PROGRAM
and
PROCEEDINGS

THE NEBRASKA ACADEMY OF SCIENCES

1880-2006

including the

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

126th Anniversary Year

One Hundred-Sixteenth Annual Meeting

April 21, 2006
OLIN HALL OF SCIENCE - NEBRASKA WESLEYAN UNIVERSITY
LINCOLN, NEBRASKA

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The regional NSTA conference will be held in lieu of the 2006 NATS Fall Conference at the QWest Center in Omaha, NE, October 19 - 21, 2006.

The 2007 Fall Retreat of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, October 25-27 (Thursday, Friday, and Saturday).

President: Sheree Person-Panidil, ESU #3, Omaha, NE
President-Elect: Sally Harms, Wayne State College, Wayne, NE

AFFILIATED SOCIETIES OF THE NEBRASKA ACADEMY OF SCIENCES, INC.

1. **American Association of Physics Teachers, Nebraska Section**
   Web site: http://cune.org/brent.royuk/naapt/default.htm

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

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

4. **Nebraska Chapter, National Council for Geographic Education**
   Meet with the Nebraska Academy of Sciences at its Annual Meeting April 21, 2006

5. **Nebraska Geological Society**
   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**
   Publishers of the quarterly, *The Nebraska Bird Review*
   Annual Meeting, May 19-21, 2006, Ponca State Park, Ponca, NE
   Web site: http://rip.physics.unk.edu/NOU/

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 31 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 <neacadsci.org>.

PROGRAM

FRIDAY, APRIL 21, 2006

7:30 a.m.	REGISTRATION FOR ACADEMY, Lobby of Lecture wing, Olin Hall
7:55	Earth Science, Olin 224
8:00	Aeronautics and Space Science, Session A, Olin 249
	Aeronautics and Space Science, Session B, Planetarium
	Collegiate Academy, Biology Session A, Olin B
	Collegiate Academy, Chemistry and Physics, Olin 324
8:20	Chemistry and Physics, Session A, Chemistry, Olin A
8:30	Biological and Medical Sciences, Session A, Olin 112
	Biological and Medical Sciences, Session B, Smith Callen Conference Center
	Junior Academy, Senior High REGISTRATION Olin Hall Lobby
9:00	Anthropology, Olin 111
	Junior Academy, Senior High Competition, Olin 124, Olin 131
9:30	History and Philosophy of Science, Olin 325
11:00	MAIBEN MEMORIAL LECTURE, OLIN B
12:00	LUNCH, PATIO ROOM, STORY STUDENT CENTER
	(pay and carry tray through cafeteria line, or pay at NAS registration desk)
1:00 p.m.	Junior Academy, Junior High REGISTRATION, Olin Hall Lobby
	Junior Academy, Senior High Competition, (final), Olin 110
	Anthropology, Olin 111
	Biological and Medical Sciences, Session D, Smith Callen Conference Center
	Chemistry and Physics, Session A, Chemistry, Olin A
	Chemistry and Physics, Session B, Physics, Planetarium
	Collegiate Academy, Chemistry and Physics, Olin 324
1:24	Collegiate Academy, Biology Session A, Olin B
	Collegiate Academy, Biology Session B, Olin 249
	Collegiate Academy, Biology Session C, Olin 224
1:25	Teaching Science and Mathematics, Olin 325
1:30	Junior Academy, Junior High Competition, Olin 124, Olin 131
	Biological and Medical Sciences, Session C, Olin 112
2:00	NJAS Board/Teacher Meeting, Olin 217
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
	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

Co-Chairpersons: Brent D. Bowen and Mary M. Fink
Aviation Institute, University of Nebraska at Omaha

SESSION A

Chairperson: Brent D. Bowen
Olin Hall Room 249

8: 05 a.m. 1. MEASURING NETWORK EFFECTIVENESS IN HIGH TECHNOLOGY NET WORKS OF PUBLIC-PRIVATE PARTNERS. Nanette Scarpellini Metz and Brent Bowen*, Aviation Institute, University of Nebraska at Omaha.

8:20 2. REMOTE SENSING OF BEAN RUST. Mark Steele*, Don Rundquist, and Rick Perk, School of Natural Resources, University of Nebraska–Lincoln; and James Steadman and Lindsey Otto-Hanson, Department of Plant Pathology, University of Nebraska–Lincoln.

8:35 3. EFFECT OF SURFACE TENSION AND FORCED CONVECTION ON METHANOL DROPLET COMBUSTION. Raghavan Vasudevan* and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln.

8:50 4. THE SUSTAINABLE DEVELOPMENT OF U.S. AIR TRANSPORTATION: THE PROMISE AND CHALLENGE OF INSTITUTIONAL REFORM. John Bartle, School of Public Administration, University of Nebraska at Omaha.

9:05 5. CREWBOT SUSPENSION DESIGN. Nathan Wood, Department of Mechanical Engineering, University of Nebraska–Lincoln.

9:20 BREAK/POSTER PRESENTATIONS

9:40 6. PERFORMANCE IN SPACE TASKS: HOW WELL ARE THEY RELATED TO ENVIRONMENT? Rajash Shanmugam and Ram Bishu*, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln.

9:55 7. SMALL COMMUNITY AIR SERVICE: HAVE POLICIES DESIGNED TO FOSTER AIR SERVICE ACTUALLY STIFLED TECHNOLOGICAL INNOVATION? Scott Tarry, Lawrence Runana*, and Jorge Montoya Victoria*, Aviation Institute, University of Nebraska at Omaha.

10:10 8. NUMERICAL SIMULATION OF A NOVEL BLAST WAVE MITIGATION DEVICE. Zhenbi Su, Zhaoyan Zhang*, and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln.

10:25 9. NATURAL FREQUENCIES OF A VIBRATING UNIFORM CANTILEVER WITH A CONCENTRATED END MASS. E. Terence Foster and Brian Skourup*, College of Engineering and Technology, University of Nebraska–Lincoln; and William Waters, Puritan Manufacturing, Inc., Omaha.

10:40 10. HOW ERROR-INTOLERANCE EVOLVED IN AMERICAN AVIATION AIRSPACE MANAGEMENT. Patrick O'Neil, Aviation Institute, University of Nebraska at Omaha.

AERONAUTICS AND SPACE SCIENCE

Co-Chairpersons: Brent D. Bowen and Mary M. Fink
Aviation Institute, University of Nebraska at Omaha

SESSION B

Chairperson: Mary M. Fink
Olin Hall Planetarium

8:05 a.m. 1. DISTANCE LEARNING IN COLLEGIATE AVIATION: A SUPPLY AND DEMAND ANALYSIS. C. Daniel Prather, Aviation Institute, University of Nebraska at Omaha.

8:20 2. THE NATIONAL GEOSPATIAL EXTENSION PROGRAM. Karisa Vlasek*, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha; and Nathan Mattox, Department of Geography, University of Missouri, Columbia, MO; and John McGee, Department of Forestry, Virginia Tech University, Blacksburg; VA; and Barron Orr, Office of Arid Land Studies, University of Arizona, Tuscon, AZ; and Phil Rasmussen, Department of Plants, Soils, and Biometeorology, Utah State University, Logan UT; and Sandy Prisloe, Cooperative Extension, University of Connecticut, Haddam, CT; and et al.

8:35 3. INTERACTIVE CLASSROOM MATERIALS ON GALAXIES. Andrew Frederick*, Christopher M. Siedell, and Kevin M. Lee, Center of Science, Mathematics and Computer Education, University of Nebraska–Lincoln.

8:50 4. SCIENCE CURRICULUM DEVELOPMENT: THE AVN 3510 AEROSPACE SCIENCES WORKFORCE DEVELOPMENT INITIATIVE. Brent Bowen, Michaela Schaaf, Karisa Vlasek, and Scott Vlasek*, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha; and Neal Grandgenett and Carol Mitchell, College of Education, University of Nebraska at Omaha.

9:05 5. COMPUTERIZED RANKING TASKS FOR INTRODUCTORY ASTRONOMY. Keith Nickum*, Andrew Frederick, and Kevin M. Lee, Center for Science, Mathematics, and Computer Education, University of Nebraska–Lincoln.

9:20 BREAK/POSTER PRESENTATIONS

9:40 6. NATIVE IMAGE: INSTITUTE OF MANAGING APPLICATIONS IN GEOSPATIAL EXTENSION. Karisa Vlasek*, Brent Bowen, and Hank Lehrer, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha; and Jan Bingen, Department of Computer Science, Little Priest Tribal College, Winnebago.

9:55 7. AN EVALUATION OF THE IMPACT OF NASA EPSCoR ON THE STATE OF NEBRASKA. Brent Bowen, Michaela Schaaf*, Karisa Vlasek, and Cindy Webb, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha; and Valerie Russell, The Russell Center, LaVista.

10:10 8. INFORMATION TECHNOLOGY, IMAGERY, AND INTERACTIVITY: KEY COMPONENTS OF NEW STRATEGIES FOR EARTH SYSTEMS SCIENCE EDUCATION. Neal Grandgenett and Bill Schnase*, Department of Teacher Education, University of Nebraska at Omaha; and Steve Hamersky*, Gross High School, Omaha.

10:25 9. DEVELOPING AND APPLYING CHLOROPHYLL ALGORITHMS FOR HYPERSPECTRAL REMOTE SENSING OF COASTAL WATERS. Christine Hladik, Environmental Sciences Institute, Florida A&M University, Tallahassee, FL; and John Schalles*, Department of Biology, Creighton University, Omaha.

AERONAUTICS AND SPACE SCIENCE

Poster Session 9:20 - 9:40 a.m.
Olin Hall Room 249

VARIATION IN CIRCADIAN PAIN IN INBRED STRAINS OF MICE. Natalie Rasmussen, College of Nursing, University of Nebraska Medical Center, Omaha.

SPACE: AN EVOLUTIONARY COMPARISON. Steven Ryberg, Educational Administration, University of Nebraska–Lincoln.

DEVELOPING TRANSPORTATION AGENCY LEADERS: AN EXPLORATORY STUDY. Brent Bowen and Mary Fink, Aviation Institute, University of Nebraska at Omaha.

ANTHROPOLOGY AND GEOGRAPHY

Chairpersons: LuAnn Wandsnider and Benjamin Purzycki
Department of Anthropology and Geography
University of Nebraska–Lincoln
Olin Hall Room 111

9:00 a.m. 1. MYTH, HUMOR, AND COGNITION: A COGNITIVE ANTHROPOLOGICAL APPROACH. Benjamin Purzycki, Department of Anthropology and Geography, University of Nebraska–Lincoln.

9:20 2. TOWARDS A CROSS-CULTURAL TYPOLOGY OF MALE HOMOSEXUALITY. Brent Kennedy, Department of Anthropology and Geography, University of Nebraska–Lincoln.

9:40 3. MEXICAN CULTURAL DIVERSITY AS DESCRIBED BY NEWLY-IMMIGRATED MEXICAN ADOLESCENTS AT NORTH STAR HIGH SCHOOL IN LINCOLN, NE. Mara Giles, Department of Anthropology and Geography, University of Nebraska–Lincoln.

10:00 4. STRATEGIES OF VIOLENT RESISTANCE: A CASE STUDY FROM THE CHEYENNES AND THE COMANCHES. Martha McCollough, Department of Anthropology and Geography, University of Nebraska–Lincoln.

10:20 5. LAKOTA STRUGGLES FOR CULTURAL SURVIVAL: HISTORY, HEALTH AND DEVELOPMENT. Benjamin Jewell, Department of Anthropology and Geography, University of Nebraska–Lincoln.

11:00 MAIBEN MEMORIAL LECTURE – OLIN HALL B

12:00 p.m. LUNCH

1:00 6. EARLY HOLOCENE ARCHAEOLOGY, GEOARCHAEOLOGY, AND PALEOECOLOGY ON THE CLARY RANCH, WESTERN NEBRASKA. Matthew Hill* and David Rapson, Department of Anthropology, Iowa State University, Ames, IA; and David May, Department of Geography, University of Northern Iowa, Cedar Falls, IA; and James Theler, Department of Sociology and Archaeology, University of Wisconsin–La Crosse, WI.

1:15 7. 255 PIECES OF CHIPPED STONE: INSIGHTS ON LONG-TERM HUMAN USE OF THE PINE RIDGE ESCARPMENT AND ASSOCIATED PLAINS OF WESTERN NEBRASKA FROM A LOW DENSITY SURFACE ARCHAEOLOGICAL RECORD. LuAnn Wandsnider* and Elisha Mackling, Department of Anthropology and Geography, University of Nebraska–Lincoln; and Matthew Douglass, Department of Anthropology, Auckland University, New Zealand.

1:30 8. STONE TOOL PRODUCTION AT LA UNIÓN, HONDURAS. Carleen Sanchez, Department of Anthropology and Geography and Institute for Ethnic Studies, University of Nebraska–Lincoln.

1:45 9. MAKING THE MARK: AN INTERPRETATION OF IRONSTONE MARKERS IN 19TH CENTURY AMERICA. Samantha Kirkley, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:05 10. HITTING THE ROAD: A CASE STUDY OF GEOPHYSICAL PROSPECTING TECHNIQUES AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49), AN HISTORIC TRAIL FORD IN SOUTHEASTERN NEBRASKA. Arlo McKee, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2;20 11. SIX-GUN AND HUNTING RIFLE: FIREARMS-RELATED ARTIFACTS FROM THE BEAVER CREEK TRAIL CROSSING SITE (25SW49). William Altizer, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:35 12. BUTTON, BUTTON, WHO'S GOT THE BUTTON?: BUTTONS AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49). Ashlee Dickinson, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:45 13. FRONTIER IMPRESSIONS: THE ROLE OF DAUB AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49). Brennen Dolan, Department of Anthropology and Geography, University of Nebraska–Lincoln.

3:00 14. FROM HARRIS MATRIX TO TIME MATRIX: NEW INSIGHTS AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49). Nolan Johnson, Department of Anthropology and Geography, University of Nebraska–Lincoln.

3:15 15. ARCHEOLOGICAL DIMENSIONS OF THE ORIGINS OF MODERN WARFARE: BATTLEFIELDS OF THE 1898 SANTIAGO CAMPAIGN. Peter Bleed* and Douglass Scott, Department of Anthropology and Geography, University of Nebraska–Lincoln.

3:40 MCGINNIS AWARD

BIOLOGICAL AND MEDICAL SCIENCES

Chairperson: Theodore Burk
Department of Biology, Creighton University

SESSION A

Session Chairperson: James Platz, Creighton University
Olin 112

8:30 a.m.1. A SURVEY OF AQUATIC GASTROPODS OF THE PRAIRIE POTHOLE REGION OF SOUTH DAKOTA. Bruce J. Stephen, Southeast Community College, Lincoln.

8:45 2. A COMPARISON OF A POINT AND A QUADRAT METHOD OF SAMPLING PRAIRIE VEGETATION. Carla M. Delucchi, Biology Department, Dana College, Blair.

9:00 3. TRIBOLIUM BEETLES: A POTENTIAL PEST SPECIES MODEL FOR GLOBAL WARMING EFFECTS. Mark A. Schlueter*, William R. Wolesensky, Katie M. Gaspers, and Lydia Zaragosa, Department of Biology and Department of Mathematics, College of Saint Mary, Omaha.

9:15 4. MODELING THE EFFECTS OF TEMPERATURE VARIATIONS ON ARTHROPOD PREDATOR-PREY SYSTEMS. William Wolesensky*, Department of Mathematics, College of Saint Mary, Omaha; and J. David Logan, Department of Mathematics, University of Nebraska–Lincoln.

9:30 BREAK

9:40 5. MITOCHONDRIAL DNA, SCIENTIFIC ANOMALIES AND A CAUTIONARY NOTE FOR SYSTEMATISTS: DON'T SHOOT THE MESSENGER. James E. Platz* and C. F. Austerberry, Department of Biology, Creighton University, Omaha, and T. Grudzien, Department of Biological Sciences, Oakland University, Rochester, MI.

9:55 6. THE BIOLOGY OF PTERIDOPHYTE TAXONOMY PRESENT ON VOLCAN ZUNIL. Stacey A. O'Brien* and J. E. Platz, Department of Biology, Creighton University, Omaha.

10:10 7. MOTIF DETECTION IN *STAPHYLOCOCCUS AUREUS*. Kate Dempsey*, Daniel Quest, and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha.

10:25 8. HISTONE BIOTINYLATION IN GERMINATING SWITCHGRASS (*PANICUM VIRGATUM* L.) SEEDS. Kyle Johnson, Concordia University, Seward, NE; and Gautam Sarath, USDA-ARS and University of Nebraska–Lincoln, NE; and Keyna Kobza, Yap-Ching Chew, Janos Zempleni, and Ashraf Raza, University of Nebraska–Lincoln, NE.

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

Session Chairperson: Theodore Burk, Creighton University
Smith Callen Conference Center

8:30 a.m. 1. EFFECTS OF HYDROGEN PEROXIDE ON GENE EXPRESSION IN *PARAMECIUM BURSATA* CHLORELLA VIRUS-1. Garry Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln.

8:45 2. INFLAMMATION AND CARDIOVASCULAR DISEASE. Veneracion G. Cabana, Division of Science and Mathematics, Union College, Lincoln.

9:00 3. SLEEP DEPRIVATION AND MUSCLE STRENGTH AND ENDURANCE. Christopher Wiles*, Oscar Lucar, and Veneracion G. Cabana, Division of Science and Mathematics, Union College, Lincoln.

9:10 4. DIRECTED EVOLUTION OF AN ARCHAEAL DNA POLYMERASE, $9^{o}N_{M}$, WITH ENHANCED ACTIVITIES FOR GAMMA-PHOSPHATE LABELED NUCLEOTIDES. Teresa M. Urlacher*, Jon P. Anderson, David L. Steffens, Bambi Reynolds, Kristin Keefe, Jolene Egelhoff, Donald T. Lamb, Daniel L. Grone, Lyle R. Middendorf, and John G. K. Williams, LI-COR Biosciences, Lincoln.

9:25 BREAK

9:35 5. TRANSCRIPTIONAL REGULATION OF THE HUMAN N-CADHERIN GENE. Kate Marley*, Will Packard, Aspen Bricker, Matthew James, Adam Gentzler, and Scott Madden, Doane College, Crete.

9:45 6. IMMUNOELECTRONMICROSCOPY FOR CALCITONIN GENE-REGULATED PEPTIDE AND CHOLECYSTOKININ COLOCALIZATION AND COSTORAGE IN THE MOUSE INFERIOR OLIVARY COMPLEX. Kathleen G. Tallman, Doane College, Crete.

10:00 7. RNA-PROTEIN INTERACTIONS IN THE 5' NTR OF COXSACKIEVIRUS B3. Megan Azimi* and William Tapprich, Department of Biology, University of Nebraska at Omaha.

10:10 8. A STUDY OF THE THERMAL STABILITY OF THE CVB3 VIRUS. Tess M. Eidem, Department of Biology, University of Nebraska at Omaha.

10:20 9. THE QUANTITATION OF SUB2P AFFINITY FOR RDNA IN *SACCHAROMYCES CEREVISIAE*. Benjamin D. Hanzel* and Elaine Lahue, Department of Biology, University of Nebraska at Omaha.

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCE

SESSION C

Session Chairperson: John Schalles, Creighton University

Olin 112

1:30 p.m. 1. CELL-CELL SIGNALING IN MYCOBACTERIA. Angela McKinney-Williams*, Department of Biology, Nebraska Wesleyan University; and Delilah Hudson, University of Nebraska–Lincoln; and Jeffrey Cirillo, Texas A & M University College of Medicine, College Station, TX.

1:45 2. GROWTH CONDITIONING AND CHARACTERIZATION OF *CLOSTRIDIUM PERFRINGENS*. Amanda J. Bowman* and Avery L. Paulson, Chadron State College, Chadron.

2:00 3. CONJUGATIVE TRANSFER OF VIRULENCE FACTORS FROM *CLOSTRIDIUM PERFRINGENS*. Suzanne K. Morse* and Avery L. Paulson, Chadron State College.

2:15 4. FORMATION OF A LIBRARY FOR THE BACTERIOPHAGE UNL-1 AND CHARACTERIZATION OF GENES OF INTEREST. Kyle Rupp* and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney.

2:25 5. EFFECTS OF DIABETES MELLITUS ON POTASSIUM CHANNELS AND THE KCNQ1 GENE IN CARDIAC TISSUE. Katherine Baker, Department of Biology, University of Nebraska at Kearney.

2:40 6. INFLUENCE OF DIABETES MELLITUS AND EXERCISE TRAINING ON GENE EXPRESSION IN CARDIAC MUSCLE TISSUE. Cory Ciccone*, Mary Connealy, Karynn Kucera, and Janet Steele, Department of Biology, University of Nebraska at Kearney.

2:50 7. INFLUENCE OF DIABETES MELLITUS AND EXERCISE TRAINING ON OXIDATIVE STRESS REPAIR MECHANISMS IN CARDIAC TISSUE. Mary Connealy*, Cory Ciccone, Karynn Kucera, and Janet Steele, Department of Biology, University of Nebraska at Kearney.

3:00 BREAK

3:10 8. THE EFFECT OF HUMIC ACID ON ALUMINUM TOLERANCE IN CORN. Brian K. Banks* and Paul Twigg, Department of Biology, University of Nebraska at Kearney.

3:20 9. DETERMINING THE PREVALENCE OF WEST NILE VIRUS INFECTION IN CANINE POPULATIONS IN CENTRAL NEBRASKA. Whitney Meyer* and Brad Ericson, Department of Biology, University of Nebraska at Kearney.

3:30 10. IDENTIFICATION OF BACTERIA FROM AN ALKALINE LAKE USING FTIR. Scott E. Griffith* and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney; and Brad A. Plantz, Department of Biological Sciences, University of Nebraska-Lincoln.

3:40 11. GENETIC CHARACTERIZATION OF CHINCH BUG (*BLISSUS OCCIDUUS*) RESISTANCE IN BUFFALOGRASS (*BUCHLOE DACTYLOIDES*) BY SUPPRESSION SUBTRACTIVE HYBRIDIZATION. Lindsay A. Vivian* and Paul Twigg, Department of Biology, University of Nebraska at Kearney.

3:50 12. CONSTRUCTION AND CHARACTERIZATION OF A CDNA LIBRARY FROM BUFFALOGRASS (*BUCHLOE DACTYLOIDES*) INFESTED WITH CHINCH BUGS (*BLISSUS OCCIDUUS*). Brooke A. Malcom* and Paul Twigg, Department of Biology, University of Nebraska at Kearney.

4:00 13. FLIES AND DISEASE: AN EXPLORATION OF THE VECTORING POTENTIAL OF *DROSOPHILA VIRILIS, MUSCA DOMESTICA, AND SARCOPHAGA CARNARIA* WHEN COMPARING BACTERIAL EXPOSURE AND GROOMING BEHAVIOR. Michael W. Kling* and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney.

4:10 14. FRACTIONATION AND CHARACTERIZATION OF THE ANTIMICROBIAL SECRETIONS IN *NICROPHORUS* SP. Megan Nelson* and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney.

4:20 15. THOMSEN MEADOW, A BOTANICALLY DIVERSE LOWLAND PRAIRIE IN THE LOUP RIVER VALLEY. Sara L. Veloso* and Steven J. Rothenberger, Department of Biology, University of Nebraska at Kearney.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

Session Chairperson: Theodore Burk, Creighton University
Smith Callen Conference Center

1:00 p.m. 1. ALTERATIONS TO THE α2 & γ2 SUBUNITS OF THE GABA-A RECEPTOR AS A RESULT OF TRAUMATIC BRAIN INJURY. Rebecca Meyer* and Cynthia Gibson, Department of Psychology, Creighton University, Omaha.

1:15 2. EXPRESSION OF AMYLOID PRECURSOR PROTEIN, PHOSPHORYLATED TAU, AND MICROTUBULE-ASSOCIATED PROTEIN IN THE HIPPOCAMPUS AND CORTEX OF MICE FOLLOWING REPEATED MILD TRAUMATIC BRAIN INJURIES. J. A. Dobrowolska* and C. J. Gibson, Department of Psychology, Creighton University, Omaha.

1:30 3. MONITORING PRODUCTION OF NITRIC OXIDE IN OSTEOBLAST-LIKE CELLS BY QPCR AND A GREISS REAGENT ASSAY. Mary A. Adams*, Department of Chemistry, and M. R. Wyatt, Department of Biology, and M. G. Nichols, Department of Physics, Creighton University, Omaha.

1:45 4. SPATIAL AND TEMPORAL EXPRESSION OF MEMBRANE TYPE 2 MATRIX METALLOPROTEINASE DURING AVIAN DEVELOPMENT. Rachel Patterson*, M. Holmberg, P. Brauer, and M. Reedy, Department of Biology and Department of Biomedical Sciences, Creighton University, Omaha.

2:00 5. AUTOMATED METHODS TO UNCOVER AND CAPTURE GENE/PROTEIN RELATIONSHIPS FROM RESEARCH LITERATURE. Scott Abboud*, Rhi Zhang, and Parvathi Chundi, Department of Computer Science, University of Nebraska at Omaha.

2:10 6. A GENETIC ROADMAP FOR THE DEVELOPMENT OF RETINAL STEM CELLS. Scott Abboud* and Faisal Ahmed, Department of Computer Science, University of Nebraska at Omaha; and Iqbal Ahmad, Department of Ophthalmology and Visual Sciences, University of Nebraska Medical Center, Omaha.

2:25 7. CHARACTERIZATION OF TYPE III SECRETION SYSTEMS (TTSS) IN *PSEUDOMONAS AERUGINOSA*. Pratima Kunwar*, T. J. Warren, S. B. Kampalli, and D. W. Rowen, Department of Biology, University of Nebraska at Omaha.

2:35 8. MACROPHAGES AS VEHICLES FOR ANTIVIRAL DRUG DELIVERY ACROSS THE BLOOD BRAIN BARRIER. Avery Shaw, Chadron State College, Chadron.

2:45 BREAK

2:55 9. DEVELOPMENT OF SMALL ANIMAL MODEL FOR HIV-1 INDUCED ALVEOLITIS: IMPLICATIONS FOR PATHOGENESIS AND NOVEL TREATMENT APPROACHES. C. Lawson*, B. Knipe, R. Potula, Y. Persidsky, G. D. Kanmogne, and M. Pauley, Center for Neurovirology and Neurodegenerative Disorders, University of Nebraska Medical Center, and College of Information Science and Technology, University of Nebraska at Omaha.

3:10 10. MUCIN 17 EXPRESSION AND REGULATION IN DIGESTION DISEASE. Wade M. Junker*, Shantibhusan Senapati, Nicolas Moniaux, and Surinder K. Batra, Department of Biochemistry, University of Nebraska Medical Center, Omaha.

3:25 11. PERP, A MEDIATOR OF P53 DEPENDENT APOPTOSIS, IS INDUCED AND TRANSLOCATED TO NUCLEUS FOLLOWING ISCHEMIC RENAL INJURY. Brynn Lastovica*, Dana College, Blair; and Babu J. Padanilam, Departments of Internal Medicine and Cellular and Integrative Physiology, University of Nebraska Medical Center, Omaha.

3:35 12. SYMPATHOEXCITATION IN CHRONIC HEART FAILURE: ANG II INDUCED INHIBITION OF VOLTAGE-GATED K^+ CHANNEL - AN *IN VIVO* AND *IN VITRO* STUDY. Marcus Finch*, Lie Gao, Wei Wang, Ethan Mann, Yulong Li, Dongmei Liu, Harold D. Schultz, and Irving H. Zucker, Department of Cellular and Integrative Physiology, University of Nebraska Medical Center, Omaha.

3:50 13. *IN VITRO* AND *IN VIVO* DIFFERENTIATION OF MOUSE EMBRYONIC STEM CELLS. Brian Kadow*, H. Basma, G. R. Yannam, T. Yamamoto, C. Spendlove, and I. J. Fox, Department of Surgery, University of Nebraska Medical Center, Omaha.

4:00 14. CHARACTERIZATION OF *OTK18* GENE INTERACTIONS UTILIZING *DROSOPHILA MELANOGASTER* SCHNEIDER 2 CELLS, MICROARRAYS, AND QUANTITATIVE RT-PCR. Sarah E. Marshall*, Cole R. Spresser, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.

4:10 15. LIVING AT THE EDGE. WHAT CAN WE LEARN ABOUT BROOD PARASITISM FROM THE COLONIALLY-NESTING RED-WINGED BLACKBIRD (*AGELAIUS PHOENICEUS*)? Josef Kren, Department of Biology, Midland Lutheran College, Fremont.

CHEMISTRY AND PHYSICS

Co-Chairpersons: Don Kaufman and Scott Darveau
Department of Chemistry
University of Nebraska at Kearney

SECTION A, CHEMISTRY

9:45 a.m. Featured Speaker: Charles Kingsbury
Olin A

8:20 a.m. WELCOME

8:30 1. PALLADIUM-CATALYZED CYCLIZATION OF ENE-ENAMIDES. Ross N. Andrews* and James M. Takacs, Department of Chemistry, University of Nebraska–Lincoln.

8:45 2. STUDIES IN EXTENDED CONJUGATE ADDITION: SYNTHESIS AND REACTIONS OF 1-METHYL-5-(ALKYNYL)BICYCLO[(n+2).1.0]-2-ALKANANONES. David Moody* and Martin Hulce, Department of Chemistry, Creighton University, Omaha.

9:00 3. SYNTHESIS OF 4-BENZYL-L-HISTIDINE ANALOGUES. Michael Mao, Martin Hulce*, and D. David Smith, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

9:15 4. SYNTHETIC APPROACHES TO PEROXYSPIROKETALS. Curtis A. Wray* and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln.

9:30 BUSINESS Meeting and BREAK

9:45 5. COURSE OFFERINGS, PREPAREDNESS AND CONCEPT COGNITION IN CHEMISTRY, PAST, PRESENT and FUTURE. C. A. Kingsbury, Department of Chemistry, University of Nebraska–Lincoln.

11:00 MAIBEN MEMORIAL LECTURE, OLIN B

12:00 p.m. LUNCH

1:00 6. HIGH-THROUGHPUT METHOD FOR MEASURING PROTEIN DISSOCIATION CONSTANTS (K_D) USING 1D ^{1}H NMR. Matthew Shortridge*, Kelly Mercier, and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln.

1:15 7. A RAPID METHOD FOR THE DETERMINATION OF THE PERCENTAGE OF ALIPHATIC VERSUS VINYL HYDROGEN ATOMS AND LEVELS OF TRANS FATTY ACIDS IN TRIACYLGLYEROLS. Don Kaufman*, Michael D. Mosher*, Alex Haeberle, Scott Bennett, and Andrea Martinez-Skinner, Department of Chemistry, University of Nebraska at Kearney.

1:30 8. ARE GEMINATE RADICAL INTERMEDIATES INVOLVED IN PARA-TO-NITRO PHOTOSUBSTITUTION BY AMINES ON NITROPHENYL ETHERS? Kandra M. Johnson* and Gene G. Wubbels, Department of Chemistry, University of Nebraska at Kearney.

1:45 9. ELECTRON HOLE TRANSFER CATALYSIS BY HYDROXIDE ION IN PHOTOCHEMICAL SMILES REARRANGEMENT AND MEISENHEIMER COMPLEX FORMATION. Nobutoshi Ota*, Michelle L. Crosier, and Gene G. Wubbels, Department of Chemistry, University of Nebraska at Kearney.

2:00 10. DFT STUDIES OF THE ANION BINDING BEHAVIOR OF TETRA-OXOCYCLOHEXA-DIENYLIDENE PORPHYRINOGEN AND ITS N-BENZYLATED ANALOGS. Paul A. Karr*, Department of Physical Science and Mathematics, Wayne State College; and Amy L. McCarty, Melvin E. Zandler, and Francis D'Souza, Department of Chemistry, Wichita State University, KS; and Katsuhiko Ariga and Jonathan P. Hill, International Center for Young Scientists, National Institute for Materials Science, Ibaraki, Japan.

2:15 BREAK

2:30 11. BACKBONE CONTACTS TO METAL IONS AND GLUCOSAMINE-6-PHOSPHATE IN THE *GLMS* RIBOZYME. J. Jansen, T. McCarthy, G. Soukup, and J. Soukup*, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

2:45 12. NOVEL HIV-1 PROTEASE ASSAY BASED ON NEAR-INFRARED FRET. Xinzhan Peng, Garrick Little*, Xinshe Xu, William Volcheck, Jiyan Chen, Chuck Prescott, and Daniel Draney, LI-COR Biosciences, Inc., Lincoln.

3:00 13. A NOVEL PHOTOSTABLE PHTHALOCYANINE DYE, IRDYE™ 700DX, FOR NEAR-INFRARED FLUORESCENCE LABELING OF BIOMOLECULES. Xinzhan Peng, Garrick Little, Xinshe Xu*, William Volcheck, Greg Bashford, Don Lamb, Daniel Grone, Yonghong Zhang, Craig Johnson, Chuck Prescott, Jiyan Chen, and Daniel Draney, LI-COR Biosciences, Inc., Lincoln.

3:15 14. COMPETITIVE AND IRREVERSIBLE ANTAGONISTS OF CGRP. D. David Smith*, Department of Biomedical Sciences, and C.K. Taylor and P.W. Abel, Department of Pharmacology, and M.R. Hulce, Department of Chemistry, Creighton University, Omaha.

3:30 15. DEVELOPMENT OF AN ELECTROGENERATED CHEMILUMINESCENT DETECTION METHOD FOR FLUOROQUINOLONE ANTIBIOTICS. Erin M. Gross*, Marcel Fallet, Rohesh Fernando, Evan Kimura, and Kylie Steuben, Department of Chemistry, Creighton University, Omaha.

3:45 16. DEVELOPMENT OF MALEIMIDE AND IODOACETYL-ACTIVATED SILICA FOR PROTEIN IMMOBILIZATION. Rangan Mallik* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

4:00 CLOSING COMMENTS

CHEMISTRY AND PHYSICS

SECTION B, PHYSICS

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

1:00 p.m. WELCOME

1:05 1. KEYNOTE ADDRESS: WHAT TO EXPECT FROM THE LHC IN 2007 AND BEYOND. Dr. Michael Cherney, Department of Physics, Creighton University, Omaha.

1:45 2. JET TRIGGER ANALYSIS FOR THE ALICE ELECTROMAGNETIC CALORIMETER. Christopher Anson* and Michael Cherney, Department of Physics, Creighton University, Omaha.

2:00 3. ANALYTICAL AND NUMERICAL SOLUTION OF QUANTUM-MECHANICAL DOUBLE WELL USING TRICONFLUENT HEUN EQUATION PART I. W.N. Mei*, A. Holloway, and R. F. Sabirianov, Department of Physics, University of Nebraska at Omaha.

2:15 4. ANALYTICAL AND NUMERICAL SOLUTION OF QUANTUM-MECHANICAL DOUBLE WELL USING TRICONFLUENT HEUN EQUATION PART II. A. Holloway*, W. N. Mei, and R. F. Sabirianov, Department of Physics, University of Nebraska at Omaha.

2:30 5. EVIDENCE FOR THE TIME VARIATION OF THE FINE STRUCTURE CONSTANT FROM THE COSMIC MICROWAVE BACKGROUND ANISOTROPY. Ryan Collins* and Gintaras Duda, Department of Physics, Creighton University, Omaha.

2:45 BREAK

3:00 6. NEW INTERFEROMETRIC SPECTROMETER FOR MEASUREMENT OF LASER PULSE WIDTH FOR ZEISS LSM 510 META NLO MULTIPHOTON MICROSCOPE. Nagitha Ekanayake* and M. G. Nichols, Department of Physics, Creighton University, Omaha.

3:15 7. NONVOLATILE TWO-TERMINAL MOLECULAR MEMORY. J. Snodgrass[1], G.P. Li[1], J. Lu[1], W.N. Mei[1,2], *R. F. Sabirianov[1,2]: [1]Department of Physics, University of Nebraska at Omaha; and [2]Center for Materials Research and Analysis, University of Nebraska–Lincoln.

3:30 8. ULTRA PERIPHERAL COLLISIONS PRODUCING VECTOR MESONS AT RHIC. Kimberly Kirchner, Department of Physics, Creighton University, Omaha.

3:45 9. PROGRESS IN ESTABLISHING A LARGE AREA COSMIC RAY OBSERVATORY AMONG NEBRASKA HIGH SCHOOLS. Lyle Sass* and Thomas McShane, Department of Physics, Creighton University, Omaha.

4:00 CLOSING REMARKS

EARTH SCIENCE

Chairperson: Ryan D. Weber
Department of Geosciences
University of Nebraska–Lincoln
Olin 224

7:55 a.m. OPENING REMARKS – Ryan D. Weber

8:00 1. METASTABLE EQUILIBRIUM SUGGESTED BY DICARBOXYLIC ACIDS IN CARBONACEOUS CHONDRITES AND RESULTING CALCULATION OF REDOX CONDITIONS DURING AQUEOUS ALTERATION ON THE PARENT BODY. Jason A. McAlister* and R.M. Kettler, Department of Geosciences, University of Nebraska–Lincoln.

8:15 2. DISTRIBUTION AND ORIENTATION OF MARTIAN GULLIES IN THE COPERNICUS, NEWTON, AND GORGONUM REGIONS AS CLUES TO ORIGIN. Ryan S. Morgan*, Department of Physical and Life Sciences, Chadron State College, Chadron; and A.H. Treiman, Lunar and Planetary Institute, Houston, TX.

