. The goal of this study was to establish an efficient method to prepare new multidentate chelators capable of coordinating to transition metal ions that incorporate functional groups useful for peptide attachment. This was accomplished by developing a three-step one-pot 'click' reaction to prepare 1,2,3-triazole-containing multidentate chelators functionalized with carboxylic acid groups. The preparation and analysis of these molecules will be presented.

CHARACTERIZATION OF A CONSERVED GLUTAMINE IN THE COILED COIL-HELIX COILED COIL-HELIX DOMAIN OF THE NOVEL MITOCHONDRIAL PROTEIN, CHCHD3

Dena Brock and Sharmin M. Sikich, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

The protein ChChd3 is a novel mitochondrial protein of undetermined function. ChChd3 consists of two domains; 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 and may be important for localization, oxidative folding, and metal binding. Another protein, Cox17, also has a CHCH domain, and is a mitochondrial protein involved in copper metal binding. Through the use of bioinformatics techniques four specific types of phosphorylation sites, as well as glycosylation and myristylation sites have been identified in the protein. These sites may be targets of mutagenesis in future work to determine their involvement in regulation and localization of ChChd3. In this work, a conserved glutamine residue in the CHCH domain of ChChd3 was mutated to an alanine to study the effects of such a mutation.

This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

FABRICATION OF CARBON INK MICROELECTRODES FOR MICROCHIP CAPILLARY ELECTROPHORESIS

Sarah R. Wirth, S.J. Fredrick, and E.M.Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

Electrogenerated chemiluminescence (ECL) uses electrochemistry to start a chemical reaction that produces light. Measurements of the quantity of light produced can be used to find the concentration of the analyte. This project aims to pair ECL with microchip capillary electrophoresis. We fabricated carbon ink microelectrodes using a micromolding technique. Electrodes were deposited on glass slides by suctioning carbon through a 50 μm wide channel. An electrical connection was made to the carbon electrode. ECL was generated using a tris(2,2'-bipyridyl)ruthenium(II) – tripropylamine solution. Cyclic voltammetric scans were performed to generate light and characterize the electrodes. The scans indicated that the electrodes have a large resistance. Gold was electrodeposited on the electrodes, which increased current in the CV scans but decreased the amount of light generated. Pretreatment of the electrodes with sulfuric acid significantly increased the quantity of light collected. The sulfuric acid pretreatment has the potential to be used in the CE-ECL system.

METHOD DEVELOPMENT FOR THE DETERMINATION OF SULFATE IN DISTILLERS GRAIN USING ION CHROMATOGRAPHY WITH CONDUCTIVITY DETECTION

Lindsey Wallman, Department of Biology, Doane College, Crete, NE 68333; and Michael Carlson, Toxicology, University of Nebraska Veterinary Diagnostic Center, Lincoln, NE 68583

Distillers Dry Grains with Solubles (DGS) are a by-product of ethanol production. Traditionally, the DGS by-product is fed as a high protein source to cattle and other livestock. However, dietary sulfur levels above 0.4% can be toxic. Determination of the concentration of sulfate in distillers grain traditionally has been determined using a gravimetric or turbidimetric method. These methods are long and laborious. Ion Chromatography with conductivity detection provides a quicker and easier method for determining sulfate concentration. However, a technique to extract sulfate from distillers grain for this method has not been fully developed. The aim of this study was to successfully extract sulfate from distillers grain and analyze it by Ion Chromatography. Initial results indicate that the extraction technique was successful. Complete results will be discussed.

ADSORPTION OF HYDROGEN IN PALLADIUM. A CLASSROOM DEMONSTRATION AND A LABORATORY ACTIVITY

Elsbeth Klotz and Bruce Mattson, Department of Chemistry, Creighton University, Omaha, NE 68178

Upon passing hydrogen over palladium foil or Pd-ceramic catalyst, an interstitial hydride is formed in which hydrogen atoms occupy octahedral holes in the cubic close-packed palladium lattice. It is believed that hydrogen molecules dissociate into atoms at the palladium surface and the atoms readily migrate from hole to hole throughout the palladium. Palladium hydrides are non-stoichiometric, forming PdH_n, where $n = 0 - 0.7$. At the upper limit, Pd has adsorbed over 900 times its volume in hydrogen gas. We have developed a classroom demonstration that clearly shows this reaction. In addition, we have developed a laboratory activity in which D_2 and H_2 mixtures are passed over a Pd-ceramic catalyst resulting in the equilibrium mixture $D_2 + H_2 \rightleftharpoons 2\ HD$. The mixture can be studied by ^{1}H-NMR and the equilibrium constant determined. The DH coupling constant, J_{HD}, can be determined.

USE OF PC's FOR CONTROL SYSTEMS AT STAR

Nicholas J. Busch, Department of Physics, Creighton University, Omaha, NE 68132

The Solenoid Tracker at RHIC (STAR) at Brookhaven National Laboratory on Long Island studies hot, dense nuclear matter created from the collisions of relativistic gold nuclei, which may simulate the conditions in the early moments of the universe. STAR is a large and complex experiment with more than 40,000 operating parameters. The monitoring and control of STAR is accomplished using a standard suite of programs, a system that was originally constructed in the late 1990's. Currently, revisions are being implemented which take advantage of the increased processor speed and reduced cost of memory available in PC's. A brief overview of the STAR experiment will be provided as well as a discussion of the use of PC's in creating alarms and input/output control systems for STAR.

SYNTHESIS AND ^{17}O NMR SPECTROSCOPY OF 9,10-DIPHENYLANTHRACENE ENDOPEROXIDE

John M. Carney, Chad M. Lomas, and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178-0323

Singlet oxygen plays roles in tissue damage associated with certain diseases, including cardiovascular disease and age-related macular degeneration. As part of an effort to monitor singlet oxygen production upon decomposition of arene endoperoxides, the title endoperoxide was synthesized in two steps from 9,10-dibromoanthracene. Cross-coupling of this dibromide with phenylmagnesium bromide afforded 9,10-diphenylanthracene, which was efficiently photooxidized under controlled temperature conditions. The resulting endoperoxide was purified by chromatography or recrystallization and ^{17}O NMR spectroscopy of both naturally abundant and 70% ^{17}O-enriched samples was performed to determine chemical shift relative to standard ethers (dioxane), esters (ethyl acetate), and peroxides (benzoyl peroxide). Future decomposition studies of thermally labile arene endoperoxides will investigate the use of NMR to detect singlet oxygen production.

AN EVALUATION OF PHARMACEUTICAL CONTAMINATION IN DRINKING WATER

Cyril M. Willson and Jacqueline B. Scholar, Department of Natural Sciences, Bellevue University, Bellevue, NE 68123

This investigation involves an evaluation of pharmaceutical contamination of local suburban drinking water from the Platte and Missouri rivers in the metro area of Omaha, Nebraska. This initial investigation is qualitative via the use of Solid Phase Extraction (SPE) and Gas Chromatography-Mass Spectrometry (GC-MS) utilizing standard methods of analysis for pharmaceuticals in drinking water. Compounds which have been screened for study include acetaminophen, caffeine, carbamazepine, 17 alpha-ethinylestradiol and sulfamethoxazole. These drugs were chosen due to their representation of certain drug classes as well as confirmed presence in surface waters in the United States.

AN INVESTIGATION ON THE ORIGIN AND SIGNIFICANCE OF QUASAR OUTFLOWS

Sandra M. Behncke, A. Showalter, and J. Gabel, Department of Physics, Creighton University, Omaha, NE 68178

We present preliminary results of an investigation of quasars displaying high energy outflows based on an archival sample of NASA's Spitzer Space Telescope infrared spectra. Quasars are extremely luminous and distant objects that are powered by accretion of material onto supermassive blackholes. Some quasars have mass outflows that release tremendous amounts of energy. These outflows may represent an evolutionary stage in the lifespan of the quasar or host galaxy. If the outflows exist in all quasars, it's possible that they may be observed only by a special orientation with respect to our view. Mid to near infrared spectroscopy from Spitzer will be examined to test these models. The technology and research methods used to carry out this experiment, and preliminary analysis will be presented to the Nebraska Academy of Sciences.