8:30 3. PERMIAN MANGROVES? A LOW-DIVERSITY GLOSSOPTERID FLORA FROM THE LATE PERMIAN BETTS CREEK BEDS, QUEENSLAND, AUSTRALIA. Jonathan P. Allen* and C.R. Fielding, Department of Geosciences, University of Nebraska–Lincoln.

8:45 4. PRELIMINARY PALEONTOLOGICAL IMPLICATIONS FROM THE CROW CREEK MEMBER (PIERRE SHALE): A HYPOTHESIZED IMPACT-INDUCED TSUNAMI DEPOSIT IN THE LATE CRETACEOUS WESTERN INTERIOR SEAWAY. Ryan D. Weber* and D.K. Watkins, Department of Geosciences, University of Nebraska–Lincoln.

9:00 5. PROVISIONAL LITHOSTRATIGRAPHIC DESCRIPTION OF THE WHITECLAY GRAVEL BEDS (OGALLALA GROUP) OF NORTHWESTERN NEBRASKA. Hannan E. LaGarry* and L.A. LaGarry, Department of Math and Science, Chadron State College, Chadron; and J.B. Swinehart, School of Natural Resources, and C. R. Fielding, Department of Geosciences, and B. E. Bailey, Nebraska Department of Roads, University of Nebraska–Lincoln.

9:15 6. ICHNOLOGY OF THE LATE PLEISTOCENE "CITELLUS ZONE" ICHNOFABRIC, THE TAPHONOMY OF ITS GROUND SQUIRREL REMAINS AND THE PALEOCLIMATE DURING ITS DEVELOPMENT. Robert J. Tobin, Department of Environmental Quality, Lincoln.

9:30 7. A DIATOM RECORD OF LATE-HOLOCENE CLIMATE VARIABILITY FROM TWO LAKES IN THE NORTHERN ROCKY MOUNTAIN RANGE. Brandi B. Bracht* and S.C. Fritz, Department of Geosciences, University of Nebraska–Lincoln; and L.R. Stevens, Department of Geological Sciences, California State–Long Beach, Long Beach, CA.

9:45 8. THE INNER WORKINGS OF THE BOILING SAND SPRINGS ALONG THE DISMAL RIVER IN WESTERN NEBRASKA. Stephanie S. Day* and D.T. Pederson, Department of Geosciences, University of Nebraska–Lincoln.

10:00 9. PREDICTING THE LONG-TERM CONCENTRATION OF LANDFILL LEACHATE COMPONENTS AND QUANTITY OF LEACHATE GENERATED AT THE BLUFF ROAD LANDFILL, LINCOLN, NEBRASKA. Melaney M. Towerton* and D.T. Pederson, Department of Geosciences, University of Nebraska–Lincoln.

10:15 10. DETERMINATION OF HYDRAULIC PARAMETERS IN AQUITARD/AQUIFER FLOW SYSTEMS FROM PUMPING TESTS. Cheng Cheng* and X.H. Chen, School of Natural Resources, University of Nebraska–Lincoln.

10:30 CLOSING REMARKS

HISTORY/PHILOSOPHY OF SCIENCE

Chairpersons: Claire M. Oswald, College of Saint Mary and
T. Mylan Stout, University of Nebraska–Lincoln
Olin 325

9:30 a.m. 1. THE CONTRIBUTIONS OF ANTONIE VAN LEEUWENHOEK TO THE FIELD OF SCIENCE AND THE DISCOVERY OF MICROORGANISMS. Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.

10:00 2. THE BIOLOGICAL AND PHILOSOPHICAL STATUS OF HYDATIDIFORM MOLES, PARTHENOTES, AND TERATOMAS. Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.

10:30 3. THE ROLE OF LACTIC ACID BACTERIA IN THE FLAVOR OF CHEESE. Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.

11:00 MAIBEN MEMORIAL LECTURE, OLIN B

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Cody Arenz, Biology Department
Nebraska Wesleyan University, Lincoln

SESSION A

Olin B

8:00 a.m. 1. THE EFFECTS OF CONTROLLED PRAIRIE BURNING ON PERIMETER RUNWAY USAGE BY BLACK-TAILED PRAIRIE DOGS. Tomika Haller, Doane College, Crete.

8:12 2. FUNCTIONAL RESPONSE FOR DIFFERENT AGE CLASSES OF BROWN TROUT (*SALMO TRUTTA* L.) TO VARYING DENSITIES OF AQUATIC AND TERRESTRIAL PREY. Elizabeth N. Glenn*, Biology Department, Nebraska Wesleyan University, Lincoln; and P. Gustafsson and E. Bergman, Department of Biology, Karlstad University, Univeritetsgatan 2, 651 88 Karlstad, Sweden.

8:24 3. FECUNDITY RATE AT VARIED TEMPERATURES OF TRIBOLIUM CASTANEUM. Katie Gaspers, College of Saint Mary, Omaha.

8:36 4. A PHYLOGENETIC EXAMINATION OF SUBFAMILY BROMELIOIDEAE (*BROMELIACEAE*) USING *MAT*K REGION CPDNA. Megan A. Jensen*, J. S. Bricker, Biology Department, Nebraska Wesleyan University, Lincoln; and G. K. Brown, Department of Botany, University of Wyoming, Laramie, WY.

8:48 5. GENOTYPIC AND PHENOTYPIC RELATIONSHIP BETWEEN PORCINE *CAMPYLOBACTER COLI* VERON AND CHATELAIN 1973 AND *CAMPYLOBACTER HYOILEI* ALDERTON ET AL. 1995 ISOLATED FROM PIGS IN THE U.S. Mary K. Kersenbrock*, Biology Department, Nebraska Wesleyan University, Lincoln; and C.J. Stryker, R.P. Dassanayake, and G.E. Duhamel, Department of Veterinary and Biomedical Sciences and Veterinary Diagnostic Center, University of Nebraska–Lincoln.

9:00 6. ASSOCIATION OF SERUM SOLUBLE CD14 LEVELS WITH LUNG FUNCTION AND DISEASE IN AGRICULTURAL COHORT. Craig M Pekny*, Biology Department, Nebraska Wesleyan University, Lincoln; and T. Mathisen, S. Puumala, J. Meza, R. Slager, S. Von Essen, and D. Romberger, Internal Medicine Division of Preventive and Societal Medicine, University of Nebraska Medical Center, Omaha.

9:12 7. EPIZOOCHOROUS SEED DISPERSAL BY BISON IN THE NEBRASKA SANDHILLS. Brian Franzone* and Mark Hammer, Department of Life Sciences, Wayne State College, Wayne.

9:24 8. THE EFFECT OF BURNING AND LIMESTONE ON TALLGRASS PRIARIE RESTORATION. Meredith Meyer* and Brad Elder, Doane College, Crete.

9:36 9. SELECTION FOR STARVATION RESISTANCE IN *DROSOPHILA MELANOGASTER*. Tara L. Boren*, M.H. Wang, M. Zhou, and L. G. Harshman, School of Biological Sciences, University of Nebraska–Lincoln.

9:48 BREAK

10:00 10. COMPARISON OF THE BARBEL STRUCTURES OF THE CHANNEL CATFISH, *ICTALURUS PUNCTATUS*, TO PREVIOUSLY OBSERVED SPECIMENS OF VARYING SPECIES. Stephanie Blackstone* and Todd Georgi, Doane College, Crete.

10:12 11. EFFECTS OF FUNGICIDES ON APHID (*APHIS GLYCINES*) POPULATIONS IN SOYBEANS (*GLYCINE MAX*) WHEN INOCULATED WITH *BEAUVARIA BASSIANA*. Tim Brovont*, Biology Department, Nebraska Wesleyan University, Lincoln; and T. Weissling, Department of Plant Pathology, University of Nebraska– Lincoln.

10:24 12. THE IMPACT OF COMPACTION ON AGRICULTURAL SOILS. Rebekah M. Jessen* and Marian Borgmann-Ingwersen, Wayne State College. Wayne; and Bernie Thyen, Northeast Community College, Norfolk.

10:36 13. SEROPREVALENCE OF *NEOSPORA CANINUM* IN CALVES IN A CENTRAL NEBRASKA FEEDYARD. S. Sazama, Biology Department, Hastings College, Hastings.

11:00 MAIBEN MEMORIAL LECTURE, OLIN LH-B

12:00 p.m. LUNCH

1:24 14. A STUDY OF THE GENETIC MATING SYSTEM AND GENETIC DIVERSITY OF BLACK TERNS (*CHLIDONIAS NIGER*) NESTING IN SOUTHERN WISCONSIN. Erin Kucera* and Patricia Szczys, Department of Life Sciences, Wayne State College, Wayne.

1:36 15. DNA FINGERPRINTING OF BLACK-TAILED PRAIRIE DOGS (*CYNOMYS LUDOVICIANUS*) AT THE ALDRICH PRAIRIE RESEARCH SITE. Daphne Baber* and Kate Marley, Doane College, Crete.

1:48 16. DNA STUDIES OF EXTRA-PAIR COPULATIONS AND INCEST AVOIDANCE IN ZEBRA FINCH (*POEPHILA GUTTATA*) POPULATION. Andrew Kreikemeier* and Cheryl Bailey, Department of Chemistry, and Jennifer Sexton and Josef Kren, Department of Biology, Midland Lutheran College, Fremont.

2:00 17. FUNCTIONAL EFFECTS OF OXIDATION OF SERCA2A BY REACTIVE CARBONYL SPECIES DURING DIABETES. Haley Capek*, Nebraska Wesleyan University, Lincoln, NE; and Lynn Roy, Chun Hong Shao, and Keshore R. Bidasee, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.

2:12 18. INVESTIGATION OF INTEIN ENCODING REGIONS IN *PARAMECIUM BURSARIA* CHLORELLA VIRUSES. Angela Fenton*, Biology Department, Nebraska Wesleyan University, Lincoln; and James Van Etten, Nebraska Center For Virology and Department of Plant Pathology, University of Nebraska–Lincoln.

2:24 19. POPULATION GENETICS OF A WARBLER COMMUNITY IN EASTERN CONNECTICUT. Kristi A. Pohlman*, and Patricia Szczys, Department of Life Sciences, Wayne State College, Wayne.

2:36 20. COLONIZATION OF AZITHROMYCIN RESISTANT *STAPHYLOCOCCUS AUREUS* UNDER FINGERNAILS OF HEALTH-CARE WORKERS IN LONG-TERM CARE FACILITIES. Erika Pearson, Doane College, Crete.

2:48 21. WATER PURIFICATION IN RURAL DOMINICAN COMMUNITIES. Jenny Grose*, Briggs Strelow, and Gary Michels, Chemistry Department, Creighton University, Omaha.

3:00 22. OCCURRENCE OF AMOXICILLIN-RESISTANT STRAINS OF *STAPHYLOCOCCUS AUREUS* IN DOANE STUDENTS CURRENTLY TAKING AMOXICILLIN. Kamleh Shaban* and B.J. Clement, Biology Department, Doane College, Crete.

3:12 BREAK

3:24 23. CLONING OF ORF-1 FROM DH5 PBLUE BAC HIS 2B PLASMID INTO THE PCMV TAG 4 VECTOR FOR EXPRESSION IN 2A CELLS. Ross Hansen*, Biology Department, Nebraska Wesleyan University, Lincoln, NE; and Clinton Jones, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln.

3:36 24. TUMOR NECROSIS FACTOR ALPHA (TNFα) ACTIVATES p70S6K VIA MULTIPLE MITOGEN-ACTIVATED PROTEIN KINASE CASCADES. Jacob D. Gibbens, Biology Department, Nebraska Wesleyan University, Lincoln, and Olson Center for Women's Health, University of Nebraska Medical Center, Omaha.

3:48 25. CHARACTERIZATION OF BOVINE HERPES VIRUS-1 STRAINS FROM ABORTED CALVES. Aspen Bricker*, Doane College, Crete; and Gail Henderson, Vicki Geiser, and Clinton Jones, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln.

4:00 26. MICROARRAY ANALYSIS OF LOW AND HIGH VIRULENT *LISTERIA MONOCYTOGENS* EXPOSED TO HUMAN KIDNEY CELLS. Eric Miller*, Doug Christensen, and Shawn Pearcy, Department of Life Sciences, Wayne State College, Wayne.

4:12 27. THE EFFECT OF HYDROCORTISONE ON ANGIOGENESIS. Ann M. Goding, Department of Biology, Hastings College, Hastings.

4:24 28. THE OPTIMIZATION OF REAL-TIME PCR PROTOCOLS TO DETECT *PHAKOPSORA PACHYRHIZI*, SOYBEAN RUST AND *FUSARIUM SOLANI*, SUDDEN DEATH SYNDROME IN SOYBEANS. Dru Dethlefs, Biology Department, Nebraska Wesleyan University, Lincoln.

4:36 29. A STUDY OF THE GENETIC MATING SYSTEM AND GENETIC DIVERSTITY OF COMMON TERN (*STERNA HIRUNDO*) NESTING IN MASSACHUSETTS. Kelli Roland*, Patricia Szczys, and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.

4:48 30. EFFECT OF ALTERED MEMBRANE PERMEABILITY ON THE QUORUM SENSING RESPONSE OF *PSEUDOMONAS AERUGINOSA*. J. Hutter*, A. Stokes, and B. Clement, Doane College, Crete; and J. Eudy, University of Nebraska Medical Center, Omaha; and J. Gessel, University of Nebraska–Lincoln.

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Cody Arenz, Biology Department
Nebraska Wesleyan University, Lincoln

SESSION B

Olin 249

1:24 p.m. 1. THE GUANINE RIBOSWITCH'S CONTROL OF METABOLIC FUNCTIONS BEFORE AND AFTER SITE SPECIFIC MUTAGENESIS. Carolyn Green*, J. Jansen, G. Soukup, and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

1:36 2. DETECTION OF GENES INVOLVED IN *LISTERIA MONOCYTOGENES* INFECTIONS. Michael T. Jacobsen*, Doug Christensen, and Shawn Pearcy, Department of Life Sciences, Wayne State College, Wayne.

1:48 3. THE EFFECT OF NITRIC OXIDE ON PROTEASOME ACTIVITY. Ashley Franzluebbers, College of Saint Mary, Omaha.

2:00 4. EVALUATION OF THE N-*MYC* PROTOONCOGENE AS A CANDIDATE FOR THE *EPT1* MODIFIER OF ESTROGEN ACTION. Megan Campbell*, Biology Department, Nebraska Wesleyan University, Lincoln; and James Shull, University of Nebraska Medical Center, Omaha.

2:12 5. DEVELOPMENT OF *IN VITRO* MODELS FOR BOVINE LEUKEMIA INFECTION: OPTIMIZATION OF SYNCYTIA-FORMING $TCID_{50}$ ASSAY AND PCR OF BLV *POL*. Erin M. Hughes* and J. A. Isaacson, Biology Department, Nebraska Wesleyan University, Lincoln.

2:24 6. A COMBINED THREE-ANTIGEN IMMUNOFLUORESENCE ASSAY FOR DETECTION OF KAPOSI'S SARCOMA-ASSOCIATED HERPES VIRUS (KSHV) INFECTION IN ZAMBIAN MOTHER-INFANT PAIRS. Ashlee S. Muller*, Biology Department, Nebraska Wesleyan University, Lincoln; and C. Wood, Nebraska Center for Virology, University of Nebraska–Lincoln.

2:36 7. EFFECT OF HYDROGEN PEROXIDE EXPOSURE ON GENE EXPRESSION IN *PARAMECIUM BURSARIA CHLORELLA* VIRUS-1 (PBCV-1). Cristina Schroder* and Garry Duncan, Biology Department, Nebraska Wesleyan University, Lincoln; and James Van Etten, Department of Plant Pathology, University of Nebraska–Lincoln.

2:48 8. COMPARISON OF THE EFFECTS OF TRICYCLIC ANTIDEPRESSANTS ON ALPHA-2 AGONIST-INDUCED HYPOTHERMIA IN ADULT AND JUVENILE RATS. Scott Madden*, Doane College, Crete; and David Bylund and Jean Dupree, Department of Pharmacology, University of Nebraska Medical Center, Omaha.

3:00 9. ACTIVATION OF cAMP-DEPENDENT PROTEIN KINASE (PKA), PROMOTES A_{2A}-MEDIATED MIGRATION IN BEAS-2B. Nicole A. Kolm, College of Saint Mary, Omaha.

3:12 BREAK

3:24 10. REVERSAL OF MYOCARDIAL FIBROSIS IN A TRANSGENIC MOUSE MODEL OF HUMAN HYPERTROPHIC CARDIOMYOPATHY. Sharalyn M. Steenson, College of Saint Mary, Omaha.

3:36 11. HOMEOPATHIC ALTERNATIVES TO CONVENTIONAL ANTIBIOTICS. Jessica Ott, Hastings College, Hastings.

3:48 12. PARASITES OF *BISON BISON* IN EASTERN NEBRASKA: A COMPARISON OF PARASITE CONTROL STRATEGIES. Heather Young* and Glenn Kietzmann, Wayne State College, Department of Life Sciences, Wayne.

4:00 13. BIOFILMS: ATTACHMENT TO SURFACES. Megan Lohmiller*, Katie Hofer, Amanda Kuhr, Angela Wheeler, and Cheryl Bailey, Midland Lutheran College, Department of Chemistry, Fremont.

4:12 14. INHIBITION OF HSP90 ENHANCES RADIOSENSITIVITY OF HUMAN CANCER CELL LINES. Thuy Tran, College of Saint Mary, Omaha.

4:24 15. A STUDY OF THE HABITAT ASSOCIATION OF BIRDS IN THE PINE RIDGE REGION OF NEBRASKA AS PREDICTED BY THE HABCAP MODEL. Angela M. Meiergerd*, Physical and Life Sciences Department, and C. Butterfield, Department of Applied Sciences, Chadron State College, Chadron.

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Cody Arenz, Biology Department
Nebraska Wesleyan University, Lincoln

SESSION C

Olin 224

1:24 p.m. 1. TICKS COLLECTED IN NORTHEAST NEBRASKA IN SUMMER 2005: A COMPARISON OF FLAGGING AND DRY ICE TRAPPING TECHNIQUES. Melissa Slaymaker* and Glenn Kietzmann, Department of Life Sciences, Wayne State College, Wayne.

1:36 2. REPRODUCTION RATE OF BEETLES AT VARIED TEMPERATURE AND FOOD SUBSTRATES. Lydia Zaragosa, College of Saint Mary, Omaha.

1:48 3. THE POTENTIAL RELATIONSHIP OF KINASE SUPRESSOR OF RAS AND THE GLUCOSE PATHWAY. Deann C. Settles*, Doug Christensen, and Shawn Pearcy, Wayne State College, Wayne; and Robert Lewis, University of Nebraska Medical Center, Omaha, NE.

2:00 4. THE TOMATO IMIDAZOLEGLYCEROLPHOSPHATE DEHYDRATASE GENE INHIBITS HUMAN CASPASE-3 AND CONFERS STRESS PROTECTION IN PLANTS. Phillip Lorhan*, Biology Department, Nebraska Wesleyan University, Lincoln; and S. Chen and M. B. Dickman, Department of Plant Pathology, University of Nebraska–Lincoln.

2:12 5. DEVELOPING TOOLS TO UNCOVER FBR6-ANNAT1 INTERACTIONS: IDENTIFYING ANNAT1 MUTANT KNOCKOUTS AND DETERMINING ANNAT1 SUBCELLULAR LOCATION. Andrew Heckman*, Biology Department, Nebraska Wesleyan University, Lincoln; and Julie Stone, Department of Biochemistry and Plant Science Initiative, University of Nebraska–Lincoln.

2:24 6. A SMALL MAMMAL STUDY OF SEVEN HABITATS AROUND WAYNE COUNTY NEBRASKA. Sarah Tasich*, Kara Paronish, and M. Borgmann-Ingwersen, Department of Life Sciences, Wayne State College, Wayne.

2:36 7. CHARACTERIZATION OF FLUORESCENT PSEUDOMONAS SPECIES POSSESSING THE ANTIBIOTIC GENES 2,4 DIACETYLPHLOROGLUCINOL (Phl) AND PHENAZINE-1-CARBOXYLIC ACID (PCA). Andy C. Rorie*, Biology Department, Nebraska Wesleyan University, Lincoln; and Deanna Funnell and Brian Tlamka, United States Department of Agriculture, Agricultural Research Service, Wheat, Sorghum and Forage United, Lincoln.

2:48 8. CONSTRUCTION OF A TRANSPOSON MUTAGENESIS LIBRARY FOR THE IDENTIFICATION OF *MYCOBACTERIUM MARINUM* VIRULENCE GENES USING SIGNATURE TAG MUTAGENESIS. Benjamin J. Thayer*, Biology Department, Nebraska Wesleyan University, Lincoln; and J.D. Cirillo and S.L. Cirillo, Department of Veterinary & Biomedical Sciences, University of Nebraska–Lincoln.

3:00 9. SYNTHESIS OF A PYRIMIDINE DNTP ANALOG AND ANALYSIS OF ITS INCORPORATION INTO DNA PRIMER-TEMPLATES BY POLYMERASE ALPHA. Greg Timblin*, Biology Department, Nebraska Wesleyan University, Lincoln; and R. Kuchta, K. Kincaid, and N. Low-Nam, Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO.

3:12 BREAK

3:24 10. UBC9 IS ESSENTIAL TO RETROVIRUS REPLICATION. Gentry Lewis Rundle*, Tariq Jaber, Chris Bohl and R.A. Weldon, Jr., Nebraska Center for Virology, University of Nebraska–Lincoln.

3:36 11. PREDICTION OF T-CELL AND B-CELL EPITOPES FOR SURVIVIN AND HUMAN MUC1. Branden D. Nemecek, University of Nebraska–Lincoln.

3:48 12. KERATINOCYTE MIGRATION AND ADHESION ARE REGULATED BY ERBB2. Kelsey L. Tinkum*, J.G. Madson, and L.A. Hansen, Biomedical Science, Creighton University, Omaha.

4:00 13. DNASE HYPERSENSITIVITY SITE MAPPING OF THE HUMAN N-CADHERIN GENE PROMOTER AND FIRST INTRON. Will Packard, Aspen Bricker*, and Kate Marley, Doane College, Crete.

4:12 14. HIV-I SUBTYPE C ENVELOPE GLYCOPROTEIN EVOLUTION. Anita Stokes*, Doane College, Crete; and Marzena Rola, Federico Hoffman, and John West, Nebraska Center for Virology, University of Nebraska–Lincoln.

4:24 15. THE EFFECT OF ALFALFA MOSAIC VIRUS ON YIELD AND SEED QUALITY IN SOYBEAN. Erin J. Von Bonn*, Biology Department, Nebraska Wesleyan University, Lincoln; and Amy Ziems, Plant Pathology, University of Nebraska–Lincoln.

COLLEGIATE ACADEMY

CHEMISTRY AND PHYSICS

Chairpersons: David Treichel and Nathanael Fackler
Nebraska Wesleyan University, Lincoln
Olin 324

8:00 a.m. 1. METHODS OF D* RECONSTRUCTION IN PROTON-PROTON COLLISIONS USING THE STAR DETECTOR AT RHIC. Stephen C. Hansen, Department of Physics, Creighton University, Omaha, representing the STAR Collaboration.

8:10 2. DFT STUDIES OF SOLVATOCHROMIC EFFECTS: THE π^* SCALE. Elizabeth Boals* and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne.

8:20 3. PREDICTING THE SITE OF ELECTRON TRANSFER USING DFT FRONTIER ORBITALS: STUDIES ON PORPHYRIN ATTACHED EITHER TO QUINONE OR HYDROQUINONE AND QUINHYDRONE SELF-ASSEMBLED SUPRAMOLECULAR COMPLEXES. Jared D. Jaeger*, Michael D. Beck, and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne; and Amy L. McCarty, Phillip M. Smith, 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.

8:30 4. COORDINATION COMPLEXES IN CERAMIC GLAZES. Darissa E. Woodford* and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne; and J. V. Anderson, 369 Union Rd., Boelus; and E. J. Simpson, P.O. Box 263, Norfolk.

8:40 5. POLYMERIZATION CHARACTERISTICS OF SELECTED OIL PAINT MEDIUMS. Kristina M. Cassell* and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.

8:50 6. PREDICTION OF THE pKa OF WEAK BASES FROM DFT STUDIES. Travis Maloley*, Paul A. Karr, and Kirsty Kounovsky, Department of Physical Science and Mathematics, Wayne State College, Wayne; and Lou Hale, Melvin E. Zandler, and Francis D'Souza, Department of Chemistry, Wichita State University, Wichita, KS.

9:00 7. RAPID ANALYTICAL METHODS FOR VEGETABLE OILS TESTING AND THEIR POTENTIAL NEW APPLICATIONS USING UV/VIS SPECTROPHOTOMETER. Nicholas P. Stutzman*, Zeb K. Martens, and Darius Agoumba, Department of Physical Sciences and Mathematics (PSCM), Wayne State College, Wayne.

9:10 8. DEVELOPMENT PLANS FOR AN ELECTROMAGNETIC CALORIMETER CONTROL SYSTEM FOR THE ALICE EXPERIMENT. Colleen Hartsig, Department of Physics, Creighton University, Omaha.

9:20 9. THE DESIGN, CONSTRUCTION, AND IMPLEMENTATION OF A RADIO TELESCOPE TO STUDY NEUTRAL HYDROGEN SPECTRAL EMISSIONS. Brian Kloppenborg, Physics Department, Hastings College, Hastings.

9:35 10. ASSESSING THE RAPID SELF-CLEAVAGE KINETICS OF A METABOLITE-DEPENDENT RIBOZYME. Kevin Klawuhn*, B. Hanisch, G. Soukup, and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

9:50 11. ASSESSMENT OF HEATING OF LIVING CELLS DURING OPTICAL STRETCHING USING THE TEMPERATURE-DEPENDENT FLORESCENT EMISSION SPECTRUM OF LAURDAN. Russell P. Wolfe* and M.G. Nichols, Physics Department, Creighton University, Omaha.

10:05 12. TRI-BLOCK BIODEGRADABLE POLYMERS FOR DRUG DELIVERY APPLICATIONS. Beth Muszynski* and Stephen M. Gross, Department of Chemistry; and Somnath Singh, School of Pharmacy & Health Professions, Creighton University, Omaha.

10:20 13. FIRST DATA FROM THE CREIGHTON UNIVERSITY COSMIC RAY OBSERVATORY. Robert P. Thomen* and Thomas S. McShane, Creighton University, Omaha.

10:35 14. DETECTION OF EXOPLANETS USING THE TRANSIT METHOD. Emily Petermann, Physics Department, Hastings College, Hastings.

10:50 BREAK

11:00 MAIBEN LECTURE (OLIN B)

1:00 p.m. 15. USING DRUG DISCOVERY AND DESIGN AS A MODEL FOR A RESEARCH BASED ORGANIC CHEMSITRY LAB CURRICULM. Jacob Mattson*, Danielle Bradly, Jeremy Wilmes, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.

1:12 16. IMPLIMENTATION OF A PC BASED CONTROLS SYSTEM FOR THE STAR EXPERIMENT. Matthew Brnicky, Physics Department, Creighton University, Omaha.

1:24 17. EXPERIMENTAL AND THEORETICAL STUDIES IN THE FORMATION OF ARENE CHROMIUM COMPLEXES. Lindsey Stockwell*, Jill Reimer, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.

1:36 18. STUDY OF EPOXY RELAXATION TIMES IN RELATION TO SIMILAR RELAXATIONS IN MOLTEN GLASS. Brandon Rodenburg* and David Sidebottom, Department of Physics, Creighton University, Omaha.

1:48 19. MATHEMATICAL MODELING OF THE DUAL-BEAM OPTICAL STRETCHER. Carolyn L. Posey* and M. G. Nichols, Department of Physics, Creighton University, Omaha.

2:00 20. INVESTIGATION AND OPTIMIZATION OF THE REACTION MECHANISM AND SETUP OF AN ELECTROCHEMILUMINESCENCE REACTION WITH FLUOROQUINOLONES AND TRIS(2,2'-BIPYRIDINE)RUTHENIUM(III). Marcel Fallet* and Erin M. Gross, College or Arts and Sciences, Creighton University, Omaha.

2:12 21. INCORPORATION OF NAFION INTO CAPILLARY ELECTROPHORESIS WITH DETECTION BY ELECTROGENERATED CHEMILUMINESCENCE. Rohesh Fernando*, Erin Gross, Department of Chemistry, Creighton University, Omaha.

2:24 22. REDOX IMAGING OF MULTIPLE CELL TYPES USING TWO-PHOTON MICROSCOPY OF ENDOGENOUS CELLULAR FLUOROPHORES. Nishant Chauhan*, L. Tiede, S.M. Rocha-Sanchez, K.W. Beisel, and M.G. Nichols, Creighton University, Omaha.

2:36 BREAK

2:48 23. NONVOLATILE TWO-TERMINAL MOLECULAR MEMORY. J. Snodgrass[1], G.P. Li[1], J. Lu[1], W.N. Mei[1,2], R. F. Sabirianov[1,2]*; [1]Department of Physics, University of Nebraska at Omaha; and [2]Center for Materials Research and Analysis, University of Nebraska–Lincoln.

3:00 24. POLYMER GELS FOR USE IN LITHIUM POLYMER BATTERIES. John Hamilton* and Stephen M. Gross, Department of Chemistry, Creighton University, Omaha.

3:12 25. MEASUREMENT OF HEATING IN THE OPTICAL STRETCHER BY RAMAN SPECTROSCOPY. Nicholas Camacho* and M. G. Nichols, Department of Physics, Creighton University, Omaha.

3:24 26. USING SOUND WAVES TO DETECT NOBLE GASES. Adam Peterson* and Todd S. Young, Wayne State College, Wayne.

3:36 27. NOVEL IONIC LIQUID ELECTROLYTE MATERIALS FOR DYE-SENSITIZED SOLAR CELLS. Elizabeth S. Sterner* and Stephen M. Gross, Department of Chemistry, Creighton University, Omaha.

3:48 28. EXPLORING THE EFFICACY OF SELF-HEALING DENTAL RESINS. Chris Wirowek* and Stephen M. Gross, Department of Chemistry; and Mark Latta, School of Dentistry, Creighton University, Omaha.

4:00 29. CALIBRATION OF THE OPTICAL STRETCHER FOR BIOMECHANICAL STUDIES OF LIVING CELLS. Meg M. Marquardt* and M. G. Nichols, Department of Physics, Creighton University, Omaha.

4:12 30. CONSTRUCTION OF A DYNAMOMETER AND THE MEASUREMENT OF SMALL ENGINE PERFORMANCE. Dwight Easterly, Physics Department, Hastings College, Hastings.

4:24 31. THE STUDY OF PERFORMANCE CHARACTERISTICS FOR A REMOTE CONTROL SUBMARINE. Landon Haack, Physics Department, Hastings College, Hastings.

4:36 32. NEUTRALINO-NUCLEON SCATTERING RATES WITH REALISTIC FORM FACTORS FROM ELECTRON SCATTERING DATA. Anne Kemper* and G. Duda, Creighton University, Omaha.

TEACHING OF SCIENCE & MATH

Chairperson: Julia Polak
Exeter-Milligan Public Schools
Olin 325

1:25 p.m. OPENING REMARKS – Julia Polak

1:30 1. USING DYNAMIC SYSTEMS MODELING IN HIGH SCHOOL AND COLLEGE CURRICULUM. Ashley Bruegman*, Jillian Wevel, Angela Wheeler and Josef Kren, Midland Lutheran College, Fremont.

1:45 2. A STUDY OF THE IMPACT OF INSTRUCTIONAL SETTING ON STUDENT MOTIVATION IN MATHEMATICS. Connie Colton, Mathematics Teacher, Omaha Public Schools, McMillian Magnet Center, Omaha.

2:05 3. DIAGRAMMATIC MODELS INTRODUCE SCIENCE VOCABULARY: STUDENTS USE DIAGRAMS TO SCAFFOLD FUTURE LEARNING. Robyn Carter, Third Grade Teacher, Omaha Public Schools, Omaha.

2:25 4. THE IMPACT OF COOPERATIVE LEARNING ON STUDENTS ABILITIES IN INQUIRY AND ON THE UNDERSTANDINGS OF SCIENCE CONCEPTS. Nina Hewitt, Walnut Hill Elementary School, Omaha.

2:45 6. TRAVELING THE INQUIRY CONTINUM: LEARNING THROUGH TEACHER ACTION RESEARCH. Alyssia Martinez-Wilkinson, Seventh Grade Science, Bryan Middle School, Omaha.

3:05 7. CRITICAL REFLECTION: SCHOOL CHANGE, TEACHER DEVELOPMENT AND STUDENT ACHIEVEMENT. Carol Mitchell*, College of Education, University of Nebraska at Omaha; and Susan Koba*, Urban Systemic Program, Omaha Public Schools, Omaha.

JUNIOR ACADEMY OF SCIENCES

Co-Chairpersons: James Woodland, Nebraska Department of Education, Lincoln
Judy Williams, NJAS President, Central City

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 217
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
SESSION A

MEASURING NETWORK EFFECTIVENESS IN HIGH TECHNOLOGY NETWORKS OF PUBLIC-PRIVATE PARTNERS

Nanette Scarpellini Metz and Brent Bowen, Aviation Institute, University of Nebraska at Omaha, NE 68182

This study will enhance the existing knowledge of interorganizational dynamics in high technology public-private networks. The study focuses on the National Aeronautics and Space Administration (NASA) and two of the networks it formed in its public agency role. For this research, the two public-private networks studied were part of the aeronautical element of NASA. More specifically, they involve the general aviation area which is trying to advance the idea of personal aircraft as part of a nationwide transportation system. The two networks, or alliances as they are also called, are the Advanced General Aviation Transport Experiments (AGATE) and the Small Aircraft Transportation System (SATS). At a recent Congressional hearing, Secretary of Transportation Norman Mineta said, "The Department of Transportation is going to help SATS go from R&D [research and development] to implementation...implementation is already happening...the next generation national air transportation system plan will make the number of operations go up rapidly... SATS is very important to this and our future" (Aerospace States Association, 2004). This study explores what factors contributed to the perceived effectiveness of the alliances as determined by their active members. By analyzing the high technology environment in which NASA and these programs were founded, the study offers greater understanding of the organizational dynamics in terms of program development and production of desired outcomes. In developing a deeper knowledge of what elements promote effectiveness between the public and private sectors, this research is intended to discover the impact of organizational dynamics on NASA public-private partnerships such as AGATE and SATS. This study examines the network structure and network context at the individual, organizational and network level combining quantitative and qualitative data for analysis. The data will be gathered through a quantitative survey questionnaire and analyzed using the model of effectiveness in high technology networks based on research conducted by Provan and Milward (1995). The findings will be validated through follow-up interviews with network members. The importance of public-private partnerships and aviation initiatives is advancing with government support.

REMOTE SENSING OF BEAN RUST

Mark Steele, Don Rundquist, and Rick Perk, School of Natural Resources, University of Nebraska–Lincoln, NE 68588; and James Steadman and Lindsey Otto-Hanson, Department of Plant Pathology, University of Nebraska–Lincoln, NE 68588

Remotely sensed data collected for the purpose of monitoring and analyzing the onset and spread of bean rust using the CALMIT AISA hyperspectral imager can provide agricultural producers with information needed for improved management and decision-making. The presentation provides an overview of methods used in airborne remote sensing of dry beans (Phaseolus vulgaris) that were inoculated (for experimental purposes) with a rust pathogen (Uromyces appendiculatus). The geospatial techniques used to detect the presence of the pathogen are described along with the procedures for image registration and classification of pixel data. AISA images acquired over the University of Nebraska–Lincoln West Central Research and Extension Center, located near North Platte, NE were transformed, using spectral indices, to provide an overview of field conditions on August 30, 2005. Results indicate some potential for detecting the presence of a rust pathogen in the crop.

EFFECT OF SURFACE TENSION AND FORCED CONVECTION ON METHANOL DROPLET COMBUSTION

Raghavan Vasudevan and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

A numerical investigation of surface tension and forced convection effects on moving and suspended methanol droplets burning in a zero-gravity, low-pressure air environment is presented. Simulations were conducted using a predictive, transient, axisymmetric model for an initial droplet diameter of 0.5 mm, an ambient temperature of 1200 K, and initial Reynolds numbers (Re^0) in the range of 1 to 100. Results indicate that, for moving droplets, due to the presence of an envelope flame at some stage during the droplet lifetime, surface tension is important over the range of Re^0 considered; the extinction diameter decreases with increasing Re^0. For suspended droplets, when transition or envelope flame is present (Re^0 less than approximately 15), surface tension is important; when an envelope flame is present (Re^0 less than approximately 10), the extinction diameter increases with Re^0. Both for suspended and moving droplets, the droplet lifetime is weakly sensitive to surface tension. The variation of droplet lifetimes with Re^0 is much stronger for suspended droplets than for moving droplets.

THE SUSTAINABLE DEVELOPMENT OF U.S. AIR TRANSPORTATION: THE PROMISE AND CHALLENGE OF INSTITUTIONAL REFORM

John Bartle, School of Public Administration, University of Nebraska at Omaha, NE 68182

Sustainable development is a concept that has had great influence on natural resource policy, however to date it has had limited influence on transportation. This article examines how well U.S. air transportation practice meets the goal of sustainability, and finds current practice to be unsustainable. Forecasted trends suggest this problem will get worse. Neither current pollution control policies nor technological progress are sufficient to solve the problem. Reduced use of air travel could solve the problem, however the goals of mobility and speed of travel would be inhibited. Taxes could reduce the external costs caused by air pollution; however there are administrative and political barriers to this. Institutional reform seems to be the logical solution, and the process to achieve this reform is described.

CREWBOT SUSPENSION DESIGN

Nathan Wood, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

Planetary Surface Robot Work Crews (RWC) represent a new class of construction robots for future deployment in planetary exploration. Rovers currently being used for the RWC platform lack the load carrying capabilities required in regular work. Two new rovers, dubbed Crewbots, being designed in JPL's Planetary Robotics Lab specifically for RWC applications greatly increase the load carrying capabilities of the platform. A major component of the rover design was the design of the rocker type suspension, which increases rover mobility. While many previous rovers have used internal bevel gear differentials, the increased load requirements of the Crewbots calls for a more robust system. The solution presented is the use of an external modified three bar slider-linkage rocker style suspension. The final product is a suspension system capable of supporting the extreme loading cases the RWC platform presents without consuming a large portion of the Crewbots' internal space.

PERFORMANCE IN SPACE TASKS: HOW WELL ARE THEY RELATED TO ENVIRONMENT?

Rajash Shanmugam and Ram Bishu, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln, NE 68588

The human operator is considered to be the most valuable asset in the space work environment as the space program moves to extended duration of flight. This is a continuation of the work that we have been performing for the last three years. Various tasks performed inside the ISS from the available past mission videotapes were identified. Tasks which were clearly identifiable and separable from each other were analyzed further during a video analysis technique. Physical and Cognitive Task Analysis was also performed to measure physical and mental workload on the identified tasks. Tasks were then classified according to their stress level and task time standards were calculated. The second stage of the study was to create an informatics database with the analyzed tasks, their motion descriptors, time, elemental subtasks, their respective time elements, and time variance. Using Access the database was set up. The third, and final, stage of the study was to develop a software interface for easy access and modifications of the database as well as the capability of performing various calculations for potential tasks. The software has been developed and needs to be validated. In this phase, attempts have been made to link performance of IVA tasks to Workplace Dimensions. Two things are happening at NASA. Due to a Presidential directive, the focus is shifting from space travel (zero gravity) to travel to Moon and Mars (partial gravity). Consequently, the agency has redefined certain sections of Human System Integration Standards (HSIS 3000). A new Crew Exploration Vehicle (CEV) is being constructed. As a part of the space planning requirements, there is considerable interest on how space dimensions within CEV or Shuttle would affect performance. As no data is available on this, the objective of this study is to develop the relationship, purely from sound human factors principle. A matrix relating tasks to space dimensions have been developed. However, they need some experimental validation at Johnson Space Center.

SMALL COMMUNITY AIR SERVICE: HAVE POLICIES DESIGNED TO FOSTER AIR SERVICE ACTUALLY STIFLED TECHNOLOGICAL INNOVATION?

Scott Tarry, Lawrence Runana, and Jorge Montoya Victoria, Aviation Institute, University of Nebraska at Omaha, NE 68182

Small and rural communities have faced limited access to air transportation and the benefits that such services provide. To address these concerns, federal, state, and local governments have taken steps to foster air service in small communities through subsidization of scheduled airline service, provision of aid for airport infrastructure improvements, and airline/airport marketing initiatives. One persistent, and seemingly unaddressed, concern for small communities over the years has been the lack of aircraft appropriate for the kinds of operations and the limited demand typical of small community service. While the other segments of the air transport market have benefited immensely from the introduction of new aircraft, the majority of small communities continue to be served by turboprop aircraft not dissimilar to those that have served these markets since the 1960s. We find that current policies designed to support small community air transport have actually stifled the adoption of alternative aircraft technologies and hindered the development of new aircraft types that may be more appropriate for small community air service.

NUMERICAL SIMULATION OF A NOVEL BLAST WAVE MITIGATION DEVICE

Zhenbi Su, Zhaoyan Zhang, and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

This paper proposes a novel blast wave mitigation device, consisting of a piston-cylinder assembly. A shock wave is induced inside the device when it is subject to a blast wave. The shock wave propagates inside the device and is reflected repeatedly. The physical processes within the blast wave mitigation device are simulated numerically. A flux vector splitting scheme coupled with Runge-Kutta scheme is used for the shock wave propagation process. Numerical predictions are in excellent agreement with analytical solutions for special cases of the investigated problem that are available in the literature. Numerical results show that the maximum pressure on the base of the device can be several orders of magnitude smaller than the pressure of the blast wave, while the duration of the force on the base of the device can be larger than the duration of the blast wave by orders of magnitude. The end result is that the impulse on the base of the device is approximately equal to the blast wave impulse. A parametric study of the device has been carried out. The effects of the blast wave impulse, pressure and duration were studied. It is also shown that the mass of the piston and the length of the cylinder are key parameters of this blast wave mitigation device. These parameters can be optimized to mitigate the impact of the blast wave.

NATURAL FREQUENCIES OF A VIBRATING UNIFORM CANTILEVER WITH A CONCENTRATED END MASS

E. Terence Foster and Brian Skourup, College of Engineering and Technology, University of Nebraska–Lincoln, NE 68588; and William Waters, Puritan Manufacturing, Inc., Omaha, NE 68110

Free vibration natural frequencies for the uniform cantilever are well known and documented. However, when a concentrated mass appears at the end of the cantilever, there is a marked decrease in natural frequency as the mass size increases relative to the cantilever. This decrease in natural frequency can lead to destructive resonance when the cantilever experiences forced vibrations such as those of a space vehicle, machinery, or seismic effects. This presentation shows the boundary conditions pertaining to the uniform cantilever concentrated end mass case. Roots to the characteristic equation for the natural frequencies are determined for several ratios of concentrated end mass to cantilever mass. The concentrated end mass characteristic equation and its solution converge to the uniform cantilever case when the concentrated end mass becomes zero.

HOW ERROR-INTOLERANCE EVOLVED IN AMERICAN AVIATION AIRSPACE MANAGEMENT

Patrick O'Neil, Aviation Institute, University of Nebraska at Omaha, NE 68182

External political forces shaped the organizational structure and administrative processes of the FAA and preceding organizations to produce a system of regulatory oversight and operation of air traffic management that is extremely error-intolerant. This doctoral research focused on applying theories of incremental and punctuated equilibrium policy to evaluate policy formulation and implementation to explain the evolution of error-intolerance. Theoretical evaluation of organizational responsiveness to external control was also examined. Case study examination of data from 1905-2002 revealed that error intolerance was first demanded by the legislative and executive branches of government, which was modified over time to shape the regulatory structure and internal behavior of the FAA and its

predecessors. Traditional theories of incremental and punctuated equilibrium were found to be inadequate to accurately describe policy change and evolution over such a long period of time. Error intolerance development and continuance are due to a systems approach to error control. External systems continually monitor and pressure for agency improvement, while internal agency systems strive for increased levels of error-intolerance. Contrary to traditional organizational theory that describes federal bureaucracies as unresponsive to external influences, the FAA and its predecessors have consistently responded to external demands for change. A new theory of policy formulation and implementation called precipitated policy development is advanced to more accurately describe policy evolution over long periods of time.

AERONAUTICS AND SPACE SCIENCE

SESSION B

DISTANCE LEARNING IN COLLEGIATE AVIATION: A SUPPLY AND DEMAND ANALYSIS

C. Daniel Prather, Aviation Institute, University of Nebraska at Omaha, NE 68182

Distance learning, which, for the purpose of this study, is defined as academic courses that can be completed via the computer and internet and entirely absent from the traditional classroom, has seen tremendous growth in the past decade. Indeed, according to the GAO, about 1 in 13 postsecondary students enrolls in at least one distance learning course each semester (U.S. GAO, 2002). These students, who tend to be older and more likely to be employed full-time while attending school part-time, are changing the landscape of higher education. In an effort to better understand the manner in which this technology is affecting collegiate aviation specifically, a multi-phase research effort was conducted. By visiting the website of each of the 115 U.S. institutions offering non-engineering aviation programs, and conducting a survey of 200 randomly selected airport professionals, this white paper summarizes a supply and demand analysis of distance learning in collegiate aviation.

THE NATIONAL GEOSPATIAL EXTENSION PROGRAM

Karisa Vlasek, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha, NE 68182; and Nathan Mattox, Department of Geography, University of Missouri, Columbia, MO 65211; and John McGee, Department of Forestry, Virginia Tech University, Blacksburg, VA 24061; and Barron Orr, Office of Arid Land Studies, University of Arizona, Tucson, AZ 85719; and Phil Rasmussen, Department of Plants, Soils, and Biometeorology, Utah State University, Logan, UT 84322; and Sandy Prisloe, Cooperative Extension, University of Connecticut, Haddam, CT 06438; and et al

The National Geospatial Extension Program was developed as part of a convergence of user needs and agency missions. The program partners NASA's Science Directorate, NASA Space Grant, USDA (Land Grant), and NOAA (Sea Grant). The visionary goal of placing a Geospatial Extension Specialist (GES) in each state commenced with a pilot program in 2000. Due to the overwhelming success of the three pilot states, the National Geospatial Extension Program currently has 14 participating states. The GES acts as a knowledge broker, or a two-way conduit between research, applications development and practice. The program is designed to facilitate the adoption of geospatial products and services, including remote sensing, to those who might not otherwise use them. Potential users include higher education; K-12; farmers; ranchers; extension agents; and local, regional, state, tribal program areas. Program activities include workforce development, geospatial seminars, technology transfer of geospatial data and systems, and outreach and education programs.

INTERACTIVE CLASSROOM MATERIALS ON GALAXIES

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

Educational research has consistently illustrated the importance of intellectually engaging student's conceptual ideas in the classroom. One effective method of accomplishing this is to present students with challenging conceptual questions, have them defend their thinking with peers, and commit to answers by registering an individual vote before and after discussion. ClassAction is a collection of Flash computer modules designed to help astronomy instructors foster interactive engagement and provide rapid feedback. Each module consists of a topical set of visual conceptual questions that can be easily selected and projected in the classroom. Instructors have the capability to recast these questions into alternate forms based on their own preferences and formative feedback from the class. The questions are accompanied by outlines, graphics, and many simulations for providing feedback. This presentation will demonstrate recently developed modules on the properties of galaxies.

SCIENCE CURRICULUM DEVELOPMENT: THE AVN 3510 AEROSPACE SCIENCES WORKFORCE DEVELOPMENT INITIATIVE

Brent Bowen, Michaela Schaaf, Karisa Vlasek, and Scott Vlasek, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha, NE 68182; and Neal Grandgenett and Carol Mitchell, College of Education, University of Nebraska at Omaha, NE 68182

The University of Nebraska at Omaha's (UNO) Aviation Institute, College of Education, and the Nebraska NASA Space Grant program initiated collaboration on a joint course, AVN 3510 Aerospace Sciences. This introductory course will provide pre-service teacher candidates, aviation students, and students at large the opportunity for a science-oriented general education course. The curriculum will be focused in the areas of earth and space science, geospatial technologies, and aeronautics. Key topics for this course will include Geographic Information Systems (GIS), Global Positioning Systems (GPS), and the NASA Jet Propulsion Laboratory/ University of Nebraska-designed DataSlate data visualization tool. Also included will be space sciences focused solar system exploration, satellite technology, and astronautics. Students will engage in aeronautic science topics inclusive of the study of aerodynamics of flight, meteorological science and weather, and flight technology. All students will be provided an opportunity to apply concepts of flight in the Aviation Institute's Advanced Simulation Facility. Teacher Education students will use the National Science Standards to develop science curriculum from the topics that are taught in this course, while all students will engage in a technical writing exercise related to the science and technology applications of this course. Resources from many government agencies, nonprofit organizations, and commercial aerospace companies will be used to provide the students with the information necessary to apply the concepts of aerospace sciences to future workforce applications. Support for this workforce development education initiative is funded in part by a grant from the NASA Nebraska Space Grant program. In result, the elements of this collaborative curriculum revision project are presented with the intent of audience participation for revision recommendations.

COMPUTERIZED RANKING TASKS FOR INTRODUCTORY ASTRONOMY

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

Ranking tasks require students to place graphical icons into some ranked order and have been widely used for several years in physics. Ranking tasks are valued for their capacity to elicit students' natural ideas regarding physical behaviors which often helps students recognize any misconceptions that they may have. This presentation will describe the development of computer-based ranking tasks in Flash

for introductory astronomy. These ranking tasks can conveniently be incorporated into web pages, PowerPoint presentations, Flash-based delivery systems such as Breeze, and web-based assessment engines such as EDU. Computer-based delivery offers many advantages over pencil and paper versions such as assigning scores, providing feedback, incorporating instructional materials, and using color and animation in the icons. The capability to randomize the question, ranking criteria, and icons used encourages students to repeat a task until they master the concepts involved.

NATIVE IMAGE: INSTITUTE OF MANAGING APPLICATIONS IN GEOSPATIAL EXTENSION

Karisa Vlasek, Brent Bowen, and Hank Lehrer, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha, NE 68182; and Jan Bingen, Department of Computer Science, Little Priest Tribal College, Winnebago, NE 68071

The physical and cultural geography of Nebraska is diverse due to its mixture of metropolitan, rural, and Native American communities across the state. The Nebraska Geospatial Extension Program, a NASA and USDA initiative, was developed to educate and train potential users of geospatial technologies. The need exists in Nebraska to not only to reach out to metropolitan and rural areas of the state, but to Native American reservations with cutting-edge geospatial technologies. Funding from NASA over the past fourteen years has cultivated a collaborative relationship between NASA Nebraska Space Grant and EPSCoR, and Nebraska's Native American communities. Seed grant funding led to the creation of Native IMAGE (Institute for Management of Applications in Geospatial Extension) at Little Priest Tribal College (LPTC) in Winnebago, NE. Native IMAGE is playing a leadership role at LPTC in not only introducing geographic information systems (GIS) technology, but also remote sensing applications to the Winnebago Tribe of Nebraska. It is expected that Native IMAGE will become a model to assist other Native American communities in utilizing geospatial technologies to assist in land planning, range management, and cultural artifacts preservation. A key component of the program is to improve the math, science, and technology skills of students, staff, and faculty from the state's four reservation schools and two tribal colleges.

AN EVALUATION OF THE IMPACT OF NASA EPSCoR ON THE STATE OF NEBRASKA

Brent Bowen, Michaela Schaaf, Karisa Vlasek, and Cindy Webb, NASA Nebraska Space Grant Consortium, University of Nebraska at Omaha, NE 68182; and Valerie Russell, The Russell Center, LaVista, NE 68128

In order to provide a successful NASA EPSCoR program for Nebraska, it is important to evaluate the program for future success. Evaluation mechanisms exist for each of the program elements, such as research success and workforce pipeline tracking. Additionally, as Nebraska plans for the next EPSCoR competition, a comprehensive evaluation was necessary to identify strengths and weaknesses from the previous 10 years. To facilitate this process, an external evaluation of the NASA Nebraska EPSCoR program was conducted. It provides a summative evaluation of the first NASA EPSCoR program in Nebraska, including how the program addressed NASA's overarching goals for EPSCoR research; and a formative assessment of how NASA EPSCoR's ongoing project activities continue to address NASA's goals for research in Nebraska. The evaluation reviews the program's collaborative activities, systemic growth, research success, technology transfer, and management. Participant groups studied included the NASA Nebraska EPSCoR Technical Advisory Committee, NASA technical monitors, collaborative research team PIs, former researchers, and funded students. Surveys, interviews, and past quarterly reports were used to collect the data. Results and feedback from this comprehensive evaluation will allow success in the next NASA competition by examining the impact of NASA EPSCoR on the state.

INFORMATION TECHNOLOGY, IMAGERY, AND INTERACTIVITY: KEY COMPONENTS OF NEW STRATEGIES FOR EARTH SYSTEMS SCIENCE EDUCATION

Neal Grandgenett and Bill Schnase, Department of Teacher Education, University of Nebraska at Omaha, NE 68182; and Steve Hamersky, Gross High School, Omaha, NE 68147

This presentation will describe three key components suggested by educational researchers and various NASA projects to be the most important elements for enhancing student learning within Earth Systems Science Education today. The presentation will briefly describe emerging capabilities in information technology, increased access points for global imagery, and recently embraced strategies for student interactivity using the Internet. These components are being represented and tested within various NASA-related education projects in several locations across country. Examples will be briefly presented related to these new information technology based learning environments. In addition, examples of how several local classroom teachers are integrating these new opportunities for Earth Systems Science Education will be described. The audience will also be asked to mention any additional examples within the brief question and answer period of the presentation, with an opportunity for further informal discussion encouraged during the break.

DEVELOPING AND APPLYING CHLOROPHYLL ALGORITHMS FOR HYPERSPECTRAL REMOTE SENSING OF COASTAL WATERS

Christine Hladik, Environmental Sciences Institute, Florida A&M University, Tallahassee, FL 32307; and John Schalles, Department of Biology, Creighton University, Omaha, NE 68178

Optically complex coastal waters pose significant challenges to remote estimation of chlorophyll. We collected water reflectance data at six East Coast and Gulf of Mexico sites between 2002 and 2005. An airborne AISA imaging spectrometer was flown concurrently at five sites. At 189 stations used for calibration, we measured the following median values and ranges: chlorophyll 13.6 mg/m3 (0.15 - 490), total suspended matter 16.9 mg/L (1.3 - 113.2), and CDOM 440 nm absorbance 1.25 m-1 (0.00 - 21.1). The most robust predictor of phytoplankton chlorophyll was a semi-empirical algorithm using an estimate of the depth of chlorophyll absorption at 675 nm against for particle scatter and CDOM attenuation using maximum green reflectance. We then compared close range water reflectance data with AISA reflectances. Procedures for correcting AISA data provided a basis for applying our algorithm estimates to flight path imagery.

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

VARIATION IN CIRCADIAN PAIN IN INBRED STRAINS OF MICE

Natalie Rasmussen, College of Nursing, University of Nebraska Medical Center, Omaha, NE 68198

A variation in the pain response has been noted in humans and animals. Differences within and between species/strains may be due to rhythmic factors that are influenced by genetic factors. The long-range goal is to effectively treat pain at all times of the day while decreasing the adverse effects associated with analgesics by basing the dose of an analgesic on the circadian pain, neurotransmitter, or genetic rhythms. The objective of this proposal, which is the next step toward attaining the long-range goal, is to compare pain responses within and between inbred strains of male mice at six different times of day. The rationale that underlies the investigation is that understanding circadian and pain modulatory systems will assist in the ability to provide effective treatment of pain throughout the day without adverse effects.

SPACE: AN EVOLUTIONARY COMPARISON

Steven Ryberg, Educational Administration, University of Nebraska–Lincoln, NE 68182

Space exploration is the term that has come to be used to represent the idea of human beings searching the final frontier, and while government agencies have been successful in the past, the future seems to be relying more on privatization. As NASA, ESA, and other world space agencies continue to rely on dated machinery to go into space, new, private ventures are setting out to privatize the heavens. As we see today in the space program, it costs $10,000 per pound to get anything into orbit, such as satellites and the International Space Station (ISS) components. To claim that setting up commercial space tourism services is a realistic target for business today might seem unrealistic since the number of people who could afford to send themselves into space is few. Then again, Virgin Galactic claims that it is sold out of seats for its first year of operation. Perhaps if the space industry took a look at the aviation industry, new light can be shed on the subject. It has been said that those who do not learn from the past are condemned to repeat it. Is this not what NASA is doing by looking to the Saturn V for a return to the moon? Perhaps it is time for the government to invest more seed money into private firms that have the drive to try new technologies, develop new spacecraft, to boldly go where government is unable to go themselves. "How can the space industry bring space travel to the masses?" While there is not a single solution, perhaps comparing the evolution of aviation to the evolution of space can help show us where we lie today.

DEVELOPING TRANSPORTATION AGENCY LEADERS: AN EXPLORATORY STUDY

Brent Bowen and Mary Fink, Aviation Institute, University of Nebraska at Omaha, NE 68182

The development of leadership skills is an essential element of workforce development. One key challenge facing state departments of transportation is the imminent retirement of a high percentage of transportation officials. Succession management consists of the task of developing training programs, both formal and informal to meet the needs of the industry. Adding to this challenge is the burden of budget constraints, which is further compounded by the demand for additional services. In response, the Transportation Research Board (TRB) commissioned a study through the *National Cooperative Highway Research Program Project 20-5*. Brent Bowen, along with other transportation leaders, was appointed to the study's panel. The panelists contributed to each component of the study design including statement of the problem, literature review, methodological approach and data analysis. The panelists crafted a comprehensive survey to gather data regarding demographics, recruitment and retention strategies, leadership training and succession management. Additionally, Bowen had the opportunity to further contribute results from a dialogue with Secretary of Transportation Norman Mineta. The results of this panel study are presented as they appeared in a Fall 2005 TRB monograph. This study was sponsored by the Transportation Research Board of the National Academy of Sciences.

ANTHROPOLOGY AND GEOGRAPHY

MYTH, HUMOR, AND COGNITION: A COGNITIVE ANTHROPOLOGICAL APPROACH

Benjamin Grant Purzycki, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

Certain cultural ideas have particular salience among humans because of our cognitive architecture; we remember particular ideas better than others because of the way our minds have evolved. As cognitive anthropological accounts reveal, "religious"/epistemological ideas are universally quite similar insofar that they contain violations of cognitive ontological templates. However, humor is often used as a device in mythico-epistemological representations of the world. With the introduction of a computational theory of humor that is harmonious with the epidemiological approach that cognitive anthropologists have adopted, a number of hypotheses are tested regarding the retention of various potential religious ideas.

TOWARDS A CROSS-CULTURAL TYPOLOGY OF MALE HOMOSEXUALITY

Brent Kennedy, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

In order to understand the evolutionary cause(s) of homosexuality, first we must consider the variation in its practice cross-culturally. Few would deny that there are different expressed 'types' of male homosexuality, however, there is not a single anthropological classification of male homosexuality which has been tested cross-culturally. Using a modified version of Crapo's (1995) typology, I will attempt to do just that, and in doing so perhaps aid in the direction of further evolutionary research in this field. Additionally, I will be examining the relationship between two of these 'types,' *pathicism* and *androphilia*. I propose that the distinction between these types of behavior is not evolutionary, but caused by social stratification and gender inequity.

MEXICAN CULTURAL DIVERSITY AS DESCRIBED BY NEWLY-IMMIGRATED MEXICAN ADOLESCENTS AT NORTH STAR HIGH SCHOOL IN LINCOLN, NE

Mara D. Giles, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

The non-Mexican population of Nebraska has a generally superficial understanding of diversity among recently immigrated Mexicans. To break down the stereotypes at the high school level, a teaching module describing Mexican cultural diversity was designed. Information from interviews with ten newly-immigrated Mexican adolescents at North Star high school combined with literature review became the focus of the module. This was presented to fellow students to illustrate cultural diversity as represented by the interviewed students. Results indicate that this type of educational tool is an effective, yet flexible, first step toward teaching diversity.

STRATEGIES OF VIOLENT RESISTANCE: A CASE STUDY FROM THE CHEYENNES AND THE COMANCHES

Martha L. McCollough, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

After the 1830s, violent encounters between Euroamericans and the Cheyennes and Comanches escalated. This presentation explores weapons of resistance in situations of asymmetrical power. Two specific incidences will be discussed in order to explain theories of violent resistance and the reasons that they generally fail.

LAKOTA STRUGGLES FOR CULTURAL SURVIVAL: HISTORY, HEALTH AND DEVELOPMENT

Benjamin Jewell, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588-0368

The effects of alcohol use on the Pine Ridge are epidemic and have had a devastating impact to the current status of the residents. Combined with this is the historic effect of U.S. colonial relations with the Lakota, which has engendered a system of dependency, making the transition from an independent trading economy to capitalism difficult. This paper is an attempt to investigate the current life of a Pine Ridge resident and relate how the past has shaped the present through a successful attempt by the U.S. to bring an end to the way of life of the Lakota. This analysis will include a detailed statement of the economic and social impacts occurring at Pine Ridge, including, but not limited to, treaty relations with the U.S., colonial impacts on demography and health, and also interactions between Lakota and Whiteclay, NE.

EARLY HOLOCENE ARCHAEOLOGY, GEOARCHAEOLOGY, AND PALEOECOLOGY ON THE CLARY RANCH, WESTERN NEBRASKA

Matthew G. Hill, Department of Anthropology, Iowa State University, Ames, IA 50010; and David W. May, Department of Geography, University of Northern Iowa, Cedar Falls, IA 50614; and David J. Rapson, Department of Anthropology, Iowa State University, Ames, IA 50010; and James L. Theler, Department of Sociology & Archaeology, University of Wisconsin–La Crosse, WI 54601

Recent interdisciplinary investigations along a two kilometer stretch of Ash Hollow Draw in Garden County provide a wealth of substantive new evidence related to early Holocene human adaptations on the central Great Plains. Under consideration here are two archaeological sites situated within the lower portion of a ~14 m thick early to middle Holocene alluvial valley fill. Radiocarbon assays on charcoal and bone indicate the sites are penecontemporary, dating between 9100 and 9000 B.P., representing apparently complementary examples of the same settlement and subsistence system. The Clary Ranch site offers a view from the perspective of a late summer-early fall secondary processing area for bison carcasses derived from a nearby mass kill. The intensive character of carcass exploitation, involving defleshing and marrow extraction, suggests that the bulk of the yield was destined for storage in anticipation of impending winter food shortages. The primary component at the recently identified O.V. Clary site is interpreted as a residential camp, with evidence for occupation during the mid-summer, mid-winter, and late winter/early spring. On-site activities here were organized around an intact hearth area, to which the upper limb bones of at least five bison were transported for processing and subsequent consumption.

255 PIECES OF CHIPPED STONE: INSIGHTS ON LONG-TERM HUMAN USE OF THE PINE RIDGE ESCARPMENT AND ASSOCIATED PLAINS OF WESTERN NEBRASKA FROM A LOW DENSITY SURFACE ARCHAEOLOGICAL RECORD

LuAnn Wandsnider and Elisha A. Mackling, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588-0368; and Matthew J. Douglass, Department of Anthropology, Auckland University, New Zealand

Pedestrian archaeological survey on the Oglala National Grasslands in 1999 and 2001 and the Nebraska National Forest in 2005 (Dawes and Sioux Counties, Nebraska) recorded low densities of chipped stone throughout. Here we report a preliminary comparison of chipped stone assemblages from three geographic contexts differing in terms of elevation and geomorphological exposure. Even with these very sparse assemblages, we can infer rather different uses of these subtly different High Plains contexts, as we describe here.

STONE TOOL PRODUCTION AT LA UNIÓN, HONDURAS

Carleen D. Sanchez, Department of Anthropology and Geography and Institute for Ethnic Studies, University of Nebraska–Lincoln, NE 68588-0368

This paper will focus on the production and consumption of stone tools at the Late Classic period site of La Unión located in western Honduras. Although Maya lithic assemblages are typified by the ubiquitous obsidian blade technology, the majority (c. 80%) of stone tools of La Unión were fashioned from locally obtainable cryptocrystalline materials as part of an informal, non-specialized industry. However, excavations at two low ranking patio units revealed a significant number of micro-drills that were not part of the typical household tool set. Intra-site variation in stone tool use may indicate craft specialization on the part of low ranking members of the community.

MAKING THE MARK: AN INTERPRETATION OF IRONSTONE MAKERS MARKS IN 19TH CENTURY AMERICA

Samantha Kirkley, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588-0368

Nineteenth Century ceramic maker's marks illustrate the evolution of social, economic, and political changes in the United States. Staffordshire potters developed ornate, inexpensive, durable iron stone tableware which became extremely popular in the United States. English potters employed various marketing techniques to encourage ceramic sales in the U.S. Ceramic analysis from selected historic trails sites, such as Beaver Crossing, suggests that westward expansion contributed to English monopolization of iron stone tableware in the U.S. After American potters mastered iron stone production in the late 1860s, they often continued to use English looking makers marks in hopes of profiting from the Staffordshire popularity. However, by the 1880s, American potters abruptly abandoned using British style marks and replaced them with distinct national imagery, such as eagles. The ever changing marks act as cultural texts defining past social, economic, and political processes.

HITTING THE ROAD: A CASE STUDY OF GEOPHYSICAL PROSPECTING TECHNIQUES AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49), AN HISTORIC TRAIL FORD IN SOUTHEASTERN NEBRASKA

Arlo McKee, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588-0368

Many geophysical studies have included historic trail remnants in their findings. However, few studies have actually focused on the trails themselves. An historic trail often appears as a worn and compacted soil whose signature can be subtle or nearly invisible on the modern ground surface. The Beaver Creek Trail Crossing site (25SW49) in southeastern Nebraska contains five contiguous trail ruts worn into the western slope of the Beaver Creek flood plain over roughly twelve years. Since this component contains very few modern disturbances, it affords a unique opportunity in which to study the trails themselves. A geophysical case study comparing multiple survey techniques was conducted during the summer of 2005. The results of this project demonstrate the utility of geophysical applications for delineating these transitory features of the historical landscape.

SIX-GUN AND HUNTING RIFLE: FIREARMS-RELATED ARTIFACTS FROM THE BEAVER CREEK TRAIL CROSSING SITE (25SW49)

William Altizer, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588-0368

During the 2005 excavations at the site of a road ranch (25SW49) along the Nebraska City Cutoff in Seward County, Nebraska, several bullets and percussion caps were recovered. Some were found in association with faunal remains, and identification of the weapons that fired them is suggestive of hunting activities. Other artifacts, however, do not have such a clear-cut behavioral interpretation. As an assemblage, these artifacts can tell us a great deal about the presence and use of firearms at this site, and might suggest something of the "gun culture" of sites situated along the Overland Trail.

BUTTON, BUTTON, WHO'S GOT THE BUTTON? BUTTONS AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49)

Ashlee Dickinson, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

Buttons are a significant part of the assemblage documented during 2005 excavations at the historic Beaver Creek Trail Crossing site in eastern Nebraska. The buttons are associated with evidence for fires, suggesting that we can perhaps identify a laundry activity center at this site. Other evidence indicates that the settlers occupying this site excelled at reusing materials. That buttons were not similarly salvaged may be due to other factors, which I explore here.

FRONTIER IMPRESSIONS: THE ROLE OF DAUB AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49)

Brennan Dolan, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588-0368

In the summer of 2005 the University of Nebraska–Lincoln archaeological field school excavated at the Beaver Creek Trail Crossing Site (25SW49). The excavations at this historic site have so far revealed a high amount of material salvaging by site occupants. This paper takes a systematic look at daub, discussing what archaeologists can learn through the analytical treatment of daub in a manner usually accorded to, for example, chipped stone. Additionally, this presentation addresses frontier building practices with specific consideration to salvaging activity.

FROM HARRIS MATRIX TO TIME MATRIX: NEW INSIGHTS AT THE BEAVER CREEK TRAIL CROSSING SITE (25SW49)

Nolan A. Johnson, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

The Beaver Creek Trail Crossing Site (BCTCS; 25SW49) is located along the Nebraska City Cut Off of the larger California Oregon Trail System. A road ranch operated at the site from 1862-1861. Excavations were carried out in the summer of 2005 and historic Euro-American artifacts as well as Native American artifacts were uncovered. This paper applies the Harris Matrix to the site in a post-excavation setting. The traditional Harris Matrix is expanded to include discussions of artifacts and time. Using the matrix combined with these new ideas provided new and otherwise unobtainable information about site stratigraphy and construction. This information has aided in discussions about site formation and destruction at the site.

ARCHEOLOGICAL DIMENSIONS OF THE ORIGINS OF MODERN WARFARE: BATTLEFIELDS OF THE 1898 SANTIAGO CAMPAIGN

Peter Bleed and Douglas Scott, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588-0368

This paper surveys the battlefields of the brief American involvement in the Spanish Cuba-American War with the goal of showing how the methods of modern battlefield archeology can resolve both questions about specific past conflicts and general issues about the development of military technology, tactics, and strategy. The campaign occurred at a pivotal time in military history and involved both emergent and established practices. These can be studied archeologically because battlefields of the campaign are well preserved.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION A

A SURVEY OF AQUATIC GASTROPODS OF THE PRAIRIE POTHOLE REGION OF SOUTH DAKOTA

Bruce J. Stephen, Southeast Community College, Lincoln, NE 68520

A survey of aquatic snails was performed in the Prairie Pothole (Prairie Coteau) region of Northeastern South Dakota in spring and fall of 2005. Shallow water areas of 33 aquatic habitats were sampled by visual examination and then swept with small hand nets and larger dip nets. Live snails were found at 30 of the 33 sites with shells or subfossils providing evidence for the presence of snails at the remaining three sites. Ten species of pulmonate snail in three families were discovered and collected for a total of 112 records. Chemical and physical data including Calcium levels, pH, wetland type, and bottom substrate were recorded for each collection site. Some aspects of species distribution and abundance were associated with bottom substrate and wetland type. This region has not previously been surveyed for aquatic snails and thus this study provides the first look at their diversity.

A COMPARISON OF A POINT AND A QUADRAT METHOD OF SAMPLING PRAIRIE V EGETATION

Carla M. Delucchi, Department of Biology, Dana College, Blair NE 68008

A comparison of a point sampling method and a quadrat sampling method was made using restored native grasslands at DeSoto National Wildlife Refuge during the summer of 2005. The point sampling method was a modification of the Fish and Wildlife Service protocol; the quadrat method was from Daubenmire (1959). The same four transects were sampled with both methods in each of six fields. There were 50 points and 10 quadrats per transect. Plants which were relatively common (found at 25% or more points) had similar abundances with both methods. Overall, the quadrat method detected 2.2 more species per field, but the difference was not significant. The quadrat method detected 54% of the species seen in the field during sampling versus 49% detected by the point method. Both sampling methods required about the same amount of time, however, the quadrat method was difficult to use in tall vegetation. Daubenmire only recommends its use in vegetation that is less than 0.5m tall. In conclusion, both methods gave similar results even though the quadrat method sampled 44 times more area than the point method.

TRIBOLIUM BEETLES: A POTENTIAL PEST SPECIES MODEL FOR GLOBAL WARMING AFFECTS

Mark A. Schlueter, William R. Wolesensky, Katie M. Gaspers, and Lydia Zaragosa, Department of Biology, Department of Mathematics, College of Saint Mary, Omaha, NE 68106

Red Flour Beetles (*Tribolium castaneum*) and Confused Flour Beetles (*Tribolium confusum*) are important pest species. *Tribolium* are one of the most common secondary pests of stored plant commodities throughout the world. They attack stored food products such as flour, cereals, meal, cake mix, crackers, beans, pasta, dried pet food, chocolate, nuts, and seeds. Adults are about 4 mm long and have a brown appearance. Mature females lay about 11 eggs per day at their optimal temperature of 32.5°C. Larvae successfully develop into adults in a wide temperature range of 22°C to 40°C. Adults are highly adaptable, feed on a wide range of commodities, and show high resistance to low humidity (as low as 11%). Their adaptability makes them excellent colonizers and an effective pest.

Tribolium beetles' small size, rapid reproductive rate, wide temperature range for survival and reproduction, and their importance to the agricultural economy make them an ideal model organism, particular when studying the affects of global warming on pest populations. The effects of increased temperature on *Tribolium* reproductive fitness may have a substantial effect on human agriculture.

In the current study, the effect of temperature on the survival and reproductive fitness in both *Tribolium castaneum* and *T. confusum* were investigated. Reproductive fitness was examined by measuring number of larva produced, number of pupa produced, and number of offspring surviving to adulthood. Four different temperatures were invested for each species in four different food substrates. The food substrates were white flour, wheat flour, a wheat-white flour mixture with yeast, and cornmeal.

Previous results indicated that *Tribolium* prefer cornmeal. The consumption rate of cornmeal was more than double compared to wheat flour, white flour, or flour mixtures. However, the current study's results show that the highest mortality and lowest reproductive success was in the cornmeal, particularly in the higher temperature range (reproductive rate was zero). Reproductive rates (larvae production) may be lower at lower temperatures; however, survival rate to adulthood may be higher at the lower temperature. It is hypothesized that the effect of humidity at higher temperature plays a crucial role in larva survival.

The next step will be to investigate the role of humidity in beetle reproductive fitness. The final step will be to incorporate these reproductive parameter values into a new mathematical model, which may more accurately predict reproductive rates at a wide range of temperature for these common agricultural pests.

MODELING THE EFFECTS OF TEMPERATURE VARIATIONS ON ARTHROPOD PREDATOR-PREY SYSTEMS

William Wolesensky, Department of Mathematics, College of Saint Mary, Omaha, NE 68106; and J. David Logan, Department of Mathematics, University of Nebraska–Lincoln, 68588

We model the effects of both stochastic and deterministic temperature variations on arthropod predator-prey systems. Specifically, we study the stochastic dynamics of arthropod-prey interactions under a varying temperature regime, and we develop an individual model of a prey under pressure from a predator, with vigilance (or foraging effort), search rates, and other predation parameters dependent upon daily temperature variations. Simulations suggest that an increase in the daily average temperature may benefit both predator and prey. Furthermore, simulations show that the antipredator behavior may indeed decrease predation but at the expense of reduced prey survivorship due to a greater increase in other types of mortality.