MODELING AND USAGE OF THE OPTICAL STRETCHER AND SOME OF ITS POTENTIAL APPLICATIONS FOR UNDERSTANDING CHANGES IN CELL SIGNALING DUE TO MECHANICAL STRESS

Timothy J. Smith and M.G. Nichols, Creighton University, Omaha NE 68178

The optical stretcher is a dual-beam trap that utilizes the momentum transfer of photons to trap and stretch individual cells. This technique is one approach to investing the link between mechanical stimulus and biochemical changes within bone cells. By extending the ray-optics model to account for multiple internal reflections and focusing due to the spherical surface of the cell, our group has generated a model which has shown excellent agreement between predictions and experimental evidence in the form of escape force measurements and red blood cell elasticity measurements. We have also utilized the stretcher to measure the elasticity of murine 2T3 cells and found them to be nearly 12 times stiffer than red blood cells. This talk will focus on these elasticity measurements as well as current work using the stretcher to investigate the link between mechanical stress and changes in cell signaling, specifically the role of calcium and nitric oxide.

This project was supported by NIH P20 RR016469 from the INBRE Program of the National Center for Research Resources.

CONTROL INTERFACES FOR TWO ALICE SUBSYSTEMS

Robert P. Thomen, Department of Physics, Creighton University, Omaha, NE 68178

Software for the control of a laser alignment system for the Inner Tacking System (ITS) and for the Electromagnetic Calorimeter (EMC) was developed for the ALICE (A Large Ion Collider Experiment) at CERN. The interfaces for both subsystems use the CERN-standard hardware controls system PVSS (Prozessvisualisierungs- und Steuerungs-System). Software for the ITS has been created to measure the relative alignment of the ITS with the Time Projection Chamber (TPC) so to ensure accurate particle tracking. The ITS alignment system locates laser images in four cameras. The EMC requires several subsystems to be running in order to operate properly. Software has been created and tested for the detector's high and low voltage systems, and temperature monitoring hardware. The ITS and EMC software specifications and design requirements are presented and their performance is analyzed.

This work is supported by the Office of Science, US Department of Energy.

STRUCTURAL AND MECHANISTIC STUDIES OF RIBOSWITCHES

Joshua Souchek[1], Kevin Klawuhn[1], Joshua A. Jansen[1] and Juliane K. Soukup[1,2]. [1]Departments of Chemistry and [2]Biomedical Sciences, Creighton University, Omaha, NE 68178

Riboswitches are RNA sequence elements in the untranslated regions of messenger RNAs that have been identified to regulate gene expression. In order to exert control over gene expression, riboswitches must couple the task of ligand (metabolite) recognition with that of modulating a requisite aspect of gene expression. Consequently, riboswitches are generally composed of two interdependent domains that include a natural ligand-binding or aptamer domain, and an "expression platform" whose precise conformation impacts gene expression. Each of these cis-acting regulatory elements is largely found in the mRNAs of genes that comprise the biosynthetic pathway responsible for producing the cognate ligand/metabolite. Therefore, riboswitches afford an elegant mechanism for feedback regulation of biosynthetic pathways that allows organisms to respond to the metabolic state of the cell.

Our research has focused on assessing the mechanistic strategies employed by riboswitches to allow for genetic regulation. We have utilized kinetic assays in our studies of a catalytic riboswitch that binds glucosamine-6-phosphate in order to determine the importance of pH and metal ion identity to riboswitch self-cleavage activity. We have found that catalytic activity increases with increasing pH, which could be due to the protonation states of ligand and/or metal ions. In addition we have determined that the radii of the metal ions is important in determining whether catalysis is supported. We have tested both monovalent and divalent metal ion usage by this ribozyme. We are further analyzing structure and function of riboswitches through crystallographic studies. These studies could aid in design of novel agonists to treat bacterial infections.

This work was made possible by NIH Grant Number P20 RR16469 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.

PRODUCTION AND QUALITY CONTROL OF BIODIESEL

Andrew L. Wiedel and Darius Agoumba, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787; and Nicolas P. Stutzman, Northeast Nebraska Biodiesel, Scribner, NE 68057; and Robert Byrnes, Nebraska Renewable Energy Systems, Oakland, NE 68045

The rise of petroleum prices and the increase of international concerns regarding energy security, prompt today's interest in developing renewable fuels such as biodiesel. The State of Nebraska and its natural feedstock resources would gain a lot by producing and commercializing biodiesel. However, in Nebraska there is no program at any college where the education in producing biodiesel is offered. Consequently, it would be of a great interest to instruct the young generation of Nebraska about the value of making, characterizing and evaluating biodiesel. To initiate such training, Wayne State College teamed up with the Nebraska Renewable Energy Systems to carry out the production and quality control of biodiesel using different vegetable (olive, soybean, mustard, sunflower) oils and animal (pork, beef) fats at Northeast Nebraska Biodiesel Inc. Each type of oil was used as feedstock to make Biodiesel which was characterized and evaluated according to different recommended American Society for Testing and Material Standard Methods (ASTM). Obtained results from different analytical instruments (ICP/OES, NIR, Potentiometric Titrator, Cloud point tester) which are not commonly found or used at undergraduate institutions as well as the benefits in collaborating with local industrial companies will be presented.