MITOCHONDRIAL DNA, SCIENTIFIC ANOMALIES AND A CAUTIONARY NOTE FOR SYSTEMATISTS: BUT DON'T SHOOT THE MESSENGER

James E. Platz and C. F. Austerberry, Department of Biology, Creighton University, Omaha, NE 68178-0103; and T. Grudzien, Department of Biological Sciences, Oakland University, Rochester, MI 48309-4401

Molecular based techniques provide excellent tools with which to address numerous questions of interest to systematic biologists. Each has strengths and weaknesses. Several have now been applied to better understand evolution within the *Rana pipiens* complex, especially with regard to native and introduced species in Arizona. At the present this includes five native taxa, *R. pipiens, R. blairi, R. yavapaiensis, R. subaquavocalis* and *R. chiricahuensis*. A sixth species, once common along the Mogollon Rim, and currently considered to be part of the range of *R. chiricahuensis* actually represents an undescribed form. Data sets based on morphology, 48 allozymes, as well as mtDNA D loop sequences all support recognition of the Mogollon Rim form as a valid species. However, our data sets based on morphology, mating call habits, DNA assessments of nuclear fragments flanking the TC1-like transposon along with our allozyme findings differ from those of other workers based on mtDNA D loop sequences. Our cladistic analyses place *R. chiricahuensis* (sensu stricto) and the Mogollon Rim form as sister taxa with *R. subaquavocalis* as the sister to these two while mtDNA analyses from other workers place *R. chiricahuensis* and *R. subaquavocalis* as sisters and the Mogollon Rim form as their sister. Based on the small differences between *R. chiricahuensis* populations from the Chiricahua Mountains and those of *R. subaquavocalis* in the Huachuca Mountains, the mtDNA authors conclude that *R. subaquavocalis* should be recognized as populations of *R. chiricahuensis*. There is a general lack of intrapopulation variation in these critical three taxa for mtDNA sequences as well as limited differences between the taxa. This is in sharp contrast to the robust differences we found using nuclear based data sets. Of the two genomes, nuclear DNA is considered to evolve much slower than mtDNA, especially the D loop region, yet it is the D loop data set that shows the low levels of divergence. To resolve this apparent anomaly, we examined recent literature and discovered that transposition of mtDNA, including the D loop, to the nucleus is in fact very common among diverse organisms, offering one explanation for the discrepancy between nuclear and mtDNA based trees. The key step is separation of nuclear and mtDNA fractions prior to PCR amplification to insure that nuclear pseudogene sequences have not been accidentally amplified. We compare the mtDNA results with those of a third party who do separate mtDNA from nuclear DNA prior to PCR amplification. In those studies that utilize ranid frogs from Asia, mtDNA D loop divergence is quite marked at both intra and interpopulation levels as well as across species.

THE BIOLOGY OF PTERIDOPHYTE TAXONOMY PRESENT ON VOLCAN ZUNIL

Stacey A. O'Brien and J. E. Platz, Department of Biology, Creighton University, Omaha, NE 68178-0103

The division, Pteridophyta (the ferns), are among the most diverse plant groups on earth and one of the oldest, dating back 400 millions years to the Devonian period. I collected ferns on the south face of Zunil in May 2004. Zunil is a dormant volcano with a cloud forest habitat located in the northwestern portion of the Cuchamantes mountains in the district of Quetzaltenango, Guatemala, lat 14° 4' 2.6" N; lon 91° 29' 0.9" W. Collections were made in order to better characterize the fern fauna of Zunil and to provide voucher specimens for deposit in the herbarium at the University of Guatemala, Guatemala City. I collected from 2442 m to 3466 m, and obtained specimens representing 47 species within 20 genera representing 11 families. Collections were made at four elevations: Site A- 2,442 m, Site B- 2,600 m, Site

C-2,900 m, and Site D- 3,200 m. Members of the genus *Asplenium* were recovered from all four sites. Representatives of the families Adiantaceae and Polypoiaceae were collected from Sites A-D. Plant diversity was highest at Sites A and D. Site A was the most diverse with 24 species. Site D contained 20 while the intermediate elevations contained 10 species at B and nine at C. Among those unique to one elevation (29 species), Sites A and D were again the most diverse with 17 and 11 species respectively. One species, *Trichomanes crispum*, was unusual because it appears to be adapted to pockets of high sulfur habitat at Site A. No species was unique to Site B and only one at Site C. No species was collected in all four sites while five overlapped some but not all four collecting sites. Because there were published molecular data sets for ribulose-1,5-bisphosphate carboxylase/oxygenase (rbcL) for representatives of all of the genera I collected, we used cladistic analyses using PAUP to construct cladograms to see if they would result in monophyletic species assignment to genus. Three of the genera in the rbcL data set were represented by two or more species. Only one among the three genera resulted in monophyly suggesting homoplasy for the morphological characters originally utilized to make generic assignments. Therefore molecular studies are likely to aid in developing a better picture of the phylogenetic relationships among the ferns at Zunil. My results and those of others currently working at Zunil will provide additional information critical to designing conservation programs for use in Guatemala and provide a better comprehension of the diversity present in cloud forest environments in general.

MOTIF DETECTION IN *STAPHYLOCOCCUS AUREUS*

Kate Dempsey, Daniel Quest, and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha, NE 68182

Many algorithms have been developed recently to detect transcription factor binding sites, but there is a significant need in bioinformatics for these programs to fit a higher standard of sensitivity and precision. Some programs that have been developed for the purpose of motif detection include Gibbs Motif Sampler, Weeder, DME, Consensus, B.E.S.T., AlignAce, and MemeMast. The main objective of this project was to assess the functionability of these programs on the genome of the *Staphylococcus aureus* bacteria, an organism whose gene regulation has not been explored as compared to other bacteria. The co-expressed genes of *Staphylococcus* and the motif from those regions were found from a previous micro-array analysis and then the upstream binding regions (length of 1000 bps) of the co-expressed genes were then parsed into a FASTA file. Each of the programs was executed on these upstream regions under a variety of parameters while masking the repeat AT content. The computational experiment showed that no consensus motif was found using any of the listed programs. Conversely, when a known motif was inserted into a randomly generated sequence, it was correctly detected. If the known consensus sequence contained 1 or 2 mutations, each program was able to identify it accurately. However, if the consensus sequence contained 3 or more mutations, the programs failed to detect the sequence. These results could indicate a number of things, including severely mutated consensus sequences, a lack of sensitivity in the detection programs, or a need for better data. We are currently working on modifying a GenBank parser to obtain the upstream regions of genes that are believed to be related to *Staphylococcus aureus* to further explore motif-detection.

HISTONE BIOTINYLATION IN GERMINATING SWITCHGRASS (PANICUM VIRGATUM L.) SEEDS

Kyle Johnson, Concordia University, Seward, NE 68434; and Gautam Sarath, USDA-ARS and University of Nebraska–Lincoln, NE 68588; and Keyna Kobza, Yap-Ching Chew, Janos Zempleni, and Ashraf Raza, University of Nebraska–Lincoln, NE 68588

Histone biotinylation is a recent addition to the histone code. Utilizing site-specific antibodies, changes in histone biotinylation occurring in animal cells in response to internal or external stimuli have been reported. In this study, we have extended these findings to plants, specifically to the energy crop, switchgrass (Panicum virgatum L.). Histones were extracted from seeds at various stages of germination, and analyzed by immunoblotting. Positive initial results from blots probed with streptavidin-peroxidase conjugates were further confirmed using histone biotinylation site-specific antibodies. Data from the antibody studies indicated changes in the relative biotinylation at specific residues on histones during the germination process. Exogenous application of chemicals that impacted seed germination also elicited differential histone biotinylation, suggesting a role for histone biotinylation during seed germination.

Recently, mass spectrometric analyses of histones purified from animal cells have shown biotinylation of Lys 8 and Lys 12 of histone H4. Similar approaches have now been initiated for plant histones. Initial data are encouraging, and suggest that biotinylation is observed in plant histone H4 as well. We are in the process of confirming our findings. We anticipate that the combination of immunochemistry and a more comprehensive mass spectrometric analysis will reveal the changes in histone modifications occurring during switchgrass seed germination. This study should provide insights into the roles for histone biotinylation during the germination process. This work was supported in part by NIH grants DK 60447, DK 063945, and by NSF EPSCoR grant EPS-0346476 (JZ). AR acknowledges support through NIH-COBRE grant 1P20RR1767. K Kobza and K Johnson were funded by NIH grant P20 16469-05.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

EFFECTS OF HYDROGEN PEROXIDE ON GENE EXPRESSION IN *PARAMECIUM BURSARIA* CHLORELLA VIRUS-1

Garry Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Hydrogen peroxide is a naturally occurring product of cellular metabolism that can lead to oxidative stress. Like other reactive oxygen species (ROS), H_2O_2 appears to play a role in the regulation of gene expression. Spotted microarrays were used to measure the level of gene expression in *Paramecium bursaria* chlorella virus-1 (PBCV-1) exposed to hydrogen peroxide (H_2O_2). PBCV-1 is an ancient virus and member of Phycodnaviradae, a family of large double-stranded DNA viruses that infect algae. The 331 kb genome of PBCV-1 has been sequenced and is comprised of 11 tRNA genes and ~370 protein-encoding genes. About 50% of the proteins encoded by these large open reading frames (ORF) have been tentatively identified and appear to encode both prokaryotic- and eukaryotic-like proteins, many of which have not been seen in viruses before. In the control group, total RNA was isolated from *Chlorella* cells 30, 90 and 120 minutes post infection to PBCV-1 at a multiplicity of infection of 5. In the experimental group, total RNA was isolated from *Chlorella* cells at the same three time points, but H_2O_2 (100 μM final concentration) was added at five minutes post infection for each time point experiment. (The five-minute time delay allowed for normal attachment and infection of the virus before the introduction of H_2O_2.) Total RNA from all groups were sent to the Genomics Core Facility at the

University of Nebraska Medical Center where they were reverse transcribed, labeled with Cy3 and Cy5 dyes and competitively hybridized to the PBCV-1 probes (one 50-mer probe for each ORF) on the microarray slides. Expression profiles for each ORF were analyzed. By 30 minutes post infection, 25 PBCV-1 ORFs exposed to H_2O_2 were at least two-fold up-regulated, while eight were down-regulated, compared the non-exposed control. By 90 minutes post infection, 81 ORFs in cells exposed to H_2O_2 were at least two-fold up-regulated (almost a quarter of the genome) and 76 were at least two-fold down-regulated, compared to the non-exposed control, indicating signaling and transcriptional chaos. To better understand the early signaling and transcriptional events caused by the presence of H_2O_2, experiments are underway for 10 and 20 minute time points. This work was supported by NIH grant number P20 RR016469-05.

INFLAMMATION AND CARDIOVASCULAR DISEASE

Veneracion G. Cabana, Division of Science and Mathematics, Union College, Lincoln, NE 68506

The acute phase response (APR) is a multisystem host response to infectious and non-infectious inflammatory processes characterized by changes in the concentration of certain plasma proteins termed acute phase reactants. C-reactive protein (CRP) and serum amyloid A (SAA) are unique among these proteins with their >1000-fold increase within 24 to 48 hr following induction of the APR. Accumulating epidemiologic data suggest that elevated levels of CRP and SAA are risk factors for coronary heart disease. Whether they are simply markers of inflammation or active participants in the disease process is not clear. SAA circulates in plasma bound to high density lipoprotein (HDL), the so-called "good cholesterol." The results presented here are a summary of published and unpublished data from our laboratory that point to the participation of lipids, lipoproteins, and SAA in inflammatory processes during the APR which could promote atherogenesis. The APR was induced by intramuscular injection of croton oil in rabbits and intraperitoneal injection of bacterial lipopolysaccharides in C57BL/6 mice, including transgenic and knockout for the apoA-I gene that encodes for apoA-I, the main protein of HDL. In all species studied, with or without gene modification, the HDL particles became enriched with SAA and apoA-I poor, 24-48 hr following induction of the APR. Greater than 90% of SAA was lipid associated in vivo and in vitro and in cultured cells transfected with adenoviruses carrying a single copy of the SAA gene. Upon incubation of recombinant SAA with lipid vesicles (dimyristoylphosphatidyl choline), molecules corresponding to SAA monomers, dimers and trimers were formed and nascent HDL particles were observed in electron photomicrograph. During inflammatory condition in human subjects (infection, cytokine producing tumor, gun shot wound) and rabbits (injected with croton oil), the HDL became SAA and triglycerides enriched while HDL massively decreased to barely detectable levels. Low levels of HDL are a well-documented risk factor for CHD. Human and rabbit are two species that are prone to development of spontaneous atherosclerosis. Sphingomyelin levels also increased during the APR. The sphingomyelin-ceramide pathway has been shown to participate in the cytokine regulation of CRP and SAA. Endotoxin and cytokines, agents that are involved in CRP and SAA biosynthesis, have been shown to increase hepatic sphingolipid biosynthesis and produce lipoproteins enriched in ceramides and sphingomyelin. All these results point to the involvement of these lipids and proteins in lipid metabolism during inflammation and which may be related to the observed predictive role of CRP and SAA in the progression of cardiovascular diseases. Further studies are needed to elucidate the molecular mechanisms of these processes. (Support by Grant-in-aid from the American Heart Association)

SLEEP DEPRIVATION AND MUSCLE STRENGTH AND ENDURANCE

Christopher Wiles, Oscar Lucar, and Veneracion G. Cabana, Division of Science and Mathematics, Union College, Lincoln, NE 68506

The negative effects of sleep deprivation (SD) upon mood, attitude, mental concentration, and overall health have been well documented. SD predisposes individuals to increased health risks including injuries, accidents, and pathophysiological consequences. Sufficient sleep (SS) allows better performance and better achievements. Among the most sleep-deprived groups of people are teens and college students. Data on the effects of SD upon muscle efficiency are limited. The study reported here was done by two college students who analyzed the effects of SD upon muscle strength and endurance. The intensity and rate of decline of power grip was analyzed using a computerized PowerLab instrument (ADI Instrument, Mt. View, CA). Four test periods scattered during the fall semester of 2005 were conducted by each of the two students on days following nights of SS (8 hr of sleep) and nights of SD (4 hr of sleep). Baseline 100% maximal grip for each of the students was established following a night of SS. Experiments were conducted by measuring the strength and rate of decline of power grip for 60 sec each during the initial time, after 5 min rest, and after 10 sec rest. Tests were conducted around the same period of the day to minimize circadian effects. The results averaged from duplicate readings showed that following a night of SS, maximal grip decreased from baseline by about 5% and 7%, respectively for each of the two students. This was accompanied by a 30-35 % decrease in muscle endurance after a 5 min and after a 10 sec rests between testing. In contrast, following nights of SD, maximal power grip decreased from baseline by 37.5% and 32.5%, respectively for each of the students. This was accompanied by a 32-50 % decrease in the rate of muscle endurance after a 5 min and a 10 sec period of rests. In conclusion, these preliminary results point to a significant effect of SD upon muscle efficiency. The data suggest a greater effect upon muscle strength than muscle endurance. While the sample size in this study is small, the results are in agreement with studies conducted on a group of soldiers which showed that SD affected knee extension and flexion peak torque but had no effect on fatigue index (1). Further studies with larger sample size need to confirm the present results. Effect of SD upon muscle strength and endurance may contribute to the increased risk for injuries and accidents precipitated by SD. In the present study, the experiments were conducted after only one night of SS or SD. The effects on muscle strength and endurance of a series of nights of SD as well as chronic sleep loss need to be tested. This work was supported by Union College laboratory funds for Human Physiology.

(1) Bulbulian, R. et al., (1996). Eur J Appl Physiol Occup Physiol 73:273-7.

DIRECTED EVOLUTION OF AN ARCHAEAL DNA POLYMERASE, 9°N_M, WITH ENHANCED ACTIVITIES FOR GAMMA-PHOSPHATE LABELED NUCLEOTIDES

Teresa M. Urlacher, Jon P. Anderson, David L. Steffens, Bambi Reynolds, Kristin Keefe, Jolene Egelhoff, Donald T. Lamb, Daniel L. Grone, Lyle R. Middendorf, and John G. K. Williams, LI-COR Biosciences, Inc., 4308 Progressive Ave, Lincoln, NE 68504

At LI-COR Biosciences, we are investigating new technologies to reduce sequencing costs while increasing both read length and throughput. Our field-switch approach has the following advantages, 1) provide for immediate haplotyping to identify polymorphisms and, 2) facilitate *de novo* sequencing. This concept uses a DNA polymerase that has been adapted to efficiently incorporate phosphate labeled nucleotides. We have developed nucleotides labeled on the gamma-phosphate with a polyethylene glycol chain (PEG8) and a screening assay to identify DNA polymerases containing mutations that exhibit increased incorporation efficiency. Over 65,000 individual polymerase mutants have been screened resulting in an archaeal Family B DNA polymerase that is 160-fold more active with phosphate modified

nucleotides than the parent enzyme, $9°N_m$ (NEB). The mutant with the highest activity to date contains eight mutations which were found by randomizing 81 amino acid positions through five generations of directed evolution. The selection criterion for improved enzymes was an increased average rate of incorporation of phosphate modified nucleotides measured by gel analysis. The enzyme also has been modified to contain two 20 amino acid internal insertions or 'legs' for orientated binding to a surface. Activity of the two legged enzyme is maintained both in solution and when bound to a surface. Processivity is conferred by binding of the enzyme to a surface in the presence of a primed circular template, thus giving this approach the ability to generate long reads.

TRANSCRIPTIONAL REGULATION OF THE HUMAN N-CADHERIN GENE

Kate Marley, Will Packard, Aspen Bricker, Matthew James, Adam Gentzler and Scott Madden, Doane College, Crete, NE 68333

Cadherins are cell adhesion proteins involved in adherens junctions and desmosomes and make up the transmembrane component of the cell-cell junctions. Transformation from an epithelial phenotype to an invasive cancerous phenotype has been linked with loss of E-cadherin expression in a number of tissues and cell lines. In addition it has been linked with new expression of N-cadherin, a cadherin not normally expressed in epithelial cells. In fact in some breast cancer cell lines an increase in cell motility and invasive phenotype is directly related to expression of N-cadherin rather than loss of E-cadherin. In light of the role for N-cadherin in mediating cell motility and invasiveness we are studying the regulation of N-cadherin expression at the transcriptional level. We are currently mapping DNAse I hypersensitive sites in the promoter and first intron of the Human N-cadherin gene to identify binding sites for transcription factor that regulate this gene. Nuclei were extracted from HeLa cells which do express N-cadherin and A431 cells which do not, and treated with DNase I. The Southern blot probe for the mapping was cloned by PCR from a BAC spanning this region of the human genome and indicates the location of DNase I hypersensitivity sites from 2 kb 5' to 2kb 3'of the translation start. In addition we are currently testing three luciferase reporter constructs that span from -1975bp, -462bp and -214bp to the transcription start of the N-cadherin promoter to evaluate the functional role of this region *in vitro*. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

IMMUNOELECTRONMICROSCOPY FOR CALCITONIN GENE-RELATED PEPTIDE AND CHOLECYSTOKININ COLOCALIZATION AND COSTORAGE IN THE MOUSE INFERIOR OLIVARY COMPLEX

Kathleen G. Tallman, Doane College, Crete, NE 68333

The inferior olivary complex (IOC) is the sole source of climbing fiber afferents to the cerebellum. Any alteration of climbing fiber firing rate by peptide neuromodulation may affect Purkinje cell firing and cerebellar activity. A previous study identified peptide immunoreactivity within the adult mouse IOC (J. Chem. Neuroanat. 12:211, 1997). Following Kooy's terminology (Folia Neurobiol. 10:205, 1917) both calcitonin gene-related peptide (CGRP) and cholecystokinin (CCK) densely labeled small varicosities throughout the inferior olive and large varicosities in the dorsal cap of Kooy (dc) and lateral dorsal accessory olive (DAO). CGRP also labeled large varicosities in the ventrolateral outgrowth (vlo). The similarity in size and distribution of varicosities labeled by CGRP and CCK in the original study suggested colocalization of these peptides. This study proposes further investigation of CGRP and CCK colocalization by developing a pre-embedding immunelectronmicroscopy technique. Briefly, 50 um sections of perfused mouse brain stems are rinsed, incubated serially in guinea pig anti-CGRP (Bachem), 6 nm colloidal gold donkey anti-guinea pig secondary, rabbit anti-CCK, and 12 nm colloidal gold goat

anti-rabbit secondary. Thin sections are incubated in 1% osmium tetroxide for 1 hour, trimmed, and dehydrated through a series of acetone and propylene oxide before embedding in Embed 812. Blocks are trimmed and thin sections of 70-90nm are cut and stained with uranyl acetate and lead citrate. This technique should allow us to investigate the cellular localization of CGRP and CCK to determine if they are colocalized and/or cotransported. This publication was made possible by NIH Grant Number P20 RR16469 from the BRIN Program of the National Center for Research Resources.

RNA-PROTEIN INTERACTIONS IN THE 5'NTR OF COXSACKIEVIRUS B3

Megan Azimi and William Tapprich, Department of Biology, University of Nebraska at Omaha, NE 68182-0040

Cocksackievirus B3 (CVB3), a picornovirus in the same category as polio, consists of a single stranded, positive sense genome approximately 7.4Kb in length. Infection with a virulent strain of CVB3 can result in myocarditis and a protracted immune response eventually leading to cardiomyopathy. CVB3 is characterized by a long (approximately 10% of the total genome) and highly structured 5' Non-Translated Region (NTR) that contains an internal ribosome entry site (IRES) and has been found to have a crucial role in virulence and pathogenesis. Our current research is focusing on the effects RNA-protein interactions in the region of the 5' NTR known as stem loop I. Specifically, the effects on viral replication induced by the binding of poly(C) binding protein 2 (PCBP2). PCBP2 is a common cellular protein that has already been shown to bind to stem loop IV of the 5'NTR and play a role in the cap independent initiation of translation. This study aims to show that PCBP2 will also bind to stem loop I and induce a conformational change leading to the formation of RNP complexes and initiation of viral replication. The pMAL-px2 plasmid was used to express PCBP2 fused to a maltose binding protein (MBP). Resulting cellular proteins were then passed through an amylose resin chromatography column to isolate the fusion protein, which was then cleaved with the protease Factor Xa to obtain free PCBP. CVB3 virulent strain 28 DNA and primers complementary to the 5'NTR were used in a PCR to amplify the stem loop 1 region. The resulting PCR products were used for in vitro transcription of radiolabeled mRNA molecules representing the first 104 nucleotides of the 5'NTR. Electrophoretic mobility shift assays were then performed to confirm the interaction between PCBP2 and stem loop I of the 5'NTR.

A STUDY OF THE THERMAL STABILITY OF THE CVB3 VIRUS

Tess M. Eidem, Department of Biology, University of Nebraska at Omaha, NE 68182-0040

Coxsackievirus B3 (CVB3) is a picornavirus linked to type I diabetes and causes heart failure and pancreatis. The viral genome consists of a single 7400 nucleotide polyadenylated RNA. The 5' end of the virus contains a 742-base-long non translated region (5' NTR), which folds to make an internal ribosome entry site (IRES) and other structures important for genome replication. The current model of the CVB3 5'NTR shows seven domains (I-VII). We want to investigate the thermal stability of domains III and IV to understand their flexibilities and how easily these flexibilities occur. To do this we will incubate the molecule with chemicals and use probes to see where the nucleic acid base pairs are annealing and where they may be coming apart. The hypothesis is that domains III and IV exhibit different thermal stabilities.

THE QUANTITATION OF SUB2P AFFINITY FOR RDNA IN *SACCHAROMYCES CEREVISIAE*

Benjamin D. Hanzel and Elaine Lahue, Department of Biology, University of Nebraska at Omaha, NE 68182

Heterochromatin is found at the silent mating-type loci, ribosomal DNA (rDNA) repeats and telomeres in *Saccharomyces cerevisiae*. Overexpression of Sub2p, a multifunctional *S. cerevisiae* helicase family member, has been shown to reduce transcription of a reporter gene in the rDNA locus and therefore increase silencing. *SUB2* has the opposite effect at telomeres, where it can overcome silencing. Sir2p, an NAD+-dependent protein deacetylase, is required for the silencing of heterochromatin in yeast. It has been shown that reducing Sir2p at telomeres, results in more Sir2p at the ribosomal DNA and reduced silencing at telomeres with increased silencing in the rDNA. We are investigating the role of Sub2p in gene silencing using chromatin immunoprecipitation (ChIP) assays to better understand this complex regulatory process. We wish to find out if overexpressing Sub2p results in altered Sir2p distribution.

Quantitation of our ChIP assays show that when sheared DNA is immunoprecipitated with Sub2p antibody and analyzed with a panel of rDNA primers by PCR, the DNA is amplified and in varying amounts. These results are similar to DNA immunoprecipitated with antibody for Sir2p, a protein known to be directly associated with rDNA regions. However, Sir2p appears to be associated primarily with two regions. We continue to look at these and additional ribosomal DNA regions for Sub2p and Sir2p localization.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

CELL-CELL SIGNALING IN MYCOBACTERIA

Angela McKinney-Williams, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 60504; and Delilah Hudson, University of Nebraska–Lincoln, NE 68588; and Jeffrey Cirillo, Texas A&M University College of Medicine, College Station, TX 77843

Quorum sensing (QS) is a type of communication between cells in a density-dependent manner, using chemicals as signaling molecules. This phenomenon is seen in both bacterial and eukaryotic organisms. Quorum sensing plays a role in a variety of cellular functions such as gene expression, gene transfer, sporulation, virulence, and antibiotic production. Many quorum sensing molecules have been found in different types of bacteria. The nature and function of these QS molecules are diverse. The specific aim in this study is to determine if QS occurs in mycobacteria and to find the role of QS in mycobacterial pathogenesis. Most of the mycobacterial species exist in soil and must compete for survival with other bacteria. So, it is likely that quorum sensing exists in mycobacteria. This forms the hypothesis for the present study, that mycobacteria produce QS molecules. The QS system established in *Streptomyces* will be utilized to identify QS molecules in mycobacteria. Both *Streptomyces* and mycobacteria are gram-positives bacteria with a high G-C content in their genome. Because quorum sensing assays are well established for *Streptomyces* and the signaling molecules identified, *Streptomyces* will serve as a useful tool in the study of QS in mycobacteria. This work was supported by The National Institutes of Health INBRE program grant #P20 RR016469-05.

GROWTH CONDITIONING AND CHARACTERIZATION OF *CLOSTRIDIUM PERFRINGENS*

Amanda J. Bowman and Avery L. Paulson, Chadron State College, Chadron, NE 69337

Clostridium perfringens is an intestinal pathogen of human and animal models. It sporulates for survival of harsh environmental conditions and under anaerobic stress. This sporulation leads to production of enterotoxins. If the enterotoxins are by-products of some biochemical pathway or an actual determining factor of sporulation is yet to be determined. Also yet to be determined completely are the growth conditions which determine sporulation and optimal growth of *Clostridium perfringens*. We subjected environmental isolates of suspected *Clostridium perfringens* to a battery of growth and nutritional conditions, determining biochemical properties. We also characterized these isolates through PCR amplification of enterotoxin genes. Finally we built a database of these characteristic in hopes of creating an epidemiological map for a 4 state region.

CONJUGATIVE TRANSFER OF VIRULENCE FACTORS FROM *CLOSTRIDIUM PERFRINGENS*

Suzanne K. Morse and Avery L. Paulson, Chadron State College, Chadron, NE 69337

Conjugative transfer of genetic material from species to species of bacterium is an important part of continued genetic diversity. It allows for transfer of new traits within bacterium as well as those bacterium acquiring selective properties. Antibiotic resistance, encoding essential nutrients, and acquisition of additional virulence factors can be transferred from species to species. We wish to determine if such transfer of plasmids is possible to and from the Gram Positive bacteria *Clostridium perfringens* to other intestinal pathogens, most notably *Escherichia coli*. Using environmental isolates of Clostridium, we induced resistance to ampicillin by successive culture. We then cultured the Clostridium with *E. coli* K-12 transformed with pUC18. We hope to find transfer and show this can occur in a natural environment.

FORMATION OF A LIBRARY FOR THE BACTERIOPHAGE UNL-1 AND CHARACTERIZATION OF GENES OF INTEREST

Kyle Rupp and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney, NE 68849

UNL-1 is a lytic bacteriophage of *Pseudomonas aeruginosa*. This phage is of interest because it exhibits a novel DNA repair mechanism. When the host cells are exposed to UV-A light, UV-C damaged UNL-1 phage is better able to repair its DNA. This UV-A inducible DNA damage repair system may substantially increase the survivability of the bacteriophage. In order to identify any phage genes that could play a role in this novel DNA damage repair, a genomic library was made. The UNL-1 DNA was sonicated into 2-4 kb sizes, inserted into pGEM-3Z and selected based on insert size. The inserts were sequenced and then analyzed using DS Gene 1.5 from Accelrys Inc. At this time UNL-1 appears to have some homology with Bacteriophage F8 of *P. aeruginosa*. *This project was partially supported by NIH Grant #2 P20 RR16469 from the Nebraska INBRE Program of the National Center for Research Resources.

EFFECTS OF DIABETES MELLITUS ON POTASSIUM CHANNELS AND THE KCNQ1 GENE IN CARDIAC TISSUE

Katherine Baker, Department of Biology, University of Nebraska at Kearney, NE 68849

Diabetes mellitus causes the diseased heart to undergo an electrical remodeling process which increases the possibility of ventricular arrhythmias. The role of potassium channels is to contribute to the pacemaker potential in cardiac tissue through repolarization. It has been suggested that diabetes mellitus affects voltage-gated potassium channels, which ultimately leads to ventricular arrhythmia. There are three major currents through these voltage-gated potassium channels that have been identified; the transient outward current (I_{to}), the inward rectifier current (K_{K1}) and the delayed rectifier current (I_K). Of these three currents and numerous potassium channels, there are many genes that affect regulation. This study was designed to measure expression of the Kcnq1 gene, which is involved in potassium channels, in cardiac tissue from diabetic verses non-diabetic subjects. Left ventricular tissue of non-diabetic rats was compared to streptozotocin induced diabetic rats. Initial microarray results suggested a difference in the expression of the Kcnq[1] gene, which affects the potassium voltage-gated channels in cardiac tissue. Further analysis by RT-PCR, however, did not show any differences in the expression of this gene. These results do not suggest that diabetes mellitus does not affect potassium channels in cardiac tissue, they merely illustrate that the expression of this one gene involved in potassium channels is not altered.

INFLUENCE OF DIABETES MELLITUS AND EXERCISE TRAINING ON GENE EXPRESSION IN CARDIAC MUSCLE TISSUE

Cory Ciccone, Mary Connealy, Karynn Kucera, and Janet Steele, Department of Biology, University of Nebraska at Kearney, NE 68849

Cardiac gene expression distinguishes the heart with physiological left ventricular hypertrophy (LVH) from the heart with pathological LVH. The failing heart undergoes a remodeling process that is accompanied by electrical changes in K^+ channels, and oxidative stress has been identified as a key factor in this process. The goal of this study was to examine changes in gene expression caused by oxidative stress brought on by diabetes mellitus and exercise training. Fifty female Sprague-Dawley rats served as subjects. Half the rats exercise-trained by swimming up to 2 hr per day for 10 weeks while the others served as sedentary controls. Half the rats in each group were made diabetic via i.p. injection of streptozotocin while the remaining rats were injected with citrate vehicle. Rats were euthanized via overdose of sodium pentobarbital and hearts removed. RNA was isolated from cardiac tissue and microarray analysis performed. Preliminary results suggest that 1) diabetes mellitus upregulates genes for glutathione synthase, 2) diabetes mellitus upregulates genes for enzymes such as acyl-CoA dehydrogenase and thiolase, which are involved in lipid metabolism, and 3) exercise training upregulates genes for voltage-gated K^+ channels. This work was supported by NIH grant 1 P20 RR16469 BRIN Program of the National Center for Research Resources.

INFLUENCE OF DIABETES MELLITUS AND EXERCISE TRAINING ON OXIDATIVE STRESS REPAIR MECHANISMS IN CARDIAC TISSUE

Mary Connealy, Cory Ciccone, Karynn Kucera, and Janet Steele, Department of Biology, University of Nebraska at Kearney, NE 68849

Diabetes mellitus and exercise training both induce oxidative stress and reactive oxygen species formation (ROS). Recent work has demonstrated that intracellular glutathione (GSH), an endogenous antioxidant, plays an important role in preventing electrochemical changes in the failing heart, particularly those changes which affect K^+ channels. Specifically, augmentation of GSH has been shown to upregulate

the density of transient outward K^+ currents. The goal of this study was to examine antioxidant formation and enzyme efficiency in pathways limiting the damage caused by ROS in cardiac tissue. Fifty female Sprague-Dawley rats served as subjects. Half the rats exercise-trained by swimming up to 2 hr per day for 10 weeks while the others served as non-trained controls. Half the rats in each group were made diabetic via i.p. injection of streptozotocin. Rats were euthanized via overdose of sodium pentobarbital and hearts removed. Total GSH and the activity of glutathione reductase (GR) and aconitase (ACON) were analyzed in cardiac tissue. Results suggest that diabetes mellitus, exercise training, or a combination of the two, did not significantly alter the formation of GSH or the activity of GR or ACON. This work was supported by NIH grant 1 P20 RR16469 BRIN Program of the National Center for Research Resources.

THE EFFECT OF HUMIC ACID ON ALUMINUM TOLERANCE IN CORN

Brian K. Banks and Paul Twigg, Department of Biology, University of Nebraska at Kearney, NE 68849-1140

High aluminum levels in soils can severely damage plant health and growth. This is a real problem in many parts of the world, and one that is set to become more important in any area using irrigated agriculture. In this study, we examined the effect of added aluminum on corn (Zea mays) and its mitigation by humic acid. Plants were greenhouse grown until two weeks post-germination in 14" pots. The pots were randomly divided into 6 groups. Three of the groups had aluminum added at 0, 25, and 50 mg/kg of soil in nutrient solution each week. The remaining three groups received similar amounts of aluminum, but with each also receiving 1% humic acid. Every two weeks, two pots from each group were randomly selected for harvest. The fresh and dry weights for each group of harvested plants were determined. The plant material was also tested to determine levels of aluminum and phosphate. We will present the data from our various treatments to show the relationship of aluminum to plant growth and the efficacy of added humic acid to buffer its effects. This project was supported by a University of Nebraska-Kearney Undergraduate Research Council grant and the UNK Biology Department.

DETERMING THE PREVALENCE OF WEST NILE VIRUS INFECTION IN CANINE POPULATIONS IN CENTRAL NEBRASKA

Whitney Meyer and Brad Ericson, Department of Biology, University of Nebraska at Kearney, NE 68849

West Nile virus has become a concern to the human population directly due to our susceptibility to this disease and indirectly as the prevalence of West Nile virus infection increases in avian and mammalian species. West Nile virus affects the brain and characteristically causes those infected to display symptoms similar to other flavivirus infections which target the central nervous system. For example, neurological problems such as ataxia, weakness, recumbency, muscle fasciculation, depression, and hyperesthesia were noted in infected horses. Costly treatments or euthanasia must be implemented when these animals become infected. Little information is known concerning the virulence of this disease in other mammals. The purpose of this study is to determine the prevalence of West Nile virus infection in canine populations in Central Nebraska.

IDENTIFICATION OF BACTERIA FROM AN ALKALINE LAKE USING FTIR

Scott E. Griffith and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney, NE 68849; and Brad A. Plantz, Department of Biological Sciences, University of Nebraska–Lincoln, NE 68588-0666

The purpose of this project is to identify and compare bacteria from an alkaline lake using Fourier Transform - Infrared (FT-IR) spectroscopy. Currently the process of identifying bacteria from the environment is very lengthy. The process involves collecting samples, growing the bacteria on solid media, physically examining the isolated bacteria for differences, and then separating them according to the physical characteristics of the colonies. After the bacteria have been isolated, each is Gram stained and then identified based on biochemical tests or 16s rDNA sequence. Rapid screening of future isolates is then limited to subjective descriptions of a colony's morphology. In this experiment, bacteria were isolated from the water column of an alkali lake in western, Nebraska. DNA was isolated and the16s rDNA sequence was used to identify each isolate. Each isolate was then fingerprinted according to its unique metabolomic profile by using FT-IR spectroscopy and then arranged into Clades by using Cluster Analysis. By building a library of isolates that have been positively identified by 16s rDNA analysis, it is now possible to rapidly screen and identify new isolates as either "known" or "unknown" species by using FT-IR. *This project was partially supported by NIH Grant #2 P20 RR16469 from the Nebraska INBRE Program of the National Center for Research Resources.

GENETIC CHARACTERIZATION OF CHINCH BUG (*BLISSUS OCCIDUUS*) RESISTANCE IN BUFFALOGRASS (*BUCHLOE DACTYLOIDES*) BY SUPPESSION SUBTRACTIVE HYBRIDIZATION

Lindsay A. Vivian and Paul Twigg, Department of Biology, University of Nebraska at Kearney, NE 68849-1140

Buffalograss (*Buchloe dactyloides*) is perennial warm-season grass that is native to much of the Midwest. Many varieties of buffalograss have been developed for possible lawn and golf course turfgrass use due to its desirable texture and drought resistance. One of the major pests of buffalograss in the upper Midwest is the chinch bug (*Blissus occiduus*). This insect can cause severe damage to many buffalograss varieties. While this grass is very well characterized in many areas, it is not well characterized at the genomic level. For further develop the genomic resources of buffalograss and to aid in the possible selection of chinch bug resistant cultivars, we have made subtractive libraries for two varieties. Susceptible (378) and resistant (Prestige) buffalograss varieties were infested with chinch bugs for 5 days prior to harvest. From this tissue, we purified total and messenger RNA to serve as starting material for subtractive library production for both varieties using the PCR-select cDNA Subtraction kit (Clontech). Libraries were generated using TA cloning in the PCR-TOPO vector (Invitrogen). We have sequenced the 5' end of 100 randomly selected clones from each library. We will present an overview of the sequence identities, putative functions, and importance. We will also discuss the possibility of the development of molecular markers to assist in breeding for chinch bug resistance in buffalograss. This project was supported by NIH grant 1 P20 RR16469 from the BRIN program of the National Center for Research Resources, the UNL USDA-ARS, and the USGA.

CONSTRUCTION AND CHARACTERIZATION OF A CDNA LIBRARY FROM BUFFALOGRASS (*BUCHLOE DACTYLOIDES*) INFESTED WITH CHINCH BUGS (*BLISSUS OCCIDUUS*)

Brooke A. Malcom and Paul Twigg, Department of Biology, University of Nebraska at Kearney, NE 68849-1140

Buffalograss (*Buchloe dactyloides*) is a low growing warm-season grass that spreads by stolons and seed. It is native throughout much of the Midwest. It has been the subject of intensive breeding programs aimed at developing its ability to resist drought and form a fine-textured turf suitable for home lawns and golf course use. Many varieties of buffalograss are however very susceptible to attack and damage by chinch bugs. Despite heavy study in the area of breeding, the genomics of buffalograss are largely uncharacterized. To help characterize the genetics of buffalograss connected to chinch bug resistance, we have created a cDNA library from a resistant variety (Prestige) that was infested with chinch bugs for 5 days before tissue collection. Our finished library was composed of approximately 628,000 individual colonies, and had a final titer of 2.8×10^{10} cfu/ml. We have begun randomly sequencing the 5' end to make EST's. We will present our data on the putative identities and functions of the characterized clones. This project was supported by NIH grant 1 P20 RR16469 from the BRIN program of the National Center for Research Resources, the UNL USDA-ARS, and the USGA.

FLIES AND DISEASE: AN EXPLORATION OF THE VECTORING POTENTIAL OF *DROSOPHILA VIRILIS, MUSCA DOMESTICA*, AND *SARCOPHAGA CARNARIA* WHEN COMPARING BACTERIAL EXPOSURE AND GROOMING BEHAVIOR

Michael W. Kling and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney, NE 68849

It is the purpose of this study to conduct research on the ability of particular species of flies to mechanically transfer disease and the potential effect grooming behavior has on disease transmission. Two species that are known to transmit disease, *Musca domestica* and *Sarcophaga carnaria*, and a species that is not known to transfer disease, *Drosophila virilis*, were exposed to bacteria and then various cleaning times were allowed. Bacterial numbers were quantified before and after exposure and grooming. There were no significant differences found due to different lengths of exposure to the bacteria. The flies were heavily contaminated within 2 minutes of exposure. Significant differences were found between the disease causing species and the non-disease causing species when comparing bacterial contamination following cleaning. Each fly species was also exposed to *Escherichia coli, Salmonella cholerasuis*, or *Pseudomonas aeruginosa* to determine whether the type of bacteria the individual is exposed also influences the potential to transfer disease. These data are important in understanding the role that flies have in mechanical disease transmission and the best routes for control. This project was partially supported by NIH Grant #2 P20 RR16469 from the Nebraska INBRE Program of the National Center for Research Resources.

FRACTIONATION AND CHARACTERIZATION OF THE ANTIMICROBIAL SECRETIONS IN *NICROPHORUS* SP.

Megan Nelson and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney, NE 68849

The burying beetle, belonging to the genus *Nicrophorus*, uses antimicrobial oral secretions to preserve carrion buried under the ground. This secretion decreases the decay rate of the carrion so that their larvae may feed upon the carcass. It is hypothesized that the compound responsible for the

antimicrobial activity is a peptide. Previously described classes of antimicrobial peptides include the cecropins, defensins, and the proline or glycine-rich peptides. These compounds can be found in insects and are generally associated with insect innate immunity. In order to study the antimicrobial peptides, oral secretions were collected from *N. marginatus* and fractionated using high pressure liquid chromatography. The goal of this research was to use size exclusion HPLC to isolate and identify the specific antimicrobial peptides employed by *N. marginatus*. The antimicrobial activity of each fraction was tested using the Microtox Analyzer that monitors changes in the fluorescence of *Vibrio fischerii*. This project was partially supported by NIH Grant #2 P20 RR16469 from the Nebraska INBRE Program of the National Center for Research Resources.

THOMSEN MEADOW, A BOTANICALLY DIVERSE LOWLAND PRAIRIE IN THE LOUP RIVER VALLEY

Sara L. Veloso and Steven J. Rothenberger, Department of Biology, University of Nebraska at Kearney, NE 68849-1140

Thomsen meadow is a natural, sub-irrigated wet meadow located on the south side of the Loup River near Rockville, Sherman Co., NE (S 1/3 of the SW 1/4 of SEC 8, T13N, R13W). The meadow, approximately 16 Ha in size, has never been farmed and has not been grazed for at least 50 years. It is mowed annually as a source of prairie hay, but is not harvested until late August, allowing adequate time for most of the forbs and grasses to flower and reseed. The Thomsen meadow was extensively studied during the 2005 growing season. This site and a comparable grazed meadow were quantitatively sampled using randomly positioned plots that were each 10 m^2. Percent plant cover was estimated using a modified Daubenmire cover-abundance scale. Vegetation was also sampled by placing 20 (0.2 m^2) random quadrats along systematic transects within each plot. From these samples, density and frequency for forbs and percent cover for graminoids was calculated. Soil samples from each plot were collected in triplicate for analysis. A floristic checklist for Thomsen meadow was also compiled. Species diversity is relatively high and is dominated by the Asteraceae, Cyperaceae, and Poaceae Families. The botanical significance of this meadow is great due to the presence of a threatened species, small white lady's slipper orchid, *Cypripedium candidum* Muhl. ex Willd. Our study verified approximately 12 previously documented colonies and a minimum of 25 newly discovered orchid plants.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

ALTERATIONS TO THE α2 and γ2 SUBUNITS OF THE GABA-A RECEPTOR AS A RESULT OF TRAUMATIC BRAIN INJURY

Rebecca Meyer and Cynthia Gibson, Psychology Department, Creighton University; Omaha, NE 68178

Traumatic brain injury (TBI) is a critical problem in the United States, causing the deaths of over 50,000 people each year and the disablement of 90,000 more[5]. Those injured show a number of cognitive deficits, especially in the areas of attention and memory[1]. TBI causes an initial cascade of neurotransmitter release leading to a massive depolarization of the neurons. The ionic disruption of the cell leads to neural excitotoxicity and extensive intracellular damage. Calcium influx through the N-Methyl-D-Aspartate (NMDA) channel is the primary source of glutamate-related excitotoxicity after TBI[3], and elevated calcium alters γ-Aminobutyric Acid (GABA) receptor-mediated chloride conductance[4]. GABA-A is prominent in the brain and has an important inhibitory function by regulating chloride influx. To further explicate the relationship between TBI and subsequent alterations to brain functioning through NMDA and GABA-A receptors, moderate fluid percussion injuries were performed

on rats and the brains were removed at 24 hours and 7 days post-injury. Western blot analysis was used to examine protein expression of two GABA-A receptor subunit proteins, $\gamma 2$ and $\alpha 2$. The $\gamma 2$ and $\alpha 2$ subunits are among the most abundant and both are important for benzodiazepine binding and action[2]. This indicates that the alterations to the GABA-A receptors as a result of TBI may have important pharmacological implications. Protein expression alterations, the functional impact of these alterations and future lines of study will be discussed. This work was supported by the Nebraska INBRE project, P20 RR16469, James Turpen (PI).

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EXPRESSION OF AMYLOID PRECURSOR PROTEIN, PHOSPHORYLATED TAU, AND MICROTUBULE-ASSOCIATED PROTEIN IN THE HIPPOCAMPUS AND CORTEX OF MICE FOLLOWING REPEATED MILD TRAUMATIC BRAIN INJURIES

J. A. Dobrowolska and C. J. Gibson, Department of Psychology, Creighton University, Omaha, NE 68178

The emergence of amyloid β (peptide) plaques and neurofibrillary tangles (NFTs), due to phosphorylated tau protein, occurs in both Alzheimer's Disease (AD) and traumatic brain injury (TBI). Therefore, TBI may increase the likelihood of later AD pathology[1,2,3]. Amyloid β plaques are a result of cleavage of amyloid precursor protein (APP) by β- and γ-secretases and are now known to be central to the degeneration of neurons during AD[4]. Increases in precursors to amyloid β, such as APP, have been found in *pugilistica dementia* (punch-drunk syndrome)[1], in severe brain injury in humans[5], and in the controlled cortical impact (CCI) model of brain injury in rats[6]. Tau is a microtubule-associated protein (MAP) associated with axons. Tau binds to microtubules (MTs) and the result is a stable MT complex. However, when tau is phosphorylated, there is a reduction in its ability to bind to MT, and the stability of the MT diminishes. The result is a NFT. Hyperphosphorylation of tau, along with the formation of NFTs, is an early event in AD pathogenesis and has been seen to increase in severe TBI patients[3]. Our objective was to test whether multiple mild injuries produce cumulative damage similar to a single, more severe injury[7]. Therefore, we examined the expression of APP, MAPII, and phosphorylated tau staining 15 days post-injury in the cortex and hippocampus of mice subjected to 0, 1, 4 or 6 mild TBIs incurred using an impact acceleration injury model. The results indicate that repeated mild TBIs increase APP expression only in the CA1 and dentate gyrus of the hippocampus at this time point. This evidence may indicate that repetitive mild injuries may only alter APP in specifically vulnerable regions. Further investigation of MAPII and phosphorylated tau expression will be performed. 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.

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MONITORING PRODUCTION OF NITRIC OXIDE IN OSTEOBLAST-LIKE CELLS BY QPCR AND A GREISS REAGENT ASSAY

Mary A. Adams, Department of Chemistry, and M.R. Wyatt, Department of Biology, and M.G. Nichols, Department of Physics, Creighton University, Omaha, NE 68178

While it is well known that bone mass changes in response to biomechanical loading, the fundamental cellular mechanisms that regulate these changes remain unknown. Nitric oxide, produced by nitric oxide synthase (NOS)3 in response to inflammatory stimuli, is thought to regulate bone remodeling. We hope to measure single cell gene expression and biochemical elasticity following mechanical stretching to elucidate the mechanosensory potential of osteogenic cells. The pro-inflammatory cytokine interleukin 1β (IL-1β) is a known inducer of NOS3 expression in osteogenic cell lines. In this study, mouse osteoblast-like cells of the MC3T3-E1 cell line were treated with three different concentrations of IL-1β for varying amounts of time. After treatment with IL-1β gene expression was quantified by quantitative PCR (QPCR). Unexpectedly, the interleukin-treated cells displayed the same expression levels of NOS3 as the negative controls. Greiss reagent was then used to determine if the cells responded to IL-1β by producing nitric oxide. It was determined that the interleukin-treated cells produced between 2.4 fmol/cell and 63.6 fmol/cell of NO, whereas NO was not detected with the negative controls. This study is being repeated on the 2T3 osteoblast cell line, where we will also be attempting to verify bone nodule formation and confirm that the cells behave as osteoblasts. 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 the NIH.

SPATIAL AND TEMPORAL EXPRESSION OF MEMBRANE TYPE 2 MATRIX METALLOPROTEINASE DURING AVIAN DEVELOPMENT

Rachel Patterson, M. Holmberg, P. Brauer, and M. Reedy, Department of Biology and the Department of Biomedical Sciences, Creighton University, Omaha, NE 68178

Matrix metalloproteinases (MMPs) comprise a family of zinc-binding proteolytic enzymes that play an essential role in tissue remodeling. MMPs are also thought to play a major role in cell behaviors such as cell proliferation, migration, differentiation, apoptosis and degradation of extracellular matrix proteins. Membrane Type – MMPs (MT-MMPs) are membrane-bound forms of MMPs that cells can direct to specific regions on their cell surface to localize proteolytic activity. In situ hybridization with an antisense RNA probe was used to detect the presence of MT2-MMP mRNAs in avian embryos during various stages of development. Afterwards, embryos were embedded in tissue freezing medium and cross-sectioned to determine the distribution and internal location of MT2-MMP mRNA. As a result, prominent MT2-MMP mRNA expression was found during the development of several organ tissues including the ventricular myocardium, corneal epithelium, pharyngeal arches, limbs, muscle, and connective tissues. In the future, expression of MT2-MMP will be compared to the expression patterns of several other MT-MMPs. Also, performing gene knockdowns would facilitate obtaining direct evidence and help indicate whether MT-MMPs are necessary for the occurrence of certain developmental events. Knowledge of MT-MMP's contributions to embryonic development may lead to the prevention of congenital defects and other various developmental anomalies. 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 the NIH.

AUTOMATED METHODS TO UNCOVER AND CAPTURE GENE/PROTEIN RELATIONSHIPS FROM RESEARCH LITERATURE

Scott Abboud, Rui Zhang, and Parvathi Chundi, Department of Computer Science, College of Information Science and Technology, University of Nebraska at Omaha, NE 68182-0116

In this paper we report our findings for abstracting key words, from scientific literature, about neural stem cells in the developing retina and try to establish relationships between those key words based strictly on the literature. Computational text mining techniques offer great promise in gathering and systematizing data in scientific literature. Relevant research abstracts are downloaded from Pubmed (http://www.pubmed.org) and parsed using string matching patterns to locate sentences containing a predetermined subset of verbs such as bind, mediate, repress, activate, etc., and capture those sentences into a file. After collecting those sentences into a file, several domain specific tools from the Unified Medical Language System (UMLS) are used to parse the sentences into meaningful phrases and key words, which are then categorized based on known concepts. The goal is to be able to build meaningful gene/protein relationships and create a database with this information for future reference or testing.

A GENETIC ROADMAP FOR THE DEVELOPMENT OF RETINAL STEM CELLS

Scott Abboud, Faisal Ahmed, Department of Computer Science, College of Information Science and Technology, University of Nebraska at Omaha, NE 68182-0116; and Iqbal Ahmad, Department of Ophthalmology and Visual Sciences, University of Nebraska Medical Center, Omaha, NE 68198-7691

Through great promise and controversy, stem cell research has caught not only the attention of researches in the scientific community, but the public as well. The potential of stem cells to treat degenerative diseases and injury could be realized by understanding mechanisms that regulate their differentiation into different cell types. We are studying stem cell regulation in the mammalian retina, which is a robust and reliable model of the central nervous system. Here, we present a putative gene network that regulates the differentiation of neural stem cells into different retinal cell types. The place of a particular gene in the hierarchy is based on the information, about its patterns of expression and function, available from diverse organisms such as Drosophila, Xenopus, chick, rodents and human. We start from neural induction and follow neural stem cell development all the way through late histogenesis of the developing retina. Therefore, this hierarchical network is arranged temporally into five categories: neural induction, anterior neural plate development, optic vesicle development, early histogenesis, and late histogenesis. Our goal is to create a clear map to navigate through the development of stem cells to progenitors to their specified cell fates, and try to predict "missing" genes in this development and stimulate hypotheses on the regulation of neural stem cells.

CHARACTERIZATION OF TYPE III SECRETION SYSTEM (TTSS) IN *PSEUDOMONAS AERUGINOSA*

Pratima Kunwar, T.J. Warren, S.B. Kampalli, and D. W. Rowen, Department of Biology, University of Nebraska at Omaha, NE 68182-0040

Type III secretion systems (TTSS) are a virulence factor of many pathogenic bacteria that mediates the secretion and translocation of specific bacterial-encoded toxins or effectors into the cytoplasm of eukaryotic host cells. A TTSS is found in both *Pseudomonas aeruginosa* which is a

pathogen of mammals and *Pseudomonas syringae* which is a pathogen of plants. The mechanisms by which TTSSs are able to secrete effectors and translocate them into both animal and plant cells are not fully understood. We are initiating a study in collaboration with Jim Alfano at the University of Nebraska–Lincoln that will compare the abilities of the TTSS of *P. aeruginosa* and P. *syringae* to secrete and translocate effectors. We hope these studies will help us identify the factors that enable these systems to secrete effectors and translocate them into either animal or plant cells. For these studies, we are constructing effortors that are modified by the addition of an epitope for a monoclonal antibody against hemagglutinin (HA) or fusion to adenylate cyclase (Cya). The modified versions of the effectors will enable us to monitor the secretion and translocation of the effectors into either animal or plant cells. Here, we will report our progress in the construction of modified effectors and our preliminary tests of the secretion and translocation of these modified effectors into mammalian cells.

MACROPHAGES AS VEHICLES FOR ANTIVIRAL DRUG DELIVERY ACROSS THE BLOOD BRAIN BARRIER

Avery Shaw, Chadron State College, Chadron, NE 69337

The Human Immunodeficiency Virus (HIV) is steadily increasing in all areas of the world. However, with the introduction of Highly Active Anti-retroviral Therapy (HAART), patients suffering from HIV, who are taking the retroviral therapy, are experiencing an increase in longevity. This increase in the life span is also bringing in a second concern, we are also witnessing a steady rise in HIV associated encephalitis and dementia. Unfortunately HAART also has downfalls in treatment including availability, adherence, side effects, cost, and most important for our research, the inability to reach hidden viral reservoirs. These downfalls have lead us to our main objective; to design a new anti-retroviral drug delivery system that will improve drug efficacy, patient adherence, and set the stage for advancement of treatment options in third-world countries. Our tested vehicle will be the macrophage due to its abilities to reach the reticular endothelial system where HIV proliferates at high rates. To test the hypothesis, bone marrow was extracted from donor mice. The bone marrow macrophages were cultured to approximately 10 billion per recipient mouse and then loaded with the indinavir drug, a component of HAART. The results of the first migration study determined the following; 8 hours, primarily migration was focused in the area of the lunges with minor distribution to the liver and spleen; in 24 hours the macrophages migrated from the lung to the liver and spleen; Days 1 through 7 were shown by g-scintillation and spectrometry and histological examination that the bone marrow macrophages were retained in those tissues throughout the study. The paradigm for encephalitic effects within the mouse CNS included SCID mouse with blunted T and B cell immunity, resulting in the SCID mouse being the recipient of the bone marrow macrophages. The donor mouse was the C.B. 17 mouse which is the parent strain to the SCID mouse and the human monocyte-derived macrophages were cells obtained by elutriation, and injected intra-cranially into the SCID CNS. After one round of replication, the SCID mouse then received the bone marrow macrophages. In one week the brain of the SCID mouse was then harvested. Staining techniques proved that HIV encephalitis was present, as well as the indinavir drug delivered by the bone marrow macrophage. These results proved that the SCID mouse HIV encephalitis model was effective in eliciting bone marrow macrophages across the blood brain barrier as well as proving the bone marrow macrophages were attracted to areas of HIV replication in the CNS.

DEVELOPMENT OF SMALL ANIMAL MODEL FOR HIV-1-INDUCED ALVEOLITIS: IMPLICATIONS FOR PATHOGENESIS AND NOVEL TREATMENT APPROACHES

C. Lawson[1,3], B. Knipe[1], R. Potula[1], Y. Persidsky[1,2], G.D. Kanmogne[1], and M. Pauley[3].
[1]Center for Neurovirology and Neurodegenerative Disorders, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha, NE 68198; [2]Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha, NE 68198; [3]College of Information Science and Technology, University of Nebraska at Omaha, Omaha, NE 68135

HIV-infected patients may present respiratory complications related to alterations in pulmonary immune regulation. HIV-1 can cause an interstitial lung disease associated with a marked infiltration of T cells in the lung interstitium and alveolar spaces, lymphocytic alveolitis. We tested the idea that activation of peroxisome proliferator-activated receptor gamma (PPAR- g , regulating pleiotropic anti-inflammatory pathway) may affect inflammatory cells in the lung and attenuate tissue injury. Preliminary results indicate that (1) CD8+ lymphocytes were predominant cell type infiltrating lung parenchyma; (2) increase in lymphocytic infiltrate paralleled disruption of endothelial barrier in the lung; (3) PPAR-g agonists prevented endothelial cell injury and possibly decreased levels of lymphocyte infiltration; and (4) PPAR-g agonists diminished viremia levels.

In this talk, I will summarize the above results and will explain how our data show that lymphocytic alveolitis can be reproduced in the hu-PBL-NOD/SCID model for studies of pathogenesis and testing of new therapeutic paradigms. I will also discuss a difficulty that became apparent during this work, specifically the repetitive nature of the image analysis. This has motivated me to learn how to automate this task; I will discuss my approach during my talk.

MUCIN 17 EXPRESSION AND REGULATION IN DIGESTION DISEASE

Wade Junker, Shantibhusan Senapati, Nicolas Moniaux, and Surinder Batra, Department of Biochemistry, University of Nebraska Medical Center, College of Medicine, Omaha, NE 68198

With increasing interest on mucins as diagnostic and therapeutic targets in cancers and other diseases, novel mucins are being identified. Mucin 17 (MUC17) is a large, membrane-anchored glycoprotein. Study of the molecule has revealed an aberrant expression of the mucin in pancreatic cancer as the molecule does not present itself in the normal pancreas. Mucin 17 is however, normally displayed in the gastrointestinal tract where it likely serves a role in protecting the epithelial surfaces from this extracellular environment. Radiation hybridization mapping has revealed that in fact, three GI track specific mucins (MUC3, MUC12, and MUC17) cluster within close proximity of each on chromosome 7. Evolutionary pressures maintain clusters mucin genes at specific chromosomal loci including: 11p15.5 (secreted, gel forming - MUC2, -5AC, -5B, -6), 3q29 (soluble, non-gel forming MUC4, MUC20) and those under study at 7q22 (membrane-bound MUC3A/B, -12, -17). The genomic organization and related nature of the genes within this cluster suggests that they share common function. The three GI track-specific mucins likely have roles in mediating response to extracellular stimuli and modify the rheological properties of the mucinous layer. It stands to reason that some nature of co-regulatory control exists for these mucins and an altered expression has implication in the diseased state. The

expression of MUC17 is regulated by a 1,146 bp fragment upstream of MUC17 that contains select responsive elements including those for the (VDR/RXR heterodimer, Wilms Tumor Suppressor, NF-kappaB, Gut-enriched Kruppel-like factor, Smad3/4, Cdx-2, GATA-binding factor 1, and AP-1). This suggests that MUC17 colonic display is potentially regulated by retinoic acid, vitamin D, and/or TGF-Beta. The responsive promoter fragment will be tested in presence of these ligands. Colonic cell lines were tested for MUC3, MUC12, and MUC17 expression by RT-PCR to investigate the occurrence of the three mucins in relation to each other. MUC3 and MUC17 were highly expressed in duodenal cancer cell lines. In addition, select cell lines show the presence of MUC3 and MUC17 splice variants which code for secreted forms of the membrane-bound mucins. Western blot and immunohistochemical analyses using rabbit polyclonal antibody generated against MUC17 confirmed MUC17 in normal and colonic adenocarcinoma tissue sections. Normal colonic mucosa shows faint intracytoplasmic staining in the surface epithelium. Colonic adenocarcinoma shows granular staining in Golgi area. In conclusion, results provide existence of two alternatively spliced MUC17 transcripts (which code for membrane-bound and secreted forms of the protein) and show evidence that MUC17 expression is altered in colonic adenocarcinoma where its exact implication will be determined in the near future.

PERP, A MEDIATOR OF P53 DEPENDENT APOPTOSIS, IS INDUCED AND TRANSLOCATED TO NUCLEUS FOLLOWING ISCHEMIC RENAL INJURY

Brynn Lastovica[1], Dana College, Blair, NE 68008; and Babu J. Padanilam[1,2]. [1]Internal Medicine, [2]Cellular and Integrative Physiology, University of Nebraska Medical Center, Omaha, NE 68198

The p53 tumor suppressor gene plays a pivotal role in mediating apoptotic cell death in renal ischemia-reperfusion injury (IRI). Inhibition of p53 using pharmacological inhibitors has offered functional protection against IRI by preventing apoptosis but not necrosis. The mechanism by which p53 activation leads to cell cycle arrest or apoptosis is proposed to be at least in part dependent on the direct transcriptional activation of target genes. Although, a role for the balance in the expression and functions of anti-apoptotic p21 and the pro-apoptotic Bax proteins is proposed in p53-dependent apoptosis in IRI, their roles are yet to be established. In order to further elucidate the pathway by which p53 elicits apoptosis, we investigated the role of the PERP (p53 apoptosis effector related to PMP-22), an apoptosis-associated p53 target that is directly activated by p53. The PERP mRNA and protein are highly induced in ischemic renal kidneys post- reperfusion at 3, 6, 12 and 24 hours. The initial increase in the PERP expression after IRI is to a large extent cytoplasmic. However, at 12-24 hours post-injury, translocation of PERP to the nuclei in some of the proximal tubular cells in the outer medulla is observed. Expression and/or translocation of PERP post-renal ischemia was significantly inhibited by genetic ablation or pharmalogical inhibition of p53 using pifithrin-alpha (PIF). Renal proximal tubular cells cultured in vitro, when exposed to oxidant, hypoxic or sodium azide injury also showed an induction of PERP and its translocation to the nucleus, whereas PIF significantly inhibited its expression. Taken together, our data indicate that PERP is induced in p53-dependent manner and may play a role in p53-mediated apoptosis in renal ischemic tissues and in renal proximal tubular cells following different apoptotic stimuli. Inhibition of the p53 apoptotic pathways in renal cells may be a therapeutic strategy for treating IRI. Defining p53 targets; such as PERP, is a useful step towards this goal.

SYMPATHOEXCITATION IN CHRONIC HEART FAILURE: ANG II INDUCED INHIBITION OF VOLTAGE-GATED K^+ CHANNEL – AN *IN VIVO* AND *IN VITRO* STUDY

Marcus Finch, Lie Gao, Wei Wang, Ethan Mann, Yulong Li, Dongmei Liu, Harold D. Schultz, and Irving H. Zucker, Department of Cellular & Integrative Physiology, University of Nebraska College of Medicine, Omaha, NE 68198-5850

We have reported that elevated central Ang II plays a critical role in sympathoexcitation of chronic heart failure (CHF) by stimulating up-regulated AT1 receptors in rostral ventrolateral medulla (RVLM). However, the link between enhanced Ang II signaling and electrophysiological characteristics of neurons in RVLM remains unclear. In the present experiments, we first screened for potentially altered genes in the brainstem of rats with CHF that relate membrane conductance in neurons using the Rat Genome 230 2.0 Array GeneChip. We found that Kv 4.3 gene was significantly down-regulated in the CHF rats (Ratio of Sham to CHF: 2.1 ± 0.2 times, $P < 0.05$, $n = 3$). Second, we used real-time PCR and Western blot further to confirm this down regulation of Kv 4.3 in the RVLM of CHF rats (mRNA: 1.3 ± 0.1 to 0.7 ± 0.1, $P < 0.05$; protein: 2.0 ± 0.1 to 0.9 ± 0.1, $P < 0.05$). Finally, we used a neuronal cell line (CATH.a neurons) to explore the effect of Ang II on Kv 4.3. We found that Ang II treatment (1) down-regulated the mRNA (0.4 ± 0.03 to 0.2 ± 0.03, $P < 0.05$) and protein (1.5 ± 0.2 to 0.6 ± 0.1, $P < 0.05$) of Kv 4.3; (2) decreased the K+ peak current (Ik: 289.6 ± 31.5 to 143.3 ± 8.9 pA, $P < 0.05$); and (3) up-regulated the mRNA (0.7 ± 0.1 to 1.8 ± 0.2, $P < 0.05$) and protein (0.8 0.1 to 1.5 ± 0.2, $P < 0.05$) of the AT1 receptor. We conclude that the sympathoexcitation of CHF may be due to, in part, the effect of Ang II down-regulating the Kv 4.3 expression and decreasing I_K, and thereby increasing the excitability of neurons in the RVLM, via the enhanced AT_1 receptor expression. (Supported by NIH grant HL PO-1 62222)

***IN VITRO* AND *IN VIVO* DIFFERENTAITION OF MOUSE EMBRYONIC STEM CELLS**

Brian Kadow, H. Basma, G.R. Yannam, T. Yamamoto, C. Spendlove, and I.J. Fox, Department of Surgery, University of Nebraska Medical Center, Omaha, NE 68198-3280

Organ transplantation can treat a variety of conditions that result in organ failure. A lack of donor organs, however, limits its efficacy. Embryonic stem (ES) cells, which are derived from the inner cell mass of a developing embryo, have the capacity to differentiate into all of the cells and tissues in a mature human body. Transplantation of ES cell-derived tissue is a promising alternative to transplantation of organs from living and cadaver donors. ES cells could potentially be manipulated to regenerate damaged tissues and potentially grow an entire organ. These engineered tissues could then be transplanted into patients, restoring faulty organ function. To assess ES cell potential for use in transplantation, we induced ES cell differentiation through teratoma formation and embryoid body formation, and sought to identify hepatocytes and islet cells, which could potentially be used for clinical transplantation.

CHARACTERIZATION OF OTK18 GENE INTERACTIONS UTILIZING *DROSOPHILA MELANOGASTER* SCHNEIDER 2 CELLS, MICROARRAYS, AND QUANTITATIVE RT-PCR

Sarah E. Marshall, Cole R. Spresser, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney, NE 68849

OTK18 is a novel human transcriptional suppressor with 13 zinc finger motifs and both Krüppel-associated boxes A and B. This transcriptional regulator plays multiple roles within human development and the innate immune response. It has been implicated in regulation of human immunodeficiency virus type-one (HIV-1) infection of mononuclear phagocytes (MP) by suppressing viral replication in monocyte-derived macrophages, being up-regulated in MP of human brain tissue with severe HIV-1 encephalitis, and is regulated by interactions with the Tat protein. As has been done for many human genes, further characterization of *OTK18* could be done in a simpler model system. Therefore, the main thrust of the proposed research was to utilize the *Drosophila melanogaster* embryonic Schneider 2 (S2) cell line as model system to characterize OTK18 gene interactions. cDNA microarray analysis was performed on total RNA extracted from S2 cells that had been transfected with *pEGFP-OTK18* (plasmid with an enhanced green fluorescent protein promoter) for 6, 12, and 24 hours. The cDNA microarray analysis revealed differential expression of five genes known to be important in regulation of *Drosophila* immunity. The identity and quantitative reverse transcription-polymerase chain reaction verification of the message levels of these genes will be discussed. In the future, we hope to define a mechanism for *OTK18* gene regulation of immunity and developmental processes. This work was supported by NIH grant 1 P20 RR16469 BRIN Program of the National Center for Research Resources.

LIVING AT THE EDGE. WHAT CAN WE LEARN ABOUT BROOD PARASITISM FROM THE COLONIALLY-NESTING RED-WINGED BLACKBIRD (*AGELAIUS PHOENICEUS*)?

Josef Kren, Midland Lutheran College, Fremont, NE 68025

Red-winged Blackbird, a most abundant North America bird species is commonly parasitized by Brown-headed Cowsbirds (*Molothrus ater*). I investigated 422 nests in 36 nesting colonies in 1994, and 702 nests in 42 colonies in 1995 on distribution of (35 ha) in Arthur County or a fragmented riparian habitat around Keystone Lake in Keith County. The occurrence of brood parasitism was significantly higher in riparian colonies than in the marsh colonies in both years. Possible explanations for spatial distribution of parasitic events and statstistical analysis are presented.

CHEMISTY AND PHYSICS

CHEMISTRY

PALLADIUM-CATALYZED CYCLIZATION OF ENE-ENAMIDES

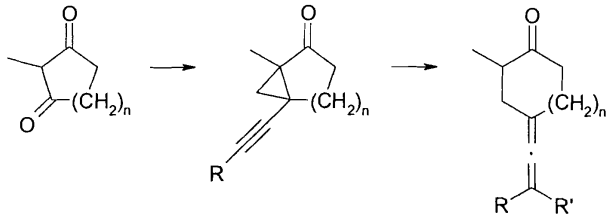
Ross N. Andrews and James M. Takacs, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

The palladium-catalyzed telomerization of butadiene and the related cycloisomerization of bis-dienes have received previous study. Heteroatom substitutents attached directly to the bis-diene system represent a distinctly different, little-studied class of substrates. A palladium-N-heterocyclic carbene catalyst system affects the palladium-catalyzed cycloisomerization of an ene-enamide forming a substituted 2-piperidinone.

STUDIES IN EXTENDED CONJUGATE ADDITION: SYNTHESIS AND REACTIONS OF 1-METHYL-5-(ALKYNYL)BICYCLO[(n+2).1.0]-2-ALKANANONES

David Moody and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178

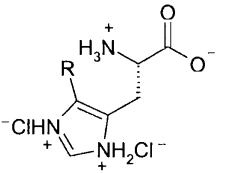
A strategy for the synthesis of the title compounds was developed. Protection of 2-methyl-1,3-cycloalkanediones as isobutyl monoenol ethers was followed by reaction with alkynylmagnesium bromides to provide intermediate propargylic alcohols. Acid-catalyzed dehydration with concommittant enol ether deprotection provided the desired 3-alkynyl substituted conjugated ketones. Reduction using lithium aluminum hydride gave the corresponding allyl alcohols, which were cyclopropanated. Reoxidation leads to the desired bicyclo[(n+2).1.0]-2-alkanones (n = 1,2). These compounds are useful for the preparation of ring-enlarged exocyclic allenes.



SYNTHESIS OF 4-BENZYL-L-HISTIDINE ANALOGUES

Michael Mao and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178; and D. David Smith, Department of Biomedical Sciences, Creighton University, Omaha, NE 68178

To confirm a spectroscopically assigned structure of the potent calcitonin gene-related peptide (CGRP) antagonist N"-benzyl-(4-benzyl)His^{10}-CGRP(8-37), synthesis of 4-benzyl-L-histidine was undertaken. Diastereomeric 4-phenylspinacines formed by Pictet-Spengler reaction of benzaldehyde with L-histidine can be hydrogenated to provide 4-benzyl-L-histidine dihydrochloride. This rapid approach to the synthesis of 4-substituted histidines has implications for the preparation of conformationally restricted 4-substituted histidines.



R=Bn: 4-Bn-L-His · 2 HCl

SYNTHETIC APPROACHES TO PEROXYSPIROKETALS

Curtis A. Wray and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

We will describe our synthetic approaches to peroxyspiroketals, a previously unreported class of compounds. Based upon our previous experience with synthesis of both acyclic and monocyclic peroxyacetals, including several peroxide-containing natural products, we anticipated that peroxyspiroketals would be synthetically accessible and relatively stable. Our synthetic route relies upon a cobalt (II)-promoted dioxygenation for introduction of masked hydroperoxides, which undergo intramolecular reaction with a ketone to introduce the peroxyspiroketal. Our presentation will also discuss the chemical and conformational properties of cyclic peroxides.

COURSE OFFERINGS, PREPAREDNESS AND CONCEPT COGNITION IN CHEMISTRY, PAST , PRESENT and FUTURE

C. A. Kingsbury, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Student attitudes strongly affect cognition, and our teaching effectiveness thus is a slave to issues largely beyond our direct control. Is there a way to take back control? Probably not, since social conditions and science itself change faster than our ability to react. Are there ways to improve things other than changing course offerings? Probably, and suggestions will be made. The increasing importance of materials science and biological applications of chemistry poses a particular challenge. Introductory courses stress basic concepts, and it is difficult to get across basic concepts using extremely complicated examples.

HIGH-THROUGHPUT METHOD FOR MEASURING PROTEIN DISSOCIATION CONSTANTS (K_D) USING 1D ^{1}H NMR

Matthew Shortridge, Kelly Mercier and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln, NE 68522

Many of today's drug discovery programs require high-throughput screening methods that rely heavily on a quick evaluation of binding interactions to qualitatively rank potential drugs. By monitoring binding interactions between ligand-protein complexes, NMR provides a means to validate discovery leads which optimizes the processes of drug development. Typically, NMR-based screens observe a single chemical shift or line-width change to detect a protein-ligand binding interaction. The relatively low-throughput of NMR screens and high-demand on sample requirements makes it generally impractical to collect complete binding curves to measure K_D's for each compound in an assay. A methodology has been developed to quantify the protein binding interaction from a typical NMR-based screen using a single NMR line-width change. The approach can be applied to measure the protein binding interaction of a single compound in compound mixtures that are routinely used in NMR-based screens. Human Serum Albumin (HSA) was used to demonstrate the approach because of the availability of numerous ligands that are known to bind HSA with corresponding literature K_D values. Twelve individual ligand-protein complexes were ranked qualitatively by NMR line-width changes, where a binding affinity was measured for an additional six ligand-protein complexes.

A RAPID METHOD FOR THE DETERMINATION OF THE PERCENTAGE OF ALIPHATIC VERSUS VINYL HYDROGEN ATOMS AND LEVELS OF TRANS FATTY ACIDS IN TRIACYLGLYEROLS

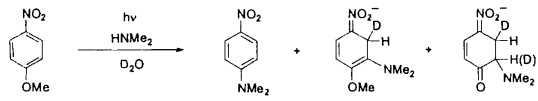
Don Kaufman, Michael D. Mosher, Alex Haeberle, Scott Bennett, and Andrea Martinez-Skinner, Department of Chemistry, University of Nebraska at Kearney, NE 68849-1150

We have found a method for readily determining the percentage of aliphatic versus vinyl hydrogen atoms in common fats and oils using one-dimensional ^{1}H-NMR. Using a similar procedure, we are able to determine the percent of trans-fatty acids in partially hydrogenated fats and oils using ^{13}C-NMR. Reported here are the procedures for making both of these calculations.

ARE GEMINATE RADICAL INTERMEDIATES INVOLVED IN PARA-TO-NITRO PHOTOSUBSTITUTION BY AMINES ON NITROPHENYL ETHERS?