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

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FRIEND OF SCIENCE AWARD TO DAVE GOSS

Dave Goss grew up in the Texas Hill Country near Medina. He graduated from Medina High School, then attended Southwestern University, where he earned a B.S. in Physics and Mathematics. He next earned an M.S. from Michigan State University in East Lansing. He finished his PhD in nuclear physics at The University of Texas at Austin. Dr. Goss came to Nebraska in August of 1964 when he joined the faculty of Nebraska Wesleyan University (NWU). He worked in the field of nuclear theory and experiment until 1977, and published eight papers in the Physical Review and one in Physical Review Letters. During this time, he taught mainly the introductory physics course and its labs, and the course in modern physics (introduction to quantum mechanics). He and his students contributed numerous talks to the Nebraska Academy of Sciences and the American Physical Society.

In the late 70's and 80's Dr. Goss began to teach primarily the upper division courses in mechanics, optics, electromagnetic theory, thermal physics, physical fluid dynamics, introductory quantum mechanics, and the sophomore modern physics course. He also taught science survey courses for non-science majors in musical acoustics, physical science, earth science, and meteorology. He earned a B.S. in geology from the University of Nebraska–Lincoln during his 1981-2 sabbatical, and later taught an introductory geophysics course there as an adjunct professor. During the mid 1980's he worked part-time and full time on projects associated with the development of the Superconducting Super Collider, the particle accelerator that was to have collided beams of protons at a maximum energy of 40 TeV in the center of mass. He worked on this project from 1985 until it was terminated by Congress in 1994, and coauthored two papers and wrote a considerable number of reports during this period.

During his 2000-2001 sabbatical year, Dr. Goss did most of the coursework for the M.S. degree in Geosciences at the University of Nebraska–Lincoln; he graduated with the M.S. in 2004, working under the direction of Professor Vitaly Zlotnik on some hydrological problems. Over his career, Dr. Goss has also reviewed for a number of publications. He is a member of the American Physical Society (Division of Particles and Fields, Forum on Physics and Society, Division of Beam Physics), American Association of Physics Teachers, American Association for the Advancement of Science, Nebraska Academy of Sciences, American Geophysical Union, and Geological Society of America. Dr. Goss is also a Professional Geologist, licensed by the State of Nebraska Board of Geologists.

FRIEND OF SCIENCE AWARD TO SUSAN SEACREST

Susan Seacrest holds a B.A. degree from St. Olaf College and a M.S. Ed. from the University of Rochester. After several years as a teacher and guidance counselor in the Lincoln Public Schools, Susan founded the Groundwater Foundation in 1985 and served as its President until January 1, 2008. Under her direction, the Foundation grew to become a nationally known, well-respected voice for groundwater education. Foundation programs include a community based recognition program called Groundwater Guardian, and Groundwater Guardian Green Sites, a location specific program that connects outreach with measurable environmental benefits. In addition, Seacrest assisted in the development of a wide variety of Groundwater Foundation outreach programs focusing on such groundwater issues as private well stewardship, on-site wastewater treatment, source water protection and conservation.

Foundation programs have been featured in TIME Magazine, National Geographic, and as part of broadcasts on National Public Radio," The Osgood Files" and "CBS Sunday Morning." Seacrest's expertise in groundwater education was recognized by the United States Environmental Protection Agency through her appointment to several EPA advisory boards including the Children's Health Protection Advisory Council, and to two terms on the National Drinking Water Advisory Council. In November 1999, Seacrest was a speaker at a Water Issues briefing at the United Nations, spoke at an International Association of Hydrologists Conference in Ireland in 2003, was the keynote speaker for the Midwest Groundwater Conference in 2006 and has been invited to be the commencement speaker at St. Olaf College in May 2008. Seacrest was honored with the 2007 Heinz Environmental Award by the Heinz Family Foundation.

Retiring from her duties as President of the Groundwater Foundation in December of 2007, Seacrest is currently pursuing a career as a secondary school guidance counselor and teacher.

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