Kandra M. Johnson and Gene G. Wubbels, Department of Chemistry, University of Nebraska at Kearney, NE 68849

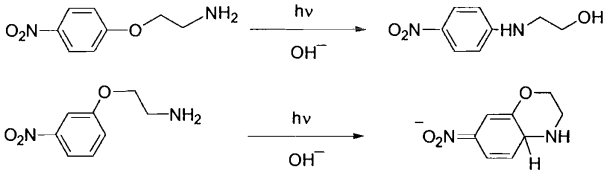
Photosubstitution on 4-nitroanisole by dimethylamine in the presence of a slight excess of hydroxide ion giving mainly N,N-dimethyl-4-nitroaniline is accompanied by formation of stable anionic adducts having the amino nitrogen bonded at the meta-to-nitro position. This implies that the para-to-nitro σ-complex preceding the methoxy substitution product is formed not by geminate radical recombination but by meta-to-nitro nucleophilic attack and fast [1,6] sigmatropic rearrangement of the meta σ-complex to the para σ-complex preceding the para substitution product.



ELECTRON HOLE TRANSFER CATALYSIS BY HYDROXIDE ION IN PHOTOCHEMICAL SMILES REARRANGEMENT AND MEISENHEIMER COMPLEX FORMATION

Nobutoshi Ota, Michelle L. Crosier, and Gene G. Wubbels, Department of Chemistry, University of Nebraska at Kearney, NE 68849

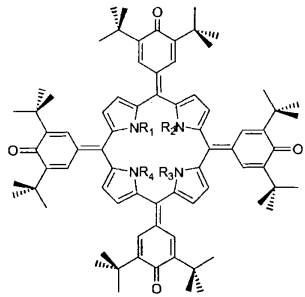
Studies of Smiles photorearrangements and catalysis of the photoreactions by bases reveal that photochemical para-to-nitro Smiles rearrangment and para-to-nitro Meisenheimer complex formation can be effected for nitrophenoxyethylamines by high concentrations of hydroxide ion in aqueous solution. First order dependence on hydroxide ion as the catalyst occurs for both photoreactions, but the catalytic mechanism involving hydroxide ion does not involve acid-base catalysis. The reactions take place from the triplet excited states of the nitrophenyl ethers. Analysis of quantum yields and kinetics is consistent with an electron hole transfer catalysis mechanism.



DFT STUDIES OF THE ANION BINDING BEHAVIOR OF TETRA-OXOCYCLOHEXADIENYLIDENE PORPHYRINOGEN AND ITS N-BENZYLATED ANALOGS

Paul A. Karr, 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[1] Recently, we synthesized and studied a new class of porphyrinogen, viz., tetra-oxocyclohexadienylidene porphyrinogen (**1**) and its N-benzylated[2] (**2** and **3**) and N-naphthylmethyl analogs.3 These porphyrinogens were found to be electron deficient as compared to parent porphyrin while the redox processes for the N-benzylated derivatives were found to be better defined than the parent porphyrinogen. Both X-ray structural and DFT molecular modeling studies revealed severe distortion of the porphyrinogen macrocycle.[2,3] These properties of porphyrinogens suggested that they could act as anion receptors. In the present study, we have verified this and report anion binding behavior of porphyrinogens, **1-3** in dichloromethane. It was found that compound **1** binds to two anions, compound **2** binds to a single anion while **3** binds to none. The anion binding is modeled by PBEPBE/6-31G(d) and PBEPBE/6-31+G(d) model chemistries coupled with SCRF, PCM solvation methods and the experimentally measured binding constants were utilized to arrive at structure-activity relations.



1: $R_1=R_2=R_3=R_4=H$
2: $R_1=R_3=H$; $R_2=R_4=CH_2C_6H_5$
3: $R_1=R_2=R_3=R_4=CH_2C_6H_5$

References

1. *The Porphyrin Handbook*, K. M. Kadish, K. M. Smith and R. Guilard, Eds.; Academic Press: Burlington, MA, 2000; Vol. 1-20.
2. J. P. Hill, I. J. Hewitt, C. E. Anson, A. K. Powell, A. L. McCarthy, P. A. Karr, M. E. Zandler, and F. D'Souza. J. Org. Chem., 2004, 69, 5861–5869.
3. J. P. Hill, W. Schmitt, A. L. McCarty, K. Ariga, F. D'Souza, *Eur. J. Org. Chem.* 2005, 2893-2902.

BACKBONE CONTACTS TO METAL IONS AND GLUCOSAMINE-6-PHOSPHATE IN THE GLMS RIBOZYME

J. Jansen, T. McCarthy, G. Soukup, and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha, NE 68178

Cellular metabolism typically involves regulation of gene expression either through protein-DNA or protein-RNA interactions. Recent studies, however, have identified a number of RNA elements termed riboswitches that directly bind metabolites and regulate gene expression through conformational changes that affect transcriptional termination or translational repression. The glmS riboswitch resides in the 5′ untranslated region of glmS mRNA and functions as a catalytic riboswitch that regulates amino sugar metabolism in certain gram-positive bacteria. The glmS ribozyme catalyzes self-cleavage of the mRNA and ultimately inhibits gene expression in response to binding glucosamine-6-phosphate (GlcN6P), the metabolic product of the GlmS protein. We have utilized nucleotide analog interference mapping (NAIM) and suppression (NAIS) to investigate backbone functional groups that are essential for ligand-dependent ribozyme function. NAIM experiments utilizing GlcN6P as ligand have identified potential sites of ligand and/or metal ion interaction, while NAIS experiments utilizing glucosamine (GlcN) as ligand analog reveal those sites that represent tertiary contacts to the phosphate moiety of GlcN6P. These studies demonstrate that the ligand-binding site lies in close proximity to the cleavage site in an emerging model of ribozyme structure that supports a role for ligand within the catalytic core.

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 the NIH.

NOVEL HIV-1 PROTEASE ASSAY BASED ON NEAR-INFRARED FRET

Xinzhan Peng, Garrick Little, Xinshe Xu, William Volcheck, Jiyan Chen, Chuck Prescott, and Daniel Draney, LI-COR Biosciences, 4308 Progressive Ave., Lincoln, NE 68504

A novel HIV-1 protease assay based on near-IR FRET has been developed that shows a 35-fold signal increase after proteolytic cleavage. This assay has an excellent Z'-factor of 0.85, no interference by visible fluorescence background, and a wide range of DMSO tolerance. The IC50 of a known HIV-1 protease inhibitor, the Pepstatin A, has been measured in this assay and the result is well correlated with the value reported in the literature. This assay is a sensitive, robust assay for high-throughput screening (HTS) and readily adapted to other therapeutically significant protease targets.

A NOVEL PHOTOSTABLE PHTHALOCYANINE DYE, IRDYE™ 700DX, FOR NEAR-INFRARED FLUORESCENCE LABELING OF BIOMOLECULES

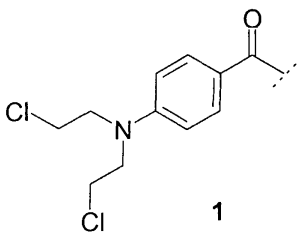
Xinzhan Peng, Garrick Little, Xinshe Xu, William Volcheck, Greg Bashford, Don Lamb, Daniel Grone, Yonghong Zhang, Craig Johnson, Chuck Prescott, Jiyan Chen, and Daniel Draney, LI-COR Biosciences, Inc., 4308 Progressive Ave., Lincoln, NE 68504

We reported here an extremely photostable dye, IRDye™ 700DX, for near-infrared fluorescence labeling of monoclonal antibodies IgG. This novel water-soluble silicon phthalocyanine dye is about 45 to 128 times more photostable than current near-IR fluorophores, e.g. Alexa Fluor 680, Cy5.5, Cy7 and IRDye800CW dyes, and about 27 times more photostable than tetramethylrhodamine (TMR), one of the most photostable organic dyes. This dye has excellent water-solubility, free of aggregation in high ionic strength buffers, large molar extinction coefficient and bright fluorescence. Antibodies conjugated with IRDye™ 700DX at high D/P ratio exist as monomeric species in high ionic buffer and have bright fluorescence. The IRDye™ 700DX conjugated antibodies in western blots and cytoblots assays generate sensitive, high specific detection with very low background.

COMPETITIVE AND IRREVERSIBLE ANTAGONISTS OF CGRP

D. David Smith, Department of Biomedical Sciences, and C.K. Taylor and P.W. Abel, Department of Pharmacology, and M.R. Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178

Calcitonin gene-related peptide (CGRP) is a 37 amino acid residue neuropeptide possessing potent vasodilatory properties. The N-truncated fragment CGRP(8-37) lacks the disulphide bridge found between positions 2 and 7 and is a competitive inhibitor. Recently, we reported that modifications to the N-terminus and His^{10} of CGRP(8-37) substantially increase receptor affinity and antagonist potency. In this study, a new analogue N-α-benzoyl-[His-$benzyl^{10}$]-CGRP(8-37) was synthesized by solid phase methods and showed high affinity for human CGRP receptors. Irreversible analogues of this peptide were synthesized incorporating N,N-*bis*(2-chloroethyl) amino- (1) and fluorosulphonyl- (2) groups into the *para*-position of the N-terminal benzoyl group. While both analogues covalently bound to CGRP receptors, structure-activity studies suggest that analogues containing the N,N-*bis*(2-chloroethyl) amino-group bound in a similar manner to competitive antagonists whereas as analogues containing the fluorosulphonyl- groups bound in a different hitherto unknown manner. Development of irreversible antagonists of CGRP will provide useful tools to determine the role of CGRP in living systems and prove useful for the design of therapeutic agents.



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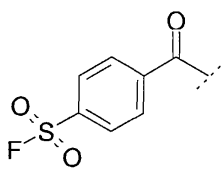


2

DEVELOPMENT OF AN ELECTROGENERATED CHEMILUMINESCENT DETECTION METHOD FOR FLUOROQUINOLONE ANTIBIOTICS

Erin M. Gross, Marcel Fallet, Rohesh Fernando, Evan Kimura, and Kylie Steuben, Department of Chemistry, Creighton University, Omaha, NE 68178

The cyclic voltammetry and electrogenerated chemiluminescence (ECL) of a series of fluoroquinolone antibiotics has been investigated with the ultimate goal of developing an ECL detection method. This detection method may then be coupled with a separation technique such as capillary electrophoresis or liquid chromatography. Fluoroquinolone antibiotics are commonly used to treat infections in both animals and humans. Therefore, it is important to develop analytical methods to detect these compounds in food products, blood samples and wastewater.

When a drug molecule, such as enrofloxacin, is irreversibly oxidized in the presence of the luminescent species tris(2,2'-bipyridyl)ruthenium (II) ($Ru(bpy)_3^{+2}$), chemiluminescence is produced from the reaction of $Ru(bpy)_3^{+3}$ and a strongly reducing intermediate produced from the oxidation of enrofloxacin. An ECL emission spectrum demonstrated that the ECL arises from $Ru(bpy)_3^{+2}$. Maximal light emission was observed at a potential of 1.2 V versus a silver, silver chloride reference electrode. This observation indicates that both $Ru(bpy)_3^{+2}$ and enrofloxacin must be oxidized for light to be produced. Various factors that affect light emission were studied, such as pH, electrode material, solvent, antibiotic concentration, and $Ru(bpy)_3^{+2}$ concentration for each of the fluoroquinolone analogs.

DEVELOPMENT OF MALEIMIDE AND IODOACETYL-ACTIVATED SILICA FOR PROTEIN IMMOBILIZATION

Rangan Mallik and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Maleimide and iodoacetyl activated silica supports were prepared by reacting amine-silica with N-(4-carboxycyclohexylmethyl) malemide (SMCC) and succinimidyl iodoacetate (SIA), respectively. Human serum albumin was immobilized on these supports and the resulting HPLC columns were evaluated in terms of the amount of active protein. These columns showed base-line separation of racemic warafarin, ibuprofen and tryptophan, indicating they could successfully be used in chiral separations.

CHEMISTRY AND PHYSICS

PHYSICS

JET TRIGGER ANALYSIS FOR THE ALICE ELECTROMAGNETIC CALORIMETER

Christopher D. Anson and Michael Cherney, Department of Physics, Creighton University, Omaha, NE 68178

In the ALICE experiment at the LHC, particle jets produced in ultra-relativistic heavy ion collisions will be used to probe the properties of dense nuclear matter. A sophisticated trigger scheme is required to select a statistically significant sample of high transverse momentum jets. This can be implemented using the large area electromagnetic calorimeter (EMCal) proposed by the ALICE-USA Collaboration. An EMCal jet trigger will be discussed and compared to an idealized leading p0 trigger in order to investigate physics underlying the trigger behavior. It will be shown that the trigger can select high energy jet events efficiently while reducing the data rate by the required amount, despite the effects of background fluctuations. A further reduction of the data rate is necessary and requires an efficient, higher level jet trigger which will also be discussed. This work supported by the Office of Science, U.S. Department of Energy.

ANALYTICAL AND NUMERICAL SOLUTION OF QUANTUM-MECHANICAL DOUBLE WELL USING TRICONFLUENT HEUN EQUATION I

W.N. Mei, A. Holloway, and R.F. Sabirianov, Physics Department, University of Nebraska at Omaha, NE 68182-0266

Double well potentials occur frequently in many branches of physics. Solving the Schrodinger equations involving double well potentials analytically is a difficult task, though numbers of numerical solutions are available. In this work we offer a simple and elegant solution for potential with combination of quadratic and quartic terms in the form of solutions of triconfluent Heun equation (THE). General Heun equation is a generalization of Gauss's hypergeometric equation with four versus three regular singular points; for THE, all four singular points merged in one at infinity. We obtained eigenvalues, eigenfunctions, and normalization constants for ground and exited states. Our algorithm for numerical computaions (written using Maple 10 software pakage) is easy-to-understand and requires regular PC computing power.

ANALYTICAL AND NUMERICAL SOLUTION OF QUANTUM-MECHANICAL DOUBLE WELL USING TRICONFLUENT HEUN EQUATION II

A. Holloway , W.N. Mei, and R.F. Sabirianov, Physics Department, University of Nebraska at Omaha, NE 68182-0266

Periodic double well structures can be found in many nanostructures produced by molecular beam epitaxy or similar techniques. Based on our knowledge, analytical and numerical solutions of the quantum-mechanical problems involving potential of this type are not available. In this work we offer for the first time an analytical method to solve periodic double well potential based on our experience dealing with single double well potential that uses solutions of triconfluent Heun equation (THE). Our approach utilizes numerical algoritm written in terms of Maple 10 routines. Consequently, we obtained eigenvalues and eigenfunctions for ground and exited states, and also their band structures.

EVIDENCE FOR THE TIME VARIATION OF THE FINE STRUCTURE CONSTANT FROM THE COSMIC MICROWAVE BACKGROUND ANISOTROPY

Ryan Collins and Gintaras K. Duda, Department of Physics, Creighton University, Omaha, NE 68178

Possible variation of the fundamental constants has long been an area of interest to physicists. This talk will focus on possible variations of the fine structure constant α. Changes in the fine structure constant can be tracked by its effects in the cosmic microwave background anisotropy. An explanation of how variation in α alters the CMB anisotropy spectrum will be provided. The publicly available CMBEasy program has been modified to examine limits on the time variation of α by fitting the α-modified spectrum to WMAP data. Results for the possible variation in α based on WMAP data will be presented along with theoretical motivations for time dependence in the fine structure constant.

NEW INTERFEROMETRIC SPECTROMETER FOR MEASUREMENT OF LASER PULSE WIDTH FOR ZEISS LSM 510 META NLO MULTIPHOTON MICROSCOPE

Nagitha Ekanayake and M.G. Nichols, Department of Physics, Creighton University, Omaha, NE 68178

Multiphoton microscopy is a powerful imaging technique which has evolved over several decades. This technique is widely used by cell biologists to perform cell imaging as it provides more detailed results over the conventional single photon excitation technique. Similar to other non-linear processes, this technique requires high photon intensity to complete the excitation. To achieve efficient multiphoton excitation rates, a high power mode-locked ultra-short laser which generates a laser pulse train of width ~100 fs and repetition rate of 80 MHz is typically used. When performing quantitative studies it is important to know the value of the pulse width of the laser at the sample, since the excitation rate scales as power squared per pulse width. This is difficult to measure due to its extremely short duration. The goal of this research is to design and construct a new interferometric spectrometer to measure the laser pulse width for Zeiss LSM 510 META NLO multiphoton microscope, using an autocorrelation technique. Advantages and disadvantages of this technique compared to other available techniques will also be reviewed.

NONVOLATILE TWO-TERMINAL MOLECULAR MEMORY

J. Snodgrass[1], G.P. Li[1], J. Lu[1], W.N. Mei[1,2], R. F. Sabirianov[1,2]. [1] Department of Physics, University of Nebraska at Omaha, NE 68182-0266; [2]Center for Materials Research and Analysis, University of Nebraska–Lincoln, NE 68588-0111

An electronic nano-device composed of one or few monolayer of polar molecules sandwiched between two asymmetric electrodes made of different semiconductors or metals is designed as a nonvolatile two-terminal memory with two resistance states. As an initial model we propose to use Gd metallofullerene as a prototype of molecule because of its reversible dipole moment. Then, we use Thomas-Fermi model to calculate the potential profile across the device and tunneling current through the proposed structure. We have solved this model exactly and show that bi-stable resistance switching occurs upon applied voltage due to the electromigration of Gd atom inside of the cage and different screening potentials in asymmetric electrodes.

ULTRA PERIPHERAL COLLISIONS PRODUCING VECTOR MESONS AT RHIC

Kimberly Kirchner (for the STAR Collaboration), Physics, Creighton University, Omaha, NE 68178

The Relativistic Heavy Ion Collider (RHIC) is at Brookhaven National Laboratory on Long Island, NY. At RHIC, gold nuclei are accelerated to a center-of-mass energy of 200 GeV per nucleon corresponding to a maximum velocity of 0.99995c; at this speed the nuclei collide. The Solenoid Tracker (STAR) is a detector, which is used to study the collisions of gold nuclei. When the ions do not hit head on they can still interact via the long-range electromagnetic force. This type of collision is called an ultra peripheral collision (UPC). During this type of collision virtual photons are exchanged by the two ions, which can result in a photonuclear reaction with one of the ions. This photon can oscillate into a quark anti-quark pair called a vector meson. There are four types of vector mesons, the rho (ρ), omega (ω), phi (Φ), and the J/psi (J/Ψ). The rho meson decays into a π^+ and a π pair. Since the pions are charged particles, they can be detected by STAR. These interactions can be used to study the nucleus of atoms. I will be presenting the physics behind the interactions of UPCs, as well as the results of a study of rho mesons in UPCs. I will also talk about the future study of the J/psi decay, which involves improving the detection method of its resulting particles. This work is supported in part by U.S. DoE. Grant # DE-FG02-05ER46186.

PROGRESS IN ESTABLISHING A LARGE AREA COSMIC RAY OBSERVATORY AMONG NEBRASKA HIGH SCHOOLS

Lyle A Sass and Thomas McShane, Creighton University, Omaha, NE 68178

The Cosmic Ray Observatory Project, CROP, provides an excellent opportunity to introduce high school students to high energy cosmic ray research. Progress that has been made in building this program in the schools of Nebraska since last spring will be documented as well the progress of the CROP program at Creighton.

EARTH SCIENCE

METASTABLE EQUILIBRIUM SUGGESTED BY DICARBOXYLIC ACIDS IN CARBONACEOUS CHONDRITES AND RESULTING CALCULATION OF REDOX CONDITIONS DURING AQUEOUS ALTERATION ON THE PARENT BODY

Jason A. McAlister and R.M. Kettler, Department of Geosciences, University of Nebraska–Lincoln, NE 68588-0340

Carbonaceous chondrites are undifferentiated meteorites that are considered to be some of the most primitive material in the solar system and are good proxies for the chemical composition of the bulk Earth. These meteorites contain an extensive suite of organic compounds some of which may have been synthesized during aqueous alteration of the asteroidal parent body. Linear saturated dicarboxylic acids containing 4-9 carbon atoms (C4-C9) are present in carbonaceous chondrite samples at concentrations that suggest these species reached metastable equilibrium. The indication of metastable equilibrium among dicarboxylic acids obtained from different carbonaceous chondrites indicates similar aqueous alteration environments on the asteroidal parent bodies. We have assumed that the concentrations of the acids extracted from the meteorites are equal to the activities of the acid of interest in the aqueous

solutions during alteration. If two carboxylic acids are in equilibrium, a plot of the activity of one acid against the activity of the other acid will have a characteristic slope based on the stoichiometry of the reaction of interest. The y-intercept of this plot has been calculated by minimizing the variance of the data around the designated slope. Upon determining the y-intercept and obtaining the equilibrium constant for the reaction of interest based on calculation of ΔG°_{r} (Yezdimer et al. 2000), the hydrogen fugacity under which metastable equilibrium was obtained at a given temperature may be calculated. Metastable equilibrium between succinic (C4), glutaric (C5), and adipic (C6) acids results in values of log fH2 of ~ - 7.3 at 25°C, ~ - 4.3 at 100°C, and ~-2 at 200°C. Concentrations of malonic acid (C3) measured in the meteorite samples do not show evidence of being in metastable equilibrium, however thermal degradation during extraction could result in reported concentrations of malonic acid that are lower than those of the unaltered sample; it is proposed that concentrations indicating metastable equilibrium may have been present prior to degradation during extraction. The demonstration of metastable equilibrium during aqueous alteration on the parent body, and determination of the redox conditions under which this process took place, will aid future investigations to model the suites of organic molecules present on asteroids and carbonaceous chondrites.

DISTRIBUTION AND ORIENTATION OF MARTIAN GULLIES IN THE COPERNICUS, NEWTON, AND GORGONUM REGIONS AS CLUES TO ORIGIN

Ryan S. Morgan, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337; and A.H. Treiman, Lunar and Planetary Institute, 3600 Bay Area Boulevard, Houston, TX 77058

Martian gullies are composite landforms that consist of a theatre shaped alcove, a V-shaped channel emanating down slope, and a depositional fan. Debris and sediments are eroded from the alcove, and then travel through the channel to be deposited on the depositional fan at the base of the slope. Our study focuses on spatial distribution and orientation of gullies in the Newton, Copernicus, and Gorgonum regions in the southern mid-latitudes of Mars. Numerous hypotheses attempt to explain gully formation including: groundwater and CO_2 seepage, melting of ground ice and snow pack, and dry flow; however our results are not consistent with any existing hypothesis.

PERMIAN MANGROVES? A LOW-DIVERSITY GLOSSOPTERID FLORA FROM THE LATE PERMIAN BETTS CREEK BEDS, QUEENSLAND, AUSTRALIA

Jonathan P. Allen and C.R. Fielding, Department of Geosciences, University of Nebraska–Lincoln, NE 68588-0340

The *Glossopteris* flora is the main constituent of the Permian in Gondwana developed during or after the Late Paleozoic glaciation, and is associated with cold and cool temperate conditions. Along with making up the main component of Permian floras in Gondwana, the *Glossopteris* flora was used as primary evidence for continental drift thereby establishing the existence of Gondwana and has been proposed as precursors to angiosperms. However, despite the relative importance of this group, most of the literature concerning *Glossopteris* has been focused on systematics, with very few studies focusing on the paleoecology of the flora. This study attempts to add much needed data to the understanding of the paleocology of *Glossopteris*.

The Late Permian Betts Creek Beds form a succession of alluvial-coastal plain coal-bearing sediments deposited in a basin marginal setting within the northeastern Galilee Basin, Queensland, Australia. These sediments preserve a low-diversity mixed-assemblage flora composed of gymnosperms, sphenophtyes, and other unidentified flora. The assemblage is dominated by glossopterids (*Glossopteris, Vertebraria*, and *Araucarioxylon*-like wood). Plant remains occur in both alluvial and coastal plain facies,

however, alluvial facies preserve allochthonous (transported) assemblages, whereas coastal plain facies preserve both allochthonous and autochthonous (*in situ*) assemblages. Data from autochothonous assemblages show that the Betts Creek Beds flora has marked differences in floral composition in comparison to other Late Permian Gondwanan floras. The flora displays a very low-diversity and is devoid of many commonly associated flora present in coeval successions. It is believed that environmental factors, notably the close proximity and possible incursion of marine conditions, explain the nature of the Betts Creek flora. This extension of glossopterids into marginal marine settings is plausible, given the ability of this group to colonize a variety of environments already well-established in the fossil record.

PRELIMINARY PALEONTOLOGICAL IMPLICATIONS FROM THE CROW CREEK MEMBER (PIERRE SHALE): A HYPOTHESIZED IMPACT-INDUCED TSUNAMI DEPOSIT IN THE LATE CRETACEOUS WESTERN INTERIOR SEAWAY

Ryan D. Weber and D.K. Watkins, Department of Geosciences, University of Nebraska–Lincoln, NE 68588-0340

The 1-3 m thick Crow Creek Member is a unique marl unit with rip-up clasts and a basal coarse layer within the Upper Cretaceous Pierre Shale in South Dakota and Nebraska. The Crow Creek Member was once thought to have been a deposited as a result from marine transgression on the eastern shore of the Western Interior Seaway. However, the discovery of shock-metamorphosed mineral grains from the Manson Impact Structure within the Crow Creek Member has spawned an impact-induced tsunami hypothesis. Recent investigation of core and outcrops along the Missouri River and tributaries revealed paleonotological and sedimentological evidence pertinent to a tsunami hypothesis. An outcrop along the White River in South Dakota displays horizontal bedding surfaces and paleocurrent indicators within the basal coarse layer. Also at White River, bedding surfaces are evident within the marl unit directly above the coarse layer.

Recognized within the marl unit at all localities is an Upper Campanian autochthonous nannofossil assemblage as well as a Lower Campanian allochthonous nannofossil assemblage with species characteristic of the Niobrara Formation. Preliminary data suggests that the allochthonous assemblage decreases upward through the unit as well as distally from the Manson Impact. This distribution is more consistent with a gravitational settling depositional model rather than a marine transgression model. Additionally, the Crow Creek Member strongly resembles offshore tsunami deposits from the Holocene and Cretaceous-Paleocene Boundary.

PROVISIONAL LITHOSTRATIGRAPHIC DESCRIPTION OF THE WHITECLAY GRAVEL BEDS (OGALLALA GROUP) OF NORTHWESTERN NEBRASKA

Hannan E. LaGarry and L.A. LaGarry, Department of Math and Science, Chadron State College, Chadron, NE 69337; and J.B. Swinehart, School of Natural Resources, and C.R. Fielding, Department of Geosciences, and B.E. Bailey, Nebraska Department of Roads, University of Nebraska–Lincoln, NE 68588

Based on lithostratigraphic correlations and detailed geologic mapping of 62 USGS 1:24,000 quadrangles in northwestern Nebraska, we provisionally describe the lithostratigraphy of the Whiteclay gravel beds (Ogallala Group) of northern Sheridan County, Nebraska. The Whiteclay gravel beds consist of a 0-20 m thick multistoried sequence of reworked gravel, cobble and boulder-sized carbonate-cemented volcaniclastic and epiclastic siltstone and sandstone nodules, lenses of epiclastic, volcanic, and granitic silt, sand, and gravel, and cobble to boulder-sized angular to subangular lithic clasts of the

Sharps beds of the Brule Formation (White River Group), the Coffee Mill Butte, Metcalfe, Mission Ranch, and Antelope Creek beds (Arikaree Group), and the Runningwater Formation (Ogallala Group). The Whiteclay gravel beds fill a system of linear fault trenches up to 2 km wide that defines the Whiteclay-Sandoz Ranch Fault zone. The unit is preserved in a series of short southeast trending reaches seperated by generally longer east trending sections. The Whiteclay gravel beds are named for nearby Whiteclay, Nebraska. Exposures suitable for reference localities (from northwest near Whiteclay to ~35 km to the southeast near Gordon) are at the Pine Springs Ranch quarry, the Reeves quarries, the Collins quarries, the Gordon municipal quarries, and the Krebs quarries. The Whiteclay gravel beds are underlain by the Sharps beds of the Brule Formation, the Metcalfe beds, Mission Ranch beds, and Antelope Creek beds of the Arikaree Group, and the Runningwater Formation of the Ogallala Group at different localities. The Whiteclay gravel beds are overlain by Quaternary colluvium, loess, pedisediment, and reworked lithic fragments at most localities. The Whiteclay gravel beds are lithostratigraphic evidence of regional faulting likely associated with continued Black Hills tectonism and wetter climates during the early Miocene. This research was funded by the 2002-2006 USGS STATEMAP Program and the School of Natural Resources, University of Nebraska–Lincoln.

ICHNOLOGY OF THE LATE PLEISTOCENE "CITELLUS ZONE" ICHNOFABRIC, THE TAPHONOMY OF ITS GROUND SQUIRREL REMAINS AND THE PALEOCLIMATE DURING ITS DEVELOPMENT

Robert J. Tobin, Department of Environmental Quality, P.O. Box 98922, Lincoln, NE 68509

Burrows and skeletal remains of small Late Pleistocene mammals are present within the "Citellus zone", a bioturbated interval or ichnofabric that includes the Gilman Canyon Formation and the top of the Loveland Formation of the central Great Plains. Remains of ferrets, ground squirrels (*Spermophilus* = "*Citellus*"), gophers, prairie dogs, voles, and mice have been identified in the "Citellus zone" local fauna. "Citellus zone" bioturbation exists over the entire 1,700 km^2 study area in south-central Nebraska and was synchronous with mid-Wisconsinan Gilman Canyon loess deposition. This conclusion is based upon the observation that burrow abundances are constant throughout Gilman Canyon thickness, whereas in the lower part of the zone decline in burrow abundance with increasing depth in the Loveland Formation suggests that the latter predates burrowing. *Thomomys*-sized geomyid trace fossils are less proportionally common with increasing depth, and fewer of these tunnels are horizontal, showing the transition from their common fodinichnia to their less common domichnia. The inclined tunnels of *Spermophilus richardsonii*- and *Cynomys*-sized domichnia become proportionally more common among the trace fossils with increasing depth until all trace fossils disappear by about 4 m depth into the Loveland Formation. To determine the spatial relationship of the ground squirrel remains to the "Citellus zone" ichnofabric, the author screen-washed 0.67 tonne of sediment sampled from burrow fill and from adjacent sediment matrix at 104 outcrops in ten major canyons in the study area. Within the upper, pedogenically altered, portion of the zone (the Gilman Canyon Formation), 14% of the remains were found in burrow fill and 86% were found in adjacent matrix. All of the weathered remains found were found in the Gilman Canyon Formation. All of the remains in the lower portion of the zone (the uppermost several meters of the Loveland Formation) were found in burrow fill. Published behavioral observations of *Spermophilus richardsonii* explain this phenomenon: upon emergence from hibernation, the animals eject skeletal remains from burrows. The bones are thus left on the surface in the vicinity of burrow entrances to be incorporated into the soil. Nine of the eleven small mammal species of the "Citellus zone" local fauna are extant; the ground squirrel species is ancestral to one of two modern subspecies and one of the two prairie dog species is extinct. The area of maximum sympatry (based upon eight of the nine extant species) of the "Citellus zone" local fauna is a small portion of eastern Colorado. The palaeoenvironment thus suggested by these remains is more arid than is the study area currently and supports short grass prairie vegetation, confirming the prairie ecosystem previously suggested by opal

phytoliths. The atmospheric CO^2 concentration at the time of the development of the "Citellus zone" is known to have been lower than is the case now, and this low concentration may have resulted in vegetation which in today's higher atmospheric CO^2 concentration occurs in a more arid environment. The ninth extant species is a gopher (*Geomys bursarius*) more common in mixed to tall grass prairie, the known vegetation of the study area during deposition of the overlying Peoria loess; hence *Geomys bursarius*' presence may be an instance of remains from burrows originating from the overlying unit ("palimpsesting"), the mixing of faunas. Otherwise (if this species was a contemporary part of the community represented by the fossils of other eight species), then the "Citellus zone" fauna was disharmonious, having lived in an environment inconsistent with any known today.

A DIATOM RECORD OF LATE-HOLOCENE CLIMATE VARIABILITY FROM TWO LAKES IN THE NORTHERN ROCKY MOUNTAIN RANGE

Brandi B. Bracht and S.C. Fritz, University of Nebraska–Lincoln, Department of Geosciences, Lincoln, NE 68588; and L.R. Stevens, Department of Geological Sciences, California State–Long Beach, Long Beach, CA 90840

Long-term limnological and ecological changes in the Rocky Mountain region can be caused by changing climate. The nature of these species changes could reflect shifts in larger scale events, such as, El Nino Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), or Atlantic Multidecadal Oscillation (AMO). Here we use changes in the diatom species composition of sediment cores, spanning the past 2000 years, from Crevice Lake, Yellowstone National Park, and Reservoir Lake, MT to infer changes in limnological conditions driven by climate. Throughout this period in Crevice Lake, planktonic diatoms dominate, but changes in species dominance indicate varying nutrient levels over time. These changes in the lake's nutrient concentrations, particularly phosphorus, are believed to have climatic drivers. The duration of water column mixing, which is related to temperature and wind strength, determines the extent of nutrient recycling from deep waters. Unlike Crevice Lake, the diatom record from Reservoir Lake seems to reflect relative water depth, not seasonality of mixing.

In Crevice Lake, from 50-800 yr B.P., *Stephanodiscus minutulus* dominates; a species that blooms during isothermal mixing. This suggests long cool springs with extensive regeneration of phosphorus from the hypolimnion. The most dramatic change in species assemblage occurs just prior to the onset of the Little Ice Age, about 800 years BP. Prior to this time, *S. minutulus* is absent, and *C. bodanica* and *Cyclotella michiganiana* are the dominant species. These species are characteristic of lower nutrient concentrations during times of stable stratification and are interpreted to reflect warm summers with long periods of thermal stratification. These changes in species abundances suggest long-term trends in seasonal length and climate variation.

Preliminary results from Reservoir Lake show changes between planktic and benthic species. These drastic biota changes could represent changes in relative water depth, with benthic assemblages correlated to shallow water depths, while planktic assemblages imply deeper water. Analyses are still underway, so it is unclear if the timing of water level shifts in Reservoir Lake are correlated with mixing changes in Crevice Lake.

THE INNER WORKINGS OF THE BOILING SAND SPRINGS ALONG THE DISMAL RIVER IN WESTERN NEBRASKA

Stephanie S. Day and D.T. Pederson, Department of Geosciences, University of Nebraska–Lincoln, NE 68588-0340

Boiling sand springs are unique artesian spring features which can be found along the Dismal River in the Sand Hills of western Nebraska. The sand within the springs is liquefied and has no grain to grain contact. The water and sand mixture acts as a high density liquid. The water flow is very turbulent

moving the grains of sand around within the column and creating a fining up sequence within the spring. Also these springs are very dynamic features which change morphology continuously with the amount and pressure of the spring feeding them. The sides are only semi stable and the sand that is around the spring can quickly become liquefied expanding the spring or the edges of the spring can become stable causing the spring to shrink. Using optically stimulated luminescence (OSL) dating techniques it is possible to tell how much the sand has been bleached and therefore to tell if a few grains of sand remain in one isolated spot or if it moves within the column getting evenly bleached with all other grains around it. Also, using OSL it may be possible to tell when the spring formed.

PREDICTING THE LONG-TERM CONCENTRATION OF LANDFILL LEACHATE COMPONENTS AND QUANTITY OF LEACHATE GENERATED AT THE BLUFF ROAD LANDFILL, LINCOLN, NEBRASKA

Melaney M. Towerton and D.T. Pederson, Department of Geosciences, University of Nebraska–Lincoln, NE 68588-0340

Landfill leachate is formed as precipitation percolates through the waste column and contaminants are transferred from the waste to the percolate. Because of the transfer of contaminants, landfill leachate has the potential to pollute ground and surface water if improperly managed. To understand how ground and surface water may be affected by landfill leachate, predictions regarding long-term trends of leachate components and the amount of leachate generated are required.

The Bluff Road Landfill in Lincoln, Nebraska provided sixteen years of active land filling data. Data included quarterly chemical leachate analyses and quantity of disposed leachate. Linear regression between leachate components and time was used to determine if the long-term concentration trend is increasing, decreasing, or stable. Predictions of quantity of leachate generated were made through application of a published model in its original form and a modified version.

Long-term trend results for xenobiotic organic compounds (XOCs) were especially of note as not many studies have access to extensive data regarding XOC's. Other leachate components, such as heavy metals, inorganic macrocomponents and dissolved organic matter behaved as reported in previous studies. Modeling the quantity of leachate generated was more successful in the modified version of the model. Overall, both forms of the model were able to duplicate the general trend of measured values, but over predicted the measured leachate volume.

DETERMINATION OF HYDRAULIC PARAMETERS IN AQUITARD/AQUIFER FLOW SYSTEMS FROM PUMPING TESTS

Cheng Cheng and Xun-Hong Chen, School of Natural Resources, University of Nebraska–Lincoln, NE 68588

Inverse numerical modeling using MODFLOW and PEST is used to determine the hydraulic parameters in single aquitard/aquifer and multiple-layer aquitard/aquifer systems from pumping tests. The six hydraulic parameters include horizontal hydraulic conductivity (K_x) and vertical hydraulic conductivity (K_z) of the aquitard and aquifer, specific storage (S_s), and specific yield (S_y). Hypothetical pumping tests are used to evaluate the feasibility of MODFLOW-PEST in determination of these parameters. Sensitivity analyses of these hypothetical examples show that K_x in the aquifer has the highest composite sensitivity which indicated that it is the most certain and reliable parameter. K_z in the aquitard has higher composite sensitivity than K_x in the aquitard, which is consistent with the flow hydraulics in aquitard/aquifer flow systems that groundwater flow is mainly vertical in the aquitard and

horizontal in the aquifer during pumping. The results of PEST optimizations of the hypothetical examples suggest that a partially penetrating pumping well is better to be utilized to determine the hydraulic parameters than a fully penetrating pumping well in aquitard/aquifer flow systems. Furthermore, selections of the domain size and the grid-size of the discretization may affect the reliabilities of the estimated parameters. Two inverse numerical groundwater flow models are constructed to determine the hydraulic parameters using pumping and recovery test data at two field sites, including the Chapman South site in the Platte River valley and the Medicine Creek site in the Republican River valley in Nebraska. Sensitivity analyses from the field tests also indicate that K_x in the aquifer and K_z in the aquitard are more reliable parameters. PEST calculates the hydraulic parameters for the two sites. The advantage of using numerical inverse approaches is that they take into account the geological heterogeneity in depth more accurately than inverse analytical solutions.

HISTORY AND PHILOSOPHY OF SCIENCE

THE BIOLOGICAL AND PHILOSOPHICAL STATUS OF HYDATIDIFORM MOLES, PARTHENOTES AND TERATOMAS

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

The biological and philosophical status of Hydatidiform Moles, Parthenotes, and Teratomas have been debated for some time. Scientists used appearance to make a judgment on the status of tumors and concluded tumors to be embryos whose development had gone astray. More recent research indicates that moles are tumors with more than one cell type, which originate from more than one germ layer. The initial biological event, which leads to such a heterogeneous event, is not yet understood.

THE CONTRIBUTIONS OF ANTONIE VAN LEEUWENHOEK TO THE FIELD OF SCIENCE AND THE DISCOVERY OF MICROORGANISMS

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

Although there appears to be a debate as to whether Hooke or Leeuwenhoek was the first to observe microorganisms, many scientists feel that Hooke and Leeuwenhoek should share in the development of microbiology. Leeuwenhoek was born in 1632 in Delft, Holland. His formal education stopped at age 16 when he became an apprentice in a dry-goods store in Amsterdam. A few years later he went back to Delft and established his own dry-goods store. Little is known about his life up to the age of 40, but what is known is that Leeuwenhoek developed an ability to make superb microscopes as he perfected his ability to grind lenses.

THE ROLE OF LACTIC ACID BACTERIA IN THE FLAVOR OF CHEESE

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

Cheesemaking began about 8000 years ago and today there are more than 1000 cheese varieties. In the manufacture of these 1000 varieties four basic ingredients are used: milk, rennet, microorganisms and salt. These ingredients are processed through steps involving gel, formation, whey expulsion, acid production and the additions of salt, followed by a period of ripening. Variations in processing techniques are a major determining factor in cheese flavors. Lactic acid bacteria are used to develop the different varieties. The evolution of different species has provided a source for the different cheese variations.

COLLEGIATE ACADEMY
BIOLOGY
SESSION A

THE EFFECTS OF CONTROLLED PRAIRIE BURNING ON PERIMETER RUNWAY USAGE BY BLACK-TAILED PRAIRIE DOGS

Tomika Haller, Doane College, Crete, NE 68333

The black tailed prairie dog (*Cynomys ludovicianus*) is a small, herbivorous mammal that, for years, has been seen as a pest by farmers and ranchers. This study will determine the relationship, if any, between available vegetation in burned and unburned grassland areas and runway activity. A prairie burn was conducted in the spring of 2005 in two plots of land adjacent to a black-tailed prairie dog colony at the Aldrich Prairie Research Site. Samples have been taken of the perimeter runway movement of the colony and the available vegetation mass since August of 2005 in both the newly burned area and in another, unburned segment of land. On average, there is five times more movement in and out of the unburned area than the burned area. The plant material in the burned area is 12 times taller than the unburned area, though the new growth contains little to no short, close to ground vegetation growth. The average mass of plant data from the burned area is 7.514 g while the average mass in the unburned area is 7.369. Results indicate that the colony is not moving into the newly burned land due to the type of re-growth in the burned area.

FUNCTIONAL RESPONSE FOR DIFFERENT AGE CLASSES OF BROWN TROUT (*SALMO TRUTTA* L.) TO VARYING DENSITIES OF AQUATIC AND TERRESTRIAL PREY

Elizabeth N. Glenn, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and P. Gustafsson and E. Bergman, Department of Biology, Karlstad University, Univeritetsgatan 2, 651 88 Karlstad, Sweden

Determining functional response curves and where asymptotes lie for different age classes of organisms are important components of foraging models that give further insight into prey consumption, growth, and behavior. In laboratory experiments, brown trout (*Salmo trutta*) exhibit a type II functional response, characterized by a hyperbolic curve starting at low densities, linearly increasing, then gradually slowing at an upper limit. Three different age classes of trout were supplied aquatic and terrestrial prey at six different densities to determine functional response curves. Results showed a significant interaction between age class and density for both aquatic and terrestrial prey. Significant differences occurred between age classes for every aquatic and terrestrial prey density except at one low terrestrial prey density (53.3 prey/m^2). Overall, the youngest fish had the lowest capture rate and reached the functional response asymptote at the lowest densities. Thus age class and prey density play important roles in capture rate. This research will serve as preliminary data and will give further insight into studies regarding prey preference of younger and older trout.

FECUNDITY RATE AT VARIED TEMPERATURES OF *TRIBOLIUM CASTANEUM*

Katie Gaspers, College of Saint Mary, Omaha, NE 68106

Tribolium castaneum, red flour beetles, is an important agriculture pest. *T. castaneum* are one of the most common pests of stored plant commodities throughout the world. The purpose of this study was to investigate which temperature *Tribolium Castaneum* reaches its optimum fecundity. Specifically which temperature has the best survival rate for the beetles; also which food source did the rate of reproduction increase. Using four different temperatures (37°, 33°, 30°, and 27°), and four different food substrates, (white flour, wheat flour white-wheat flour mixture with yeast, and cornmeal). The number of larva and pupa reproduced was collected over a four week period. Larva developed rapidly in all food substrates. In the flour mixture with yeast and in the white flour there was a significant difference than in the cornmeal. The cornmeal produced the least amount of larva and pupa and had a high mortality rate in the adults. Overall, the flour mixture with yeast and the white flour were the best substrates at all four temperatures for the optimum fecundity rate.

A PHYLOGENETIC EXAMINATION OF SUBFAMILY BROMELIOIDEAE (BROMELIACEAE) USING *MAT*K REGION CPDNA

Megan A. Jensen and J. S. Bricker, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and G. K. Brown, Department of Botany, University of Wyoming, Laramie, WY 82071

A phylogenetic analysis of *mat*K region cpDNA of 155 species within Bromeliaceae was conducted to resolve generic level taxonomy of subfamily Bromeliodeae. Results were preliminary, but did allude to some significant relationships. The only genus found to be monophyletic within the study was *Bromelia*. The monophyly of *Neoregelia* was not supported, although most of the representatives were resolved in a single clade. *Billbergia* also was polyphyletic with most representatives in one clade. *Lymania* was not found to be monophyletic, with the results indicating two possible separate lineages. *Orthophytum* and *Cryptanthus*, although polyphyletic, showed a close relationship to each other. *Aechmea, Streptocalyx*, and *Canistrum* were found to be highly polyphyletic and in need of further study.

GENOTYPIC AND PHENOTYPIC RELATIONSHIP BETWEEN PORCINE *CAMPYLOBACTER COLI* VERON AND CHATELAIN 1973 AND *CAMPYLOBACTER* HYOILEI *ALDERTON* ET AL. 1995 ISOLATED FROM PIGS IN THE U.S.

Mary K. Kersenbrock, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and C.J. Stryker, R.P. Dassanayake, and G.E. Duhamel, Department of Veterinary and Biomedical Sciences and Veterinary Diagnostic Center, University of Nebraska–Lincoln, NE 68583-0509

The *Campylobacter* bacterium has many species. *C. coli* is a common species found in a broad range of hosts such as humans, primates, pigs, and other animals including poultry. The taxonomic classification of a close relative of *C. coli, C. hyoilei*, is controversial. Previous studies have conflicted in determining whether *C. hyoilei* was a new *Campylobacter* species. The purpose of this study was to determine if *C. hyoilei* is a new species or if it is a subtype of C. coli; and also to determine whether or not *C. hyoilei* produced cytolethal distending toxin (CDT), the cause of intestinal irritation. *C. coli*, isolated from all hosts, have the toxin-producing gene (cdtB), but does not produce the toxin. There is no information about CDT in regards to *C. hyoilei*. Both bacteria are present in the United States pig population. Through biochemical tests and PCR species-specific assays it was concluded that *C. hyoilei* is not a new species, but a subtype of *C. coli*. And like *C. coli, C. hyoilei* does not produce CDT.

ASSOCIATION OF SERUM SOLUBLE CD14 LEVELS WITH LUNG FUNCTION AND DISEASE IN AGRICULTURAL COHORT

Craig M. Pekny, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and T. Mathisen, S. Puumala, J. Meza, R. Slager, S. Von Essen, and D. Romberger, Internal Medicine Division of Preventive and Societal Medicine, University of Nebraska Medical Center, Omaha, NE 68198-4350

Environmental exposure to endotoxin is a major occupational hazard which can induce lung inflammation and decrease lung function in agricultural workers. At the molecular level, soluble CD14 acts by transferring endotoxin and other bacterial ligands from circulating LPS-binding protein to the Toll-like receptor 4(TLR4)/MD-2 signaling complex. The soluble CD14 concentrations in the serum of an agricultural population (n=168) was determined by an enzyme-linked immunosorbent assay. Lung function (FEV1%, FVC%, and FEV1%/FVC%) was tested in conjunction with a survey of medical history and agricultural exposure. The soluble CD14 levels in the serum of patients with COPD and emphysema were significantly higher then those without COPD/emphysema. There was also a significant relationship between FEV1% predicted and FEV1/FVC% predicted to soluble CD14 serum levels.

EPIZOOCHOROUS SEED DISPERSAL BY BISON IN THE NEBRASKA SANDHILLS

Brian Franzone and Mark Hammer, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Large mammals can assist in the dispersal of certain plant species through epizoochory, the external attachment of seed-containing propagules. One such mammal, the American bison (*Bison bison*), has declined significantly in population since the arrival of Euro-Americans into the Great Plains. The decline of this keystone species may alter the dispersal of some native plant populations. The present study examines five hides from bison which grazed within The Nature Conservancy's Niobrara Valley Preserve in the Nebraska Sandhills. One of the five hides was collected in 2004 and all of the hair and propagules were removed from thirteen selected sections of this hide. Of the remaining four hides, two were collected in 2004 and two were collected in 2005. Propagules from these hides were removed from 117, 5x5 cm quadrats evenly distributed among thirteen sections of each hide. Each bison hide contained propagules numbering in the hundreds, with the highest concentration in the abdomen, chests, and the pits of the legs. The majority of propagules found were from native species, with the Poaceae (including *Andropogon hallii, Schizachyrium scoparium*, and *Calamovilfa longifolia*) constituting approximately 60 percent, and the Asteraceae (including *Helianthus* spp.) constituting approximately 35 percent of the total propagule abundance. One hundred intact propagules from each of the four dominant genera were selected for germination testing. The potential historic influence of 30 to 60 million bison on the distribution and genetic variation of plants in the Great Plains will be discussed.

THE EFFECT OF BURNING AND LIMESTONE ON TALLGRASS PRIARIE RESTORATION

Meredith Meyer and Brad Elder, Doane College, Crete NE 68333

We examined the effect of high limestone concentration and burning on the first year of a prairie restoration project. We restored two areas dominated by smooth brome grass (*Bromus inermis*) to tallgrass prairie. The first was located inside an abandoned limestone quarry while the other plot was located uphill out of the quarry. A portion of both plots were burned. The effect of lime on prairies remains relatively unstudied but is important as it tends to increase the Ca^{++} and Mg^{++} levels in the soil and also increase the pH levels. The pH inside the limestone quarry was significantly higher than that outside. Stem density was greater in the non-limestone plot than in the limestone plots. Rhizomes grew

deeper inside the limestone quarry, but there were more rhizome buds outside the limestone quarry. There was no statistical difference in biomass between the limestone plots and the plots outside the limestone quarry. Over all, the differences in the restored plots were due mainly to the limestone and not to the restoration project.

SELECTION FOR STARVATION RESISTANCE IN *DROSOPHILA MELANOGASTER*

Tara L. Boren, M.H. Wang, M. Zhou, and L. G. Harshman, School of Biological Sciences, University of Nebraska–Lincoln, NE 68588

Previous research indicates a correlation between increased stress resistance and longevity. Resistance to stress can include oxidative stress, starvation, desiccation and many other environmental stressors. This study focuses on artificial selection for starvation resistance in *D. melanogaster*. This study aims to examine the relationship between increased resistance to starvation and its' potential effects on longevity. Goals to be reached along the way include identifying candidate genes involved in longevity, measuring the gene expression in starvation resistant flies, ascertaining what effects starvation resistance has in the amount of lipids measured in adult flies, and looking at its effect on egg re-absorption in females.

COMPARISON OF THE BARBEL STRUCTURES OF THE CHANNEL CATFISH, *ICTALURUS PUNCTATUS*, TO PREVIOUSLY OBSERVED SPECIMENS OF VARYING SPECIES

Stephanie Blackstone and Todd Georgi, Doane College, Crete, NE 68333

The barbel of the channel catfish is a part of the animal's chemosensory system. They use this system to locate prey in turbid water and on the bottom of its environment. The structure of the mandibular barbels of *Ictalurus punctatus* was examined by SEM and light microscopes. Numerous taste buds were found on the epithelium, which was supported by loose connective tissue and a cartilage rod moved by a multiple skeletal muscles. Findings were compared with the literature and a comparison of morphological features of other species consulted. Results may provide data to understand phylogenetic relationships of other previously studied species of catfish.

EFFECTS OF FUNGICIDES ON APHID (*APHIS GLYCINES*) POPULATIONS IN SOYBEANS (*GLYCINE MAX*) WHEN INOCULATED WITH *BEAUVARIA BASSIANA*

Tim Brovont, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and T. Weissling, Department of Plant Pathology, University of Nebraska–Lincoln, NE 68583

The effects of high populations of *Aphis glycines* cause significant plant damage and overall reduction in yield of *Glycine max*. The fungus *Beauvaria bassiana* (Botanigard) is a biocontrol and was used in this study to control aphids. With the rise in threat of Asian Rust, the spraying of fungicides has now become a critical production effort. The interaction of aphids with fungicides, a key component of the future soybean production, was tested. Two experiments were ran, pretreatment and post treatment fungicide applications. The pretreatment was sprayed with the appropriate fungicide one hour before the application of Botanigard, while the post treatment was sprayed 48 hours after the application of Botanigard. Aphid populations were counted on 0,3,7,10,14 days. An ANOVA was run across all treatments in both pre/post treated experiments. There was no effect of treatment shown in either the pre-treated ($F_{9,99} = 1.02$, $P>0.05$) or the post-treated ($F_{9,96} = 0.899$, $P>0.05$). Due to the high variability within and among the treatments it was concluded that there must have been a major factor(s) effecting the initial transfer and survival of aphids.

THE IMPACT OF COMPACTION ON AGRICULTURAL SOILS

Rebekah M. Jessen and Marian Borgmann-Ingwersen, Wayne State College, Wayne, NE 68787; and Bernie Thyen, Northeast Community College, Norfolk, NE

Compaction can greatly alter the properties and productivity of soils. This study was designed to collect information on how soil compaction has adversely affected an agricultural field near Norfolk, Nebraska. Reductions in porosity, infiltration rates, and plant biomass, along with an increase in soil bulk density can all be attributed to soil compaction. Various experiments were conducted to prove that soil compaction was present in a portion of the field.

SEROPREVALENCE OF *NEOSPORA CANINUM* IN CALVES IN A CENTRAL NEBRASKA FEEDYARD

S. Sazama, Department of Biology, Hastings College, Hastings, NE 68901

Neospora caninum is an intracellular protozoan parasite that is a major cause of infectious abortion and congenital disease in cattle worldwide. When introduced into a herd, a *N. caninum* infection can spread rapidly and be a major cause of economic loss for cattle producers. This loss can be due to production of less healthy calves, lowered milk production, actual fetal loss by reproducing cattle, and loss in post-weaning weight gain. *Neospora's* main mode of transmission has been determined to be vertical, from cow to calf, and has been recognized through successive generations in dairy herds. Less research has been conducted on its effect in beef herds. Published seroprevalence rates for *N. caninum* vary significantly. The purpose of this study is to establish a seroprevalence rate for a central Nebraska beef herd using a commercially available ELISA test, and compare the rate found to that of already published rates.

A STUDY OF THE GENETIC MATING SYSTEM AND GENETIC DIVERSITY OF BLACK TERNS (*CHLIDONIAS NIGER*) NESTING IN SOUTHERN WISCONSIN

Erin Kucera and Patricia Szczys, Department of Life Sciences, Wayne State College, Wayne, NE 68787

This project is a study of the genetic mating system and genetic diversity of Black Terns (*Chlidonias niger*) nesting in Southern Wisconsin. I tested and optimized five previously published microsatellite markers for this species. Conservative estimates of alleles per locus obtained from agarose gels ranged from two to four. Five families of Black Terns were assayed with five individuals per family. Using PCR and electrophoresis, I genotyped individuals using an automated DNA sequencer to analyze DNA fragments. I measured genetic diversity and assessed paternity. The data gathered will be useful in learning more about the mating habits of Black Terns and will contribute to the testing of the Hidden Lek Hypothesis of colony formation. This data will also allow me to determine the level of inbreeding in this colony, which is essential for the wise management of this species. This research was funded in part by a grant from the Nebraska EPSCoR program and by the Nebraska IN-BRE Grant Number: P20RR16469-05.

DNA FINGERPRINTING OF BLACK-TAILED PRAIRIE DOGS (*CYNOMYS LUDOVICIANUS*) AT THE ALDRICH PRAIRIE RESEARCH SITE

Daphne Baber and Kate Marley, Doane College, Crete, NE 68333

Doane College's Aldrich Prairie Research Site (APRS) is the home to Nebraska's Eastern-most black-tailed prairie dog (*Cynomys ludovicianus*) town. There are three distinct regions within the town and we are interested in examining the relatedness of dogs within and between these three regions. We have been able to extract DNA from stool samples collected at the site and localized with a global positioning system (GPS) that interfaces with geographical information systems (GIS) software. Stool sample collecting is a significant improvement over previous methods which required trapping the dogs and taking a blood sample via toenail clipping. The limiting aspect of that method was trapping the animals and often a semester of work would only yield a few samples. We can acquire significant quantities of genomic DNA from only a small sample of fecal material which is readily available. We have used PCR to amplify microsatellite DNA regions that create unique fingerprints for each sample. By analyzing the fingerprints and coordinating that with the GIS information we hope to develop a detailed understanding of the genetic diversity of the metapopulation at the APRS. Finally this data may enable us to determine if these three regions represent three distinct colonies or three subpopulations within one colony.

DNA STUDIES OF EXTRA-PAIR COPULATIONS AND INCEST AVOIDANCE IN ZEBRA FINCH (*POEPHILA GUTTATA*) POPULATION

Andrew Kreikemeier and Cheryl Bailey, Department of Chemistry, and Jennifer Sexton and Josef Kren, Department of Biology, Midland Lutheran College, Fremont, NE 68015

Most birds are socially monogamous, but various studies have shown that extra-pair copulations (EPCs) occur frequently despite a range of paternity guards, including mate-guarding and frequent copulation. There are few quantitative estimates of the success of EPCs in fertilizing eggs. We are investigating 1: the likelihood of success of extra-pair copulations and 2: incest avoidance in a monogamous passerine, the zebra finch Poephila guttata. Adult zebra finches with various degrees of genetic relatedness are housed in aviaries with nesting boxes. Paternity of nestlings, using DNA analyses obtained from bird feathers, is investigated. To ascertain our DNA abstraction and analysis procedures, we began with blood and feathers collected from captive Northern Bobwhites (*Colinus virginianus*). To this point, we have isolated DNA and are now determining their sex by PCR (polymerase chain reaction).

FUNCTIONAL EFFECTS OF OXIDATION OF SERCA2a BY REACTIVE CARBONYL SPECIES DURING DIABETES

Haley Capek, Nebraska Wesleyan University, Lincoln, Ne 68504; and Lynn Roy, Chun Hong Shao, and Keshore R. Bidasee, Department Of Pharmacology And Experimental Neuroscience, University Of Nebraska Medical Center, Omaha, NE 68198

Diabetic heart failure is characterized by a loss of contractility. One possible mechanism for this is the loss of function of SERCA2a, the intracellular calcium cycling protein responsible for relaxation of the heart muscle between contractions. To date, the mechanism underlying SERCA2a dysfunction during diabetes is not fully understood. We previously showed that SERCA2a becomes carbonylated at select basic residues (R164, K476, K481, R636) during diabetes. The purpose of this study is to determine whether these modifications are functionally significant or merely an epiphenomenona of this disease. Wild type human SERCA2a was mutated singly and in combination to mimic the increase in bulk and change in charge induced by carbonylation. Wild type and mutant proteins were expressed in HEK 293T

cells and membrane vesicles were prepared and utilized in Western blot analysis and $^{45}Ca^{2+}$ uptake assays to determine protein expression and function. Analysis of various single, double and triple mutant combinations indicated a reduced ability of SERCA2a to transport Ca^{2+} with minimum change in protein expression. These data suggest that the bulkiness and/or charge inversion induced by carbonyl adducts reduce the ability of SERCA2a to transport Ca^{2+} and this may be a mechanism contributing to a loss of cardiac contractility in diabetic heart failure. This work was supported by The National Institutes of Health INBRE program grant #P20 RR016469-05.

INVESTIGATION OF INTEIN ENCODING REGIONS IN *PARAMECIUM BURSARIA* CHLORELLA VIRUSES

Angela Fenton, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and James Van Etten, Nebraska Center For Virology and Department of Plant Pathology, University of Nebraska–Lincoln, NE 68583

Inteins are extra peptide elements found within specific proteins. These elements activate their own excision from their host protein as well as ligate the polypeptide flanks of their host protein resulting in two proteins; the host protein and the intein. There is an inclination for intein encoding regions to be located in conserved sections of essential genes that play roles in DNA metabolism. Their locations make them difficult to remove without compromising their host gene. Intein encoding regions are found in the DNA of bacteria, archaea, chloroplasts, and single-celled eukaryotes. More recently, inteins were found in certain viruses. Two intein encoding regions were identified in a strain of the NC64A chlorella (green algae) viruses. The *Paramecium bursaria* chlorella virus (PVCV) strain NY-2A has one intein encoding region in the ribonucleotide reductase gene and one intein encoding region in the helicase gene. However, recent work has shown that the chlorella virus strain PVCV-1 contains neither of these inteins. It is unclear as to why one strain of PVCV has retained the inteins, and the other has not. Work done with several other strains of NC64A chlorella viruses show lack of these inteins, but more are being tested. This work was supported by The National Institutes of Health INBRE program grant #P20 RR016469-05.

POPULATION GENETICS OF A WARBLER COMMUNITY IN EASTERN CONNECTICUT

Kristi A. Pohlman, and Patricia Szczys, Department of Life Sciences, Wayne State College, Wayne, NE 68787

This study investigated the population genetic structure of neo-tropical migratory warblers in Connecticut. I assayed the DNA of 11 individuals of the Common Yellowthroat Warbler. I tested and optimized seven previously published microsatellite primer pairs and conservatively estimated the number of alleles per locus. Data obtained from agarose gels showed a range of 3-6 alleles per locus. Further analysis includes individual genotyping of individuals on an automated DNA sequencer to obtain accurate allele frequencies, and assays of the Blue-Winged Warbler and Yellow Warbler species. This research was funded in part by a grant from the Nebraska EPSCoR program and by the Nebraska IN-BRE Grant Number: P20RR16469-05.

COLONIZATION OF AZITHROMYCIN RESISTANT *STAPHYLOCOCCUS AUREUS* UNDER FINGERNAILS OF HEALTH-CARE WORKERS IN LONG-TERM CARE FACILITIES

Erika Pearson, Doane College, Crete NE 68333

Staphylococcus aureus is a pathogen that often creates infection control problems in hospitals and long-term care facilities. As *S. aureus* is known to be resistant to several commonly used antibiotics, the severity of this problem is growing. In this experiment, swabs were collected from underneath the fingernails of employees in five different long-term care facilities. All employees tested were defined as having direct contact with long-term care residents on a daily basis. The swabs were cultured on a media which differentiates for *S. aureus*. The cultures that were positive for the organism were then plated again using a lawn technique, and tested for resistance to the antibiotic azithromycin (one of the most frequently used antibiotics today). The results of this experiment showed that many of the employees had *S. aureus* colonized underneath their fingernails and some of these colonies did exhibit resistance to azithromycin. These results clearly demonstrate that *S. aureus* is still a very virulent pathogen, and steps to improve infection control in healthcare facilities are necessary.

WATER PURIFICATION IN RURAL DOMINICAN COMMUNITIES

Jenny Grose, Briggs Strelow, and Gary Michels, Chemistry Department, Creighton University, Omaha, NE 68178

The Institute of Latin American Concern, Creighton University's mission in the Dominican Republic, is dedicated to improving the health and quality of life for impoverished rural Dominicans. Since an adequate supply of potable water is an important aspect of good health, the ILAC center began distributing affordable, simple, family-based water purification systems (i.e. bucket filters) in 1997. In 2003, the filters were redesigned to use a ceramic (Doulton®) filter element. Subsequently, a chemistry group was formed through Creighton University to test the performance of these filters. In a 3-week program during the spring of 2005, water from filters was tested for coliform and *E.coli* bacteria. Additionally water taken from the sources used by the villagers was tested to prioritize areas for future distribution of the filters. Microbial analysis of water sources (i.e. total coliforms) showed that shallow wells, the poorest source of water, contains twice as many bacterial counts as rivers. Total coliform counts from rivers are six times higher than those from aqueduct samples. Aqueducts test twice as high as rain water samples which contain nine times the counts from bucket filters. Two campos, Cascajal and Baraquito, and two Haitian bateys, Libertad and Dos, were identified as priority areas for filter distribution.

OCCURRENCE OF AMOXICILLIN-RESISTANT STRAINS OF *STAPHYLOCOCCUS AUREUS* IN DOANE STUDENTS CURRENTLY TAKING AMOXICILLIN

Kamleh Shaban, and B.J. Clement, Department of Biology, Doane College, Crete, NE 68333

Staphylococcus aureus is a gram-positive bacterium responsible for many human diseases such as skin infections, toxic shock syndrome, osteoarthritis, respiratory tract infections, and vascular graft infections. Some people are asymptomatic carriers of *S. aureus*, though they are at greater risk for becoming ill. Many strains of *S. aureus* have developed resistance to commonly used antibiotics and other broad-spectrum drugs such as amoxicillin. This experiment was designed to determine if students at Doane College in Crete, Nebraska currently taking amoxicillin have a higher incidence of amoxicillin-resistant *S. aureus* than students who are not on any antibiotic treatment. Students were swabbed and the swabs were transferred to mannitol salt agar (MSA) plates in the lab to select for *S. aureus*. Colonies from MSA plates that were positively identified as *S. aureus* were used to make bacterial lawns with

amoxicillin E-Strips to determine *S. aureus* isolates' resistance to amoxicillin. Students on amoxicillin were swabbed twice to compare the levels of resistance during and after treatment. Initial data indicate that there is no increased risk of amoxicillin-resistant strains of *S. aureus* among students on amoxicillin.

CLONING OF ORF-1 FROM DH5 PBLUE BAC HIS 2B PLASMID INTO THE PCMV TAG 4 VECTOR FOR EXPRESSION IN 2A CELLS

Ross Hansen, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and Clinton Jones, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln, NE 68583

The ORF-1 site of pBlue Bac His 2B Plasmid is thought to combine with ORF-2 and express for specific proteins that affect regulation of the latency reactivation cycle of Bovine Herpes Virus (BHV-1). BHV-1 establishes a lifelong latent infection in the sensory ganglionic neurons of its host. Latency can be activated by several factors involving both physiological and environmental stimuli. The purpose of the experiment was to isolate the ORF-1 fragment to test for expression of specific proteins. The plasmid containing ORF-1 (pBlue Bac His 2B) insert was transformed on ampicillin resistant LB agarose plates. The vector (pCMV Tag 4) was transformed on kanamycin resistant LB agarose plates. The DNA was digested using Sal I and Pst I restriction enzymes. The ligation produced seven clones. The clones were grown on 2A cells and transfected. The fragments were run on a western blot, however they did not display any unique protein expression. This suggests that ORF-1 expression has no effect on the latency reactivation cycle. By controlling the latency BHV-1 we could control the negative symptoms of herpes virus.

TUMOR NECROSIS FACTOR ALPHA (TNFα) ACTIVATES p70S6K VIA MULTIPLE MITOGEN-ACTIVATED PROTEIN KINASE CASCADES

Jacob D. Gibbens, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and Olson Center for Women's Health, University of Nebraska Medical Center, Omaha, NE 68198-3255

The corpus luteum is a transient endocrine gland primarily responsible for progesterone synthesis for the preparation and maintenance of early pregnancy. Tumor necrosis factor alpha (TNFα) is an inflammatory cytokine which has a number of different effects in the body. Produced primarily by macrophages and T-lymphocytes it plays a role in the immune response. It has been suggested that TNFα plays a role in the development and regression of the corpus luteum. TNFα disrupts homeostasis in multiple cell types including steroidogenic luteal cells. The mammalian target of rapamycin (mTOR) is known to function in regulation of protein translation. Mammalian target of rapamycin and its downstream effector p70S6K is the pathway that has been suggested to indirectly disrupt processes in the cell responsible for homeostasis of luteal cells. The idea is that it plays a role in the cells response to TNFα. This study focused on the specific mitogen-activated protein kinase (MAPK) cascades (ERK, p38, JNK) required for the activation of mTOR/p70S6K signaling in response to TNFα. Enriched, primary bovine luteal cells were treated in vitro with TNFα in the presence or absence of specific MAPK inhibitors used as a model for the experiments. Cells were lysed and proteins analyzed by western-blot. Results from these experiments suggest that ERK, p38, and JNK MAPK cascades all play a role in the activation of p70S6K. The data suggests that MAPK cascades are involved upstream of mTOR/p70 signaling and are involved in the regulation of mTOR/p70 activation and protein synthesis in response to TNFα. Implications of TNFα stimulation of mTOR/p70S6K signaling suggests TNFα may stimulate protein synthesis as a means of promoting inflammation and/or destruction of neuroendocrine tissue. This information further expands our understanding of TNFα and could present possible medical implications.

CHARACTERIZATION OF BOVINE HERPES VIRUS-1 STRAINS FROM ABORTED CALVES

Aspen Bricker, Doane College, Crete, NE 68333; and Gail Henderson, Vicki Geiser, and Clinton Jones, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln, NE 68583

Bovine Herpes Virus 1 (BHV-1) is a significant viral pathogen of cattle which can induce respiratory disease, abortion, or occasionally encephalitis. It is a member of the alpha herpesvirinae subfamily and shares a number of biological properties with herpes simplex virus. Like all the members of this subfamily, BHV-1 establishes a latent infection in sensory ganglionic neurons of an infected host. At any time, stress or some other environmental factor can reactivate the virus to cause recurrent rounds of the disease. BHV-1 infections cause a half billion dollars in losses in the U.S. per year. In 2005, many abortions in South-Central America were attributed to BHV (BHV-5 strain). This stimulated concern that BHV-5 was moving to the U.S. from Mexico. To test this, six strains of BHV were isolated from aborted calves, three from Texas and three from Nebraska. These samples were compared to the wild type BHV-1 Cooper strain, to BHV-5, and to two vaccine strains. First viral proteins were compared by a western blot, and then by genomic DNA isolation and restriction digestion. After analysis, we concluded that BHV-5 DNA was not found in any of our clinical samples. DNA digests did suggest, however, that vaccine strains were present in all of the clinical samples. The next step will be to determine where the problem lies with the vaccines. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

MICROARRAY ANALYSIS OF LOW AND HIGH VIRULENT *LISTERIA MONOCYTOGENS* EXPOSED TO HUMAN KIDNEY CELLS.

Eric Miller, Doug Christensen, and Shawn Pearcy, Department of Life Sciences, Wayne State College, Wayne NE 68787

Listeria monocytogenes is a food borne pathogen that typically results in one death for every three people who contract it. Humans often become ill after contracting serotype 4b while serotype 1/2a is rarely pathogenic. The purpose of this research is to study the difference in the virulence of the two strains by looking at gene regulation. Each serotype was exposed to actively growing human kidney 293 cells or kidney cell media (control groups) for set incubation periods. After incubation, the *Listeria* cells were harvested and the total RNA was isolated, amplified and modified for use in a microarray format. Microarray data were statistically analyzed for genes regulated up or down two fold. These results are to be compared with those of identical research exposing these two serotypes of *Listeria* to cervical cells. This data may help us to understand the variations in gene regulation employed by *Listeria* as a response to individual human cell types. This research was funded by the Nebraska IN-BRE Grant Number: #P20RR16469-05.

THE EFFECT OF HYDROCORTISONE ON ANGIOGENESIS

Ann M. Goding, Department of Biology, Hastings College, Hastings, NE 68901

Although there are several known inhibitors and stimulators of angiogenesis, the exact choreography of this multi-step process remains unknown. The interaction and implications of increased hydrocortisone concentration during this process is also unknown. Therefore, questioning this interaction along with the relationship between angiogenesis and tumor proliferation, this study aimed to examine the effects of different hydrocortisone concentrations on angiogenesis. The hypothesis of this study was that

increased concentrations of hydrocortisone would lead to a greater degree of angiogenesis. A co-culture of human umbilical vein endothelial cells was used to analyze the process of angiogenesis. Three levels of hydrocortisone were applied to the cells to determine the extent of angiogenesis: a mid-range physiologic level, an upper range physiologic level, and an elevated level. The increased levels of hydrocortisone did not inhibit or stimulate angiogenesis to a greater degree than the mid-range physiologic level.

THE OPTIMIZATION OF REAL-TIME PCR PROTOCOLS TO DETECT PHAKOPSORA PACHYRHIZI, SOYBEAN RUST AND *FUSARIUM SOLANI*, SUDDEN DEATH SYNDROME IN SOYBEANS.

Dru Dethlefs, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

Real-time PCR protocols were developed for the detection of *Phakopsora pachyrhizi* and *Fusarium solani f. sp. glycines*. The real-time PCR protocols were developed for quickness in detecting the desired pathogen. To optimize the real-time PCR protocols, negative samples were compared with spiked positive samples from spores from soybean rust and sudden death syndrome. The optimization process involves sample preparation, DNA purification and PCR detection. The sample preparation involved a variety of grinding the soybean tissue. There were five different DNA purification kits used to purify the sample DNA. The real-time PCR protocols were optimized first according to concentration of the spores on the spiked samples. The detection was desired to cross the threshold at 30 to 35 cycles. The threshold cycle reflects the cycle number at which the fluorescence generated within a reaction crosses the threshold. The real-time PCR protocols then were optimized according to the amount of time that was needed in each step, such as how quickly the sample could be detected as close to 30 to 35 cycles. Protocols for the detection of soybean rust and sudden death syndrome were successfully optimized for their sensitivity and speed it took to run the protocol. The optimization of fast detecting protocols will enable researchers to track the spread of the pathogen and the early detection of the pathogen into new regions where it has not yet been found. Early detection of the pathogens will help individual and commercial farming to plan strategies for dealing with the pathogens.

A STUDY OF THE GENETIC MATING SYSTEM AND GENETIC DIVERSTITY OF COMMON TERN (*STERNA HIRUNDO*) NESTING IN MASSACHUSETTS

Kelli Roland, Patricia Szczys, and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne, NE 68787

DNA obtained from the blood of two families of Common Terns (*Sterna hirundo*) nesting at Bird Island, MA (one family consisting of four individuals and the other consisting of five) was analyzed for gender identification purposes utilizing PCR technology. Additionally, fragment analysis was utilized to assess micro-satellite variations in individual birds as a means of monitoring paternity in each of the families tested. This information was also used for quantifying genetic diversity in a threatened population. This research was supported in part by the Nebraska IN-BRE Grant Number: P20RR16469-05.

EFFECT OF ALTERED MEMBRANE PERMEABILITY ON THE QUORUM SENSING RESPONSE OF *PSEUDOMONAS AERUGINOSA*

J. Hutter, A. Stokes, and B. Clement, Doane College, Crete, NE, 68333; and J. Eudy, University of Nebraska Medical Center, Omaha, NE 68198; and J. Gessel, University of Nebraska–Lincoln, Lincoln, NE 68588

Pseudomonas aeruginosa is a gram negative opportunistic pathogen that utilizes a homoserine lactone-based quorum sensing (QS) for regulation of virulence gene expression. Homoserine lactone molecules are lipid soluble and diffuse readily across cellular membranes and at high cell density reenter the cell, modifying gene expression including the expression of virulence factors. *P. aeruginosa* is well known for its intrinsic resistance to multiple antibiotics and a variety of toxic molecules. A typical cell response to a stressful environment is to modify the membrane lipids, reducing the permeability of the membrane and excluding the toxic moiety. The growth characteristics and modification of membrane lipid composition of *P. aeruginosa* in response to stress induced by the presence of antibiotics in the growth medium was assessed by monitoring growth characteristics and by analysis of membrane lipid composition using GC-MS. To determine whether alteration of membrane lipids could interfere with the outcome of QS, *P. aeruginosa* (PAO-JP2), a mutant deficient in inducer molecules of the QS systems las and rhl, was grown in tryptic soy broth (TSB) amended with 100μg/ml cepthalothin. At log phase an extract of QS molecules from PAO1 was added to one of the cultures, the total RNA extracted from both, and the gene expression compared using microarray analysis with Affymetrix *Pseudomonas aeruginosa* chips. Identical membrane lipid modifications were observed in PAO-1 and PAO-JP2 grown under antibiotic stress. The effect of added QS molecules on gene expression in PAO-JP2 was assessed from the microarray data. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

COLLEGIATE ACADEMY

BIOLOGY

SESSION B

THE GUANINE RIBOSWITCH'S CONTROL OF METABOLIC FUNCTIONS BEFORE AND AFTER SITE SPECIFIC MUTAGENESIS

Carolyn Green, J. Jansen, G. Soukup, and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha, NE 68178

The interaction of proteins with nucleic acids represents the most understood mechanism of modulating gene expression. Such proteins adopt various and complex structures, sometimes by binding allosteric modulators, in order to communicate the metabolic state of the cell to genetic machinery. Certain naturally-occurring RNA structures, termed riboswitches, also directly affect gene expression through interactions with affecter molecules and subsequent conformational changes. These metabolite sensitive switches are highly structured regions of RNA found in non-coding regions of certain prokaryotic and eukaryotic mRNAs. Since riboswitches are essential for maintaining a normal level of cellular metabolism, they are targets for new antibiotic development. The success of such endeavors is dependent on a thorough understanding of the structural characteristics of riboswitches in the presence and absence of metabolite. A recently published crystal structure of the aptamer domain of the guanine riboswitch has revealed the importance of certain loop-loop interactions to ligand binding. We have performed mutation-mutation compensation experiments to study the intricacies of the loop-loop contacts. Mutant riboswitches have been constructed and their ability to bind ligand assayed. Two

mutants demonstrated increased ability to bind ligand. These have been inserted into the chromosome of *B. subtilus* to test their ability to regulate expression of a reporter gene *in vivo*. These mutants are intriguing because they are not found in nature as determined by the phylogeny described thus far, and their effects cannot be explained based on what is known about the tertiary structure of the riboswitch. Future studies aim at determining the importance of the loop-loop contacts to riboswitch structure and function. 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 the NIH.

DETECTION OF GENES INVOLVED IN *LISTERIA MONOCYTOGENES* INFECTIONS

Michael T. Jacobsen, Doug Christensen, and Shawn Pearcy, Department of Life Sciences, Wayne State College, Wayne, NE 68787

In this research, a *Listeria monocytogenes* cDNA library was produced. Using this library, microarray expression analysis studies of *L. monocytogenes* pathogenicity were conducted. These studies involved infection of two human cell culture lines, THP1 and HeLa by two different serotypes of *L.* monocytogenes: 4b and 1/2a. Serotype 4b is a more pathogenic strain that is frequently found in cases of *listeriosis*. Following infection, total RNA was isolated at either four or 16 hours post-infection and prepared for microarray analysis. For the results, a ± 2-fold gene expression threshold was set for gene detection. To date, 15 genes of interest have been identified. Interestingly, each gene of interest that was upregulated in one serotype was similarly down regulated in the other serotype. Future studies will involve confirmation of results by RT-PCR, Northern blot analysis, and related expression analysis tools. This research was funded by the Nebraska IN-BRE Grant Number: #P20RR16469-05.

THE EFFECT OF NITRIC OXIDE ON PROTEASOME ACTIVITY

Ashley Franzluebbers, College of Saint Mary, Omaha, NE 68106

Insulin degrading enzyme (IDE) is known to have a role in the development of insulin resistance. Recent studies suggest that overproduction of nitric oxide could be a contributing factor to the development of insulin resistance directly connecting with the release of nitric oxide due to a constant low-grade inflammatory state as seen in Type 2 Diabetes. With this previous knowledge, it was hypothesized that IDE is regulated by nitric oxide production during a chronic inflammatory state contribution to the observed insulin resistance in Type 2 Diabetes. To determine if nitric oxide inhibition has an effect on the IDE-proteasome complex, the fluorogenic peptide substrate FLF(methoxysuccinyl-phe-lue-phe-7-amino-4-trifluoromethyl coumarin) was used along with two other fluorogenic peptide substrates LLVY(Succinyl-Leu Leu-Val-Tyr-7-amino-4-methylcoumarin) and LSTR(Bod-Leu-Ser-Thr-Arg-7-amino-4-methylcoumarin). FLF was used to test the ohymotrypsin-like activity in living cells, LLVY was used to test the chymotrypsin-like activity of the proteasome, and LSTR was used to test the trypsin-like activity of the proteasome. The overall data found from this research paralleled very well with previous research showing what affects IDE also has an effect on proteasome activity.

EVALUATION OF THE N-*MYC* PROTOONCOGENE AS A CANDIDATE FOR THE *EPT1* MODIFIER OF ESTROGEN ACTION

Megan Campbell, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and James Shull, University of Nebraska Medical Center, Omaha, NE 68198

The importance and effects of estrogen action cannot be underestimated. Estrogen increases specific mRNA production, specific protein synthesis, and cell proliferation. It has been observed that estrogen administered to rats is an inducer of pituitary growth in two specific strains of rats, the Copenhagen (COP) and the ACI. The ACI rat strain is more sensitive to estrogen induced pituitary growth then the COP rat strain. The rat genome has been sequenced, and a locus called *Ept1* (Estrogen-induced pituitary tumor) has been mapped to rat chromosome number six. Within the *Ept1* locus, a protooncogene called N-*myc* resides. N-*myc* functions as a transcription factor and regulates cell proliferation, cell differentiation, and apoptosis. N-*myc* belongs to a family called the *Myc* proteins, which are directly linked to many different cancers such as prostate cancer and breast cancer. The expression level of N-*myc* is regulated by estrogen. The long term goal of this research is to identify genes that account for the rat strain differences in estrogen induced pituitary growth. If we are able to understand the strain differences in responses, we can understand how estrogen regulates cell proliferation and survival. The hypothesis was that the N-*myc* protooncogene which resides within the *Ept1* locus impacts estrogen induced pituitary growth between rat strains. The goal of this study was to sequence N-*myc* in order to identify any functionally significant polymorphisms. In this study no functionally significant polymorphisms were found within the coding sequence of N-*myc*. This study did find a polymorphism between the GenBank reference data and my data for the ACI and COP rat strains. The conclusion drawn from this study was, if N-*myc* has a functionally significant polymorphism it resides outside the coding region. Future work should include the sequencing of the 5' and 3' UTR and promoter regions. This work was supported by The National Institutes of Health INBRE program grant #P20 RR016469-05.

DEVELOPMENT OF *IN VITRO* MODELS FOR BOVINE LEUKEMIA INFECTION: OPTIMIZATION OF SYNCYTIA-FORMING TCID50 ASSAY AND PCR OF BLV *POL*

Erin M. Hughes and J. A. Isaacson, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

Bovine Leukemia Virus (BLV) is a lymphotropic retrovirus that mainly infects cattle. BLV belongs to a small subfamily of exogenous retroviruses including the human retroviruses HTLV-I and HTLV-II, which cause adult T-cell leukemia/lymphoma and the simian virus, STLV-I. Because HTLV and BLV are closely related, research on the pathogenesis of BLV *in vitro* is a more cost efficient, more convenient, and safer method of studying this subfamily of retroviruses. The goal of the study described here is to develop specific methods of analyzing BLV *in vitro* by using a $TCID_{50}$ assay and PCR of BLV pol 1 and pol 2. Three different cell lines were used to determine viral titers: FLK-BLV, a lamb-kidney adherent cell line persistently infected by BLV; BL-3, a bovine lymphosarcoma suspension cell line; and CC81, an adherent cat cell line. Results of the study show that BLV does induce syncytia-formation when infecting CC81 cells; but the low production of the virus does not allow determination of optimal $TCID_{50}$ titers. The optimum variables pertinent to the $TCID_{50}$ assay are: 1,000-2,000 cells per well, adding the virus the same day as the CC81 cells, and allowing the assay to incubate for 21 days before staining. PCR of BLV pol has been optimized to detect infection in the positive control FLK-BLV cells, but we have yet to determine the point at which BLV can be detected in the bovine B lymphocytes post-infection. This work was supported by NIH grant number P20 RR016469.

A COMBINED THREE-ANTIGEN IMMUNOFLUORESENCE ASSAY FOR DETECTION OF KAPOSI'S SARCOMA-ASSOCIATED HERPES VIRUS (KSHV) INFECTION IN ZAMBIAN MOTHER-INFANT PAIRS

Ashlee S. Muller, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and C. Wood, Nebraska Center for Virology, University of Nebraska–Lincoln, NE 68588

Human Herpes Virus-8 is a gamma herpes virus and the causative agent for Kaposi's sarcoma (KS) and other disorders such as multicentric Castleman's disease, and primary effusion lymphomas. K8.1, ORF 65 and ORF 73 are three of the most immunogenic proteins encoded by HHV-8 and are currently being used in immunofluoresence assays (IFA) to detect the presence of KSHV antibodies in patient serum in research labs located in Lusaka, Zambia and Lincoln, Nebraska. This current approach requires multiple tests for each sample, which exhausts the limited supply of serum and takes time to complete. The goal of this study was to develop a technique for combining the existing separate KSHV screening assays into one involving all three recombinant proteins. The main objective was to make screening for KSHV a more efficient process without compromising the level of sensitivity or specificity present in the existing testing procedure. To conduct this experiment, HHV-8 genes were transferred via vector into recombinant baculoviruses, which upon infection express KSHV protein. Three independent baculovirus infections were made in suspension with Sf9 (*Spodoptera frugiperda*) cells, kept at 27°C for 72 hours, then harvested using three different methods. In each method, a positive serum sample from a patient with Kaposi's sarcoma (JL) was used in the IFA. Approximately 80% of the cells expressed K8.1 in each fixing method. The "Mix and Fix" method was determined the most efficient and provided the greatest accuracy in combining cells to express the different proteins at the same density. This method was used to prepare the slides for the combined recombinant protein IFAs. Phase one of the IFA screened with monoclonal antibodies for ORF73 and ORF K8.1, and patient sera specific to ORF 65. Phase two accounted for the wide range of antibody present in human sera by screening a panel of samples with known IFA results. Preliminary results revealed that weak and strong signals can be picked up, but further testing on known KSHV positive patients needs to be conducted. For quantitative reaffirmation of the IFA results, cells were prepared in suspension for analysis on the Flow Cytometer. Preliminary results have yielded an excess of autofluoresence, no solid conclusions can be drawn. This work was supported by The National Institutes of Health INIBRE program grant #P20 RR016469-05.

EFFECT OF HYDROGEN PEROXIDE EXPOSURE ON GENE EXPRESSION IN *PARAMECIUM BURSARIA CHLORELLA* VIRUS-1 (PBCV-1)

Cristina Schroder, Garry Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and James Van Etten, Department of Plant Pathology, University of Nebraska–Lincoln, NE 68583

Paramecium bursaria chlorella virus-1 is a large double-stranded DNA virus of the family Phycodnaviridae that infects unicellular *Chlorella NC64A* green algae. The virus genome contains approximately 373 open reading frames, in which approximately half of the genes' functions are unknown. Previous data (Zhang, unpublished) suggest that PBCV-1 may exhibit a change in gene expression when exposed to hydrogen peroxide. This is unusual because viruses are generally unable to respond to their cellular environment. As a result, cDNA microarray analyses were employed to determine the gene expression profiles of all PBCV-1 genes treated with hydrogen peroxide against those not treated with hydrogen peroxide over a time course of 30, 90, and 120 minutes post-infection. Our results indicate that levels of gene expression were significantly up-regulated or down-regulated in 219 PBCV-1 genes treated with hydrogen peroxide compared to no treatment. The results indicate that further research is needed to identify patterns in gene expression of PBCV-1. This work was supported by The National Institutes of Health INBRE program grant #P20 RR 16469.

COMPARISON OF THE EFFECTS OF TRICYCLIC ANTIDEPRESSANTS ON ALPHA-2 AGONIST-INDUCED HYPOTHERMIA IN ADULT AND JUVENILE RATS

Scott Madden, Doane College, Crete, NE 68333; and David Bylund and Jean Dupree, Department of Pharmacology, University of Nebraska Medical Center, Omaha, NE 68198

Depression occurs when there are low levels of norepinephrine in the brain causing an up-regulation of adrenergic receptors. Tricyclic antidepressants bind to the presynaptic norepinephrine transporter preventing reuptake of norepinephrine. This causes an increased level of norepinephrine in the brain resulting in the down-regulation of alpha-2 adrenergic receptors. In this study, we explored the possibility that desipramine, a tricyclic antidepressant, would down-regulate alpha-2 receptors in adult but not in juvenile rats. In our first experiment, we measured the function of alpha-2 receptors by binding an alpha-2 agonist, brimonidine, to produce hypothermia in the rats. To be certain that brimonidine was binding to alpha-2 receptors, we blocked its hypothermic effect with an alpha-2 antagonist, RX821002. Lastly, we determined the effects of chronic desipramine treatment on brimonidine-induced hypothermia. After injecting the rats with varying doses of brimonidine, we were able to determine an optimum dose for both adult and juveniles. We used this optimum dose in our other experiments with RX821002 and desipramine. In our experiments with RX821002, we showed that increasing doses of the drug blocked the hypothermic effect of brimonidine, indicating that brimonidine activates alpha-2 receptors to induce hypothermia. In our experiments with desipramine, we showed that there was a greater drop in temperature in desipramine treated adult rats versus saline treated rats; however, the opposite effect was seen in juveniles. Thus, the effect of chronic desipramine treatment on alpha-2 receptors is that in adults there is an up-regulation of receptors, while in juveniles there is a down-regulation. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

ACTIVATION OF cAMP-DEPENDENT PROTEIN KINASE (PKA), PROMOTES A_{2A}-MEDIATED MIGRATION IN BEAS-2B

Nicole A. Kolm, College of Saint Mary, Omaha, NE 68106

The respiratory epithelium is frequently injured by infection, inhaled toxins, or during inflammatory diseases such as asthma and chronic obstructive pulmonary disorder (COPD.) Migration of neighboring cells into the injury is important for the rapid repair of damaged airway epithelium. Adenosine (ADO) was previously shown to increase migration to damaged cells in BEAS-2B via occupancy of the A_{2A} receptor. We hypothesized that activation of cAMP-dependent protein kinase A (PKA) promotes A_{2A}-mediated migration in BEAS-2B, with 10^{-7} M ADO and A_{2A} receptor agonist 5'-(N-Cyclopropyl)-carboxamido-adenosine (CPCA;10^{-7} M) in the presence and absence of KT5720, a known PKA inhibitor. All cells were pretreated with an adenosine deaminase inhibitor erythro-9-(2-Hydroxy-3-Nonyl) adenine hydrochloride (EHNA) to prevent metabolic degradation of adenosine. The cells were then placed in a modified Boyden chamber with 30 mg/ml fibronectin in the lower chambers as a chemoattractant and then incubated for five hours. In the presence of either ADO or CPCA, migration was increased, which was then blocked by activation of cAMP-dependent protein kinase, PKA, suggesting a potential role of PKA in the repair processes of inflammatory diseases, such as COPD.

REVERSAL OF MYOCARDIAL FIBROSIS IN A TRANSGENIC MOUSE MODEL OF HUMAN HYPERTROPHIC CARDIOMYOPATHY

Sharalyn M. Steenson, College of Saint Mary, Omaha, NE 68106

Hypertrophic cardiomyopathy, the most common cause of sudden cardiac death in the young, is caused by several known mutations in sarcomeric proteins. It is clinically diagnosed by unexplained cardiac hypertrophy and pathologically by myocyte hypertrophy, disarray, and interstitial fibrosis. Hypertrophy and fibrosis are the major determinants of mortality, morbidity, and sudden cardiac death in hypertrophic cardiomyopathy and in all acquired forms of cardiac diseases. Our study proposes that interstitial fibrosis, like cardiac hypertrophy, occurs secondary to the activation of trophic and mitotic factors in the heart and, thus, is potentially reversible by blocking cardiotrophic factors such as Angiotensin II. We determined the effect of blocking Angiotensin II on the interstitial fiber and collagen content of the cardiac myocytes in transgenic mice expressing mutant cardiac troponin T protein which causes hypertrophic cardiomyopathy in humans. We are also using histological sections of the treated group and a placebo group as well as a control group in the study.

HOMEOPATHIC ALTERNATIVES TO CONVENTIONAL ANTIBIOTICS

Jessica Ott, Hastings College, Hastings, NE 68901

As the number of drug-resistant strains of microorganisms increases across the world, scientists are in search of new ways to treat resistant infections. Essential oils have been used for centuries in homeopathic medicine and many claim to have antibacterial and antiviral properties. Homeopathic substances were first tested using the disc diffusion method to determine activity against selected bacterial and fungal species. Microorganisms used for the study were *Escherichia coli, Staphylococcus aureus, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, Candida kefyr, Rhodotorula rubra* and *Saccharomyces cerevisiae*. Substances with the most consistent action against microorganisms were tested further using a broth microdilution method to determine a minimum inhibitory concentration for each substance. *Rhodotorula rubra* was eliminated from the broth microdilution assay due to the difficulty in culturing the microorganism and its low incidence of infection. The substances tested were garlic, honey, tea tree oil, oregano oil, thyme oil, olive leaf extract, wintergreen oil, and lemon oil with the most effective being tea tree oil, oregano oil, thyme oil, wintergreen oil and lemon oil. Oregano oil was determined to have the greatest antimicrobial activity with a mean MIC of 0.56 (%v/v) followed by Thyme Oil with a mean MIC of 2.47 (%v/v).

PARASITES OF *BISON BISON* IN EASTERN NEBRASKA: A COMPARISON OF PARASITE CONTROL STRATEGIES

Heather Young and Glenn Kietzmann, Department of Life Sciences, Wayne State College, Wayne, NE 68787

American buffalo (*Bison bison*) from five herds in eastern Nebraska were examined for internal parasites during the summer of 2005 for the purpose of determining the effectiveness of three different parasite control strategies. The parasite control strategies observed in this study were treatment of animals with chemically based anthelmintics (Pour on Ivomec® and Panacur®), the treatment of animals with diatomaceous earth and animals that received no treatment. Fecal samples were collected four times between May and October from six animals of each herd. Samples were then processed using the Sheather's sugar flotation method for detection of helminth ova. Data based on the number of helminth ova/ 5g feces was collected for each herd and it was analyzed statistically with analysis of variance

(ANOVA). ANOVA indicated differences between bison herds that were managed differently and between the parasite control methods utilized. The data suggests that treatment of bison herds with anthelmintics is the most effective parasite control strategy of the three strategies examined, followed by the use of diatomaceous earth in the diet. Not treating bison herds with anthelmintics or diatomaceous earth was the poorest parasite control strategy observed.

BIOFILMS: ATTACHMENT TO SURFACES

Megan Lohmiller, Katie Hofer, Amanda Kuhr, Angela Wheeler, and Cheryl Bailey, Department of Chemistry, Midland Lutheran College, Fremont, NE 68025

Free swimming (planktonic) bacteria can become pathogenic by forming biofilms. Biofilms are organized microbial communities that are directly attached to a surface. Free swimming bacteria respond to signals and secrete an extracellular polymeric matrix that allows the bacteria to attach to a surface and form a mature structure consisting of many cell layers. Biofilm formation in catheters and other medical surfaces is a concern of the medical community. We are interested in understanding the relationship between the presence of serum and bacterial attachment to surfaces and the affect of tannins, fatty acids and resveratrol on the ability of *Pseudomonas aeruginosa* to attach to surfaces and form biofilms.

INHIBITION OF HSP90 ENHANCES RADIOSENSITIVITY OF HUMAN CANCER CELL LINES

Thuy Tran, College of Saint Mary, Omaha, NE 68106

Multiple pro-survival signaling pathways in tumor cells contribute to resistance to radiation therapy. The maturation and stability of many proteins central to oncogenesis are dependent on the functional heat shock protein, HSP90. Inhibition of HSP90 may improve the outcome of radiation therapy by interfering with the multiple pro-survival signal transduction pathways. We examined the optimal conditions for combination of radiation with the newly developed HSP90 inhibitor, 17-(dimethylaminoethylamino)-17-demethoxygeldanamycin (17-DMAG) to increase the radiosensitivity of tumor cells in vitro. In Clonogenic survival assay, H460 cells (Non-small lung cancer) were seeded into 6-well tissue culture plates. Cells were treated with or without 17-DMAG (100nM) and irradiated either at 10 minutes, 8 hours, or 16 hours after the administration. All media containing 17-DMAG was removed after 16 hours. Twelve to fourteen days after seeding, colonies containing at least 50 cells were counted and the surviving fractions were calculated. Clonogenic survival assays showed that 17-DMAG was most effective in increasing cell radiosensitivity with 16 hour pretreatment. The survival of cells pretreated with 17-DMAG for 16 hours decreased from 0.7 to 0.02, from 0.16 to 0.003, and from 0.004 to 0.00008 at the radiation doses of 2 Gy, 4 Gy, and 6 Gy, respectively. Examination the expression of HSP90 client proteins by Western Blotting indicated that treatment with 17-DMAG and/or radiation decreased the expression of Akt and survivin, increased expression of HSP70 and activation of P53 as compared with untreated controls and cells treated with radiation only. Our observations suggest that the exposure of 17-DMAG increases the radiosensitivity of tumor cells and provide the molecular basis of this effect through examination of HSP90 client proteins.

A STUDY OF THE HABITAT ASSOCIATION OF BIRDS IN THE PINE RIDGE REGION OF NEBRASKA AS PREDICTED BY THE HABCAP MODEL

Angela M. Meiergerd, Physical and Life Sciences Department, Chadron State College, Chadron, NE 69337; and C. Butterfield, Department of Applied Sciences, Chadron State College, Chadron, NE 69337

The ponderosa pine woodlands of the Pine Ridge Escarpment support isolated and unique populations of both flora and fauna. Unfortunately several factors have led to a decline in the overall habitat. Management practices have begun to be employed attempting to return the area to its historically natural state. In particular the ponderosa pine woodlands of the Pine Ridge provide habitat for an impressive array of cavity nesting birds which are found in this unique habitat in the northwest corner of Nebraska. Silvicultural practices affect the distributions and abundance of the birds by changing the structure and composition of the vegetation. Thus there is a need to monitor change in forest structure and other habitat changes as a result of theses activities, and to evaluate the effects of these changes on wildlife and other natural resources. The development of a geospatial database of natural resources and the validation of the habitat capability model (HABCAP) will allow researchers and managers to asses and evaluate the effects of various silvicultural practices. It will also establish a database of information for researchers and managers to utilize in the future so that sound management decisions can be made.

COLLEGIATE ACADEMY

BIOLOGY

SESSION C

TICKS COLLECTED IN NORTHEAST NEBRASKA IN SUMMER 2005: A COMPARISON OF FLAGGING AND DRY ICE TRAPPING TECHNIQUES

Melissa Slaymaker and Glenn Kietzmann, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Ticks were collected by flagging and dry ice trapping between May 5 and August 16, 2005 for the purpose of determining the best collection method for ticks in shelterbelts in Nebraska. A total of 149 ticks in 227 samples were collected in Wayne and Holt Counties in northeastern Nebraska. *Dermacentor variabilis* was the only tick species collected in this study, although other tick species are probably present in Nebraska shelterbelts. Results of this study tend to indicate that dry ice trapping is better than flagging when collecting D. variabilis. Data were compared with a student's t-test, and it seemed to support the hypothesis that dry ice trapping was more effective than flagging for *D. variabilis*.

REPRODUCTION RATE OF BEETLES AT VARIED TEMPERATURE AND FOOD SUBSTRATES

Lydia Zaragosa, College of Saint Mary, Omaha, NE, 68106

Tribolium confusum, a confused flour beetle, is commonly found in stored grains. Some of these products consist of cereal, dog food, flour, and cornmeal. *Tribolium* are a significant agricultural pest. The purpose of the study was to determine the reproduction rate of the beetles at four different temperatures (27°C, 30°C, 33°C, and 36°C) and with four different food substrates. Three different replicates of white flour, wheat flour, white-wheat flour mixture with yeast, and cornmeal were used. The reproductive data was then collected and the number of larvae and pupae were measured for four weeks. In all of the food substrates there were a large amount of larvae produced. There was a

significant difference between the amount of pupae produced in the white-wheat flour mixture with yeast and cornmeal. The white-wheat flour mixture with yeast produced the most pupae and cornmeal produced very little. Overall, the white-wheat flour mixture with yeast provided a better substrate for beetle reproduction where cornmeal did not.

THE POTENTIAL RELATIONSHIP OF KINASE SUPRESSOR OF RAS AND THE GLUCOSE PATHWAY

Deann C. Settles, Doug Christensen, and Shawn Pearcy, Wayne State College, Wayne, NE 68787; and Robert Lewis, University of Nebraska Medical Center, Omaha, NE 68198

Kinase Suppressor of Ras (KSR) is a molecular scaffold protein and positive effector of the Raf/MEK/ERK kinase cascade of the Ras pathway. The Raf/MEK/ERK pathway signals the cell to survive, undergo apoptosis, differentiate, or proliferate. KSR has been shown to directly regulate intensity and duration of ERK activation, which regulates the proliferative potential of a cell. Oncogenic potential of Ras is also regulated by KSR. What isn't known about KSR is how it affects glucose uptake. When cells are put under stress, such as glucose starvation, many triggers are activated. LKB1 is a master kinase that activates AMPK kinase family. AMPK kinases are activated when there is an increase in AMP: ATP ratio. One of these AMPK kinases is CTAK-1. CTAK-1 is bound to KSR, possibly indicating a direct relationship to the glucose pathway and KSR activation. We hypothesize that when there is a glucose starvation more KSR will be expressed to counteract the lack of glucose, showing that KSR has a role in glucose uptake. Starving KSR 1.1 and clones of KSR1.1 (Mouse Embryonic Fibroblasts) for glucose over varied amounts of time will help determine the relationship of KSR and the glucose pathway. A correlation between glucose starvation and KSR production was seen in MEF's. This research was funded by the Nebraska IN-BRE Grant Number: #P20RR16469-05.

THE TOMATO IMIDAZOLEGLYCEROLPHOSPHATE DEHYDRATASE GENE INHIBITS HUMAN CASPASE-3 AND CONFERS STRESS PROTECTION IN PLANTS

Phillip Lorhan, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and S. Chen and M. B. Dickman, Department of Plant Pathology, University of Nebraska–Lincoln, NE 68583

A recent question in plant biology is whether or not plants have similar mediated cell death pathways leading to programmed cell death (PCD) as those found in mammals. Programmed cell death is important in normal development as well as defense against pathogenic exposure in both plants and animals. Although PCD in animals has been characterized it is still unclear what drives this process in plants. Recently it was found that the Imidazoleglycerolphosphate Dehydratase (IGPD) gene from the tomato plant has inhibitory qualities in the caspase pathway of animal apoptosis. We use deletion analysis in yeast to determine where the inhibitory functional properties are found as well as show that tobacco plants have a caspase-like pathway mediating PCD using IGPD transgenic plants in a human caspase-3 assay.

DEVELOPING TOOLS TO UNCOVER FBR6-ANNAT1 INTERACTIONS: IDENTIFYING ANNAT1 MUTANT KNOCKOUTS AND DETERMINING ANNAT1 SUBCELLULAR LOCATION

Andrew Heckman, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and Julie Stone, Department of Biochemistry and Plant Science Initiative, University of Nebraska–Lincoln, NE 68588

Annexins are Ca^{2+}-dependent membrane binding proteins found in both plant and animal cells. Using a yeast two-hybrid system showed that ANNAT1 interacts with FBR6/AtSPL14. ANNAT 1 is found in the plant's stem and leafs, however the cellular location of ANNAT1 is unknown. It has been unclear as to what proteins interact with ANNAT1. Based on the behavior of other annexins, we hypothesize that the redox sensitivity of SPL14 might be influenced with its interactions with ANNAT1 and that ANNAT1 might translocate to the nucleus under stress. The GFP-ANNAT1 was used to examine subcellular localization of ANNAT1 and it appears to be cytoplasmic. A FLAG-ANNAT1 fusion protein was also created for pull-down assays. Preliminary results with transient transformation of this construct indicate that a FLAG-tagged ANNAT1 can be detected by Western blot analysis. Both constructs will be used to generate stable transgenic plants to determine whether ANNAT1 and FBR6 interact in *planta*.

A SMALL MAMMAL STUDY OF SEVEN HABITATS AROUND WAYNE COUNTY NEBRASKA

Sarah Tasich, Kara Paronish, and M. Borgmann-Ingwersen, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Small mammals play an integral role in an ecosystem. We examined relative abundance as well as richness, and diversity among small mammals in seven different habitats around Wayne Country Nebraska. The habitats included a switch grass field, a brome grass field, an old soybean field, a tree line, a ditch, an area around old farm property, and a grove. In 825 trap nights between May and October 2005, 120 mammals were caught. In the seven habitats nine different species of small mammals were caught. In order of relative abundance these included, *Peromyscus leucopus. Peromyscus maniculatus, Spermopilus tridecemlineatus, Reithrodontomys montanas, Sorex cinereus, Blarina brevicauda, Zapus hudsonius, Microtus ochrogaster*, and *Reithrodontomys megalotis*. Shannon-Diversity indices indicated that the old soybean field, brome field, and the switch grass field were the most diverse habitats.

CHARACTERIZATION OF FLUORESCENT PSEUDOMONAS SPECIES POSSESSING THE ANTIBIOTIC GENES 2,4-DIACETYLPHLOROGLUCINOL (Phl) AND PHENAZINE-1-CARBOXYLIC ACID (PCA)

Andy C. Rorie, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and Deanna Funnell and Brian Tlamka, United States Department of Agriculture, Agricultural Research Service, Wheat, Sorghum and Forage United, Lincoln, NE 68583

The naturally occurring antibiotics 2,4-diacetylphloroglucinol (Phl) and phenazine-1-carboxylic acid (PCA) produced by *Pseudomonas* spp. have proven to be a major component of disease resistant soil, specifically located in the rhizosphere. These soil pathogen suppressors, along with others such as hydrogen cyanide (HCN), can significantly increase crop yield, suppress root rot, reduce phytopathogenic bacteria, plant-parasitic nematodes and soil borne fungi. The purpose of the study was to compare *Pseudomonas* spp. populations at two differing locations and among varying cultivars. Two sorghum

cultivars, RTx 433 and B Redland, were grown at geographically distinct locations in Mead and Havelock, Nebraska. Each month (May-July) soil and root samples were harvested from both field plots and grown on selective media to determine the relative size of *Pseudomonas* spp. populations. The isolates were then transferred to a skim milk media to screen for an extracellular protease secreted by the bacteria. Once the desired bacteria were selected, DNA isolation and amplification followed as primers for Phl and PCA derived from *Psuedomonas fluorescens* were amplified by polymerase chain reaction (PCR). The major results suggested that the fluorescent *Psuedomonas* averaged much larger population sizes at the Mead location and in the roots of the B Redland cultivar at both locations. There was a small amount of contradiction to these generalized results; however, overall the bacterial population sizes decreased each month. The analysis suggests that it is beneficial to focus on environmentally specific species and strains of these bacteria to determine which *Pseudomonas* are ideal in varying climates and soil compositions, and which crop rotation technique will produce the optimal scenario for disease-suppressive soils.

CONSTRUCTION OF A TRANSPOSON MUTAGENESIS LIBRARY FOR THE IDENTIFICATION OF *MYCOBACTERIUM MARINUM* VIRULENCE GENES USING SIGNATURE TAG MUTAGENESIS

Benjamin J. Thayer, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and J.D. Cirillo and S.L. Cirillo, Department of Veterinary & Biomedical Sciences, University of Nebraska–Lincoln, NE 68583

Tuberculosis is currently becoming an increasing problem with immuno-compromised patients (such as those with AIDS), especially those in third world countries lacking proper medical care. *Mycobacterium marinum* is a slow growing bacterium that causes tuberculosis-like infection in fish and amphibians, but is not as severe of an infection in humans. Infection process studies of *M. marinum* are very useful because *M. marinum* is ~95% genetically identical to *M. tuberculosis* and it provides a safer but powerful model for similar studies on *M. tuberculosis*. For the experiment, titers of mycobacteriophages were run to determine initial concentrations. Using high titer lysate procedures the phages were amplified to obtain concentrations that would successfully infect *M. marinum* colonies. The phages specifically labeled with DNA infect *M. marinum* colonies creating mutant clones that will be used in the development of a transposon mutagenesis library. *M. marinum* libraries will be pooled and used to infect hosts organisms. After extraction of the bacteria, hybridization of replica colony blots with transformed phage-specific DNA will be ran in order to identify *M. marinum* genes that play a role in the infection process of host organisms. This procedure referred to as signature tagged mutagenesis will eventually provide a basis for similar studies on *M. tuberculosis* pathogenesis that has great implications for human immunology.

SYNTHESIS OF A PYRIMIDINE DNTP ANALOG AND ANALYSIS OF ITS INCORPORATION INTO DNA PRIMER-TEMPLATES BY POLYMERASE ALPHA

Greg Timblin, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and R. Kuchta, K. Kincaid, and N. Low-Nam, Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO 80309

DNA polymerase alpha, a B family polymerase, is one of the two major polymerase enzymes involved in human DNA replication. The mechanism by which pol alpha selects for and incorporates correct dNTPs into nascent DNA strands during replication has yet to be determined. Current research with purine dNTP analogs suggests that N-3 plays an important role in purine dNTP fidelity. When in the pol alpha active site, the atom(s) at the 2-position of pyrimidine bases are roughly in the same position as

N-3 of a purine. The purpose of this study was to investigate the importance of the 2-position in pyrimidine fidelity by synthesizing a pyrimidine dNTP analog with an electon-rich carboxyl group at the 2-position and analyzing its incorporation into DNA prime-templates y pol alpha. Synhesis of the analog began by glycosylating 2-pyridone with a toluoyl-protected chlorosugar. The nucleoside was subsequently deprotected, phosphorylated, and purified. Polymerization assays were ran to determine the rate of incorporation of the dNTP analog into radiolabeled DNA primer-templates. Pol alpha incorporated the analog into three of the DNA primer-templates (G, T, and C) at rates similar to those for incorrect natural dNTPs. The rate of incorporation of the analog into DNA-A primer-templates occurred at a rate 10-100 times greater than that of incorrect natural dNTPs.

UBC9 IS ESSENTIAL TO RETROVIRUS REPLICATION

Gentry Lewis Rundle, Tariq Jaber, Chris Bohl, and R.A. Weldon, Jr., Nebraska Center for Virology, University of Nebraska–Lincoln, NE 68588

Retroviral Gag proteins play essential roles during multiple stages of the viral life cycle. They help facilitate nuclear transport of the preintegration complex during the early stages of the viral life cycle. In addition, they drive assembly of the viral capsid, package the viral RNAs within the capsid and incorporate the viral glycoproteins into the nascent virion. It is also clear that Gag proteins must associate with cellular proteins to carry out these functions. We have identified the cellular E2 Sumo conjugating protein, Ubc9, as an interacting partner with the Gag proteins of multiple retroviruses. To gain further insight into the role Ubc9 plays during retrovirus replication, RNA Interference is used to down regulate the expression of Ubc9 in retrovirus-infected cells. We have found that retrovirus replication is greatly reduced in the absence of Ubc9. We are currently evaluating where this block in the retrovirus life cycle occurs when Ubc9 expression is interrupted.

PREDICTION OF T-CELL AND B-CELL EPITOPES FOR SURVIVIN AND HUMAN MUC1

Branden D. Nemecek, University of Nebraska–Lincoln, NE

The research goal was to predict portions of the proteins Survivin and Human MUC1 that have the highest probability of becoming T-Cell and B-Cell epitopes which could be used in cancer vaccinations. The prediction process was first done for possible T-Cell epitopes. To find the leading candidates for possible recognition, I looked at proteasomal cleavage, tapasine complex binding, and ability to bind to the major histocompatibility complex (MHC). Proteasomal cleavage was predicted by an algorithm available on the internet. From these fragments, I focused on nonomers with either no predicted cleavage sites or one possible cleavage site. These nonomers were then scored by a series of algorithms (Peters et al. 2003). The final scoring was for the ability to bind to different types of human MHC. The main focus of this scoring was an average of thirteen different types and a focus on HLA-A2, which is the most common type of human MHC. All of these predictions were examined and a ranking of epitope strength was developed. For B-Cell prediction, the goal was to find portions of the proteins that were hydrophilic and had turns that would be exposed to be recognized by B-Cells. Hydropathy charts were used to find the hydrophilic regions for exposure purposes. The crystal structure from the protein data bank was used to identify turns in the proteins that would be exposed for recognition by B-Cells. Some possible portions or the proteins are suggested to be used in vaccinations due to their exposure and availability to be recognized. The predictions that were made are currently being used initial testing.

KERATINOCYTE MIGRATION AND ADHESION ARE REGULATED BY ERBB2

Kelsey L. Tinkum, J.G. Madson, and L.A. Hansen, Biomedical Science, Creighton University, Omaha, NE 68178

Skin cancer is an important human health concern, with more than one million cases of non-melanoma skin cancer in the United States each year. We have demonstrated that erbB2 activation increases skin cancer development in mice. In addition, microarray analysis using mouse skin revealed that erbB2 regulates many genes important in cell migration and adhesion, processes critical to tumor progression. For example, inhibition of erbB2 up-regulates the expression of thrombospondin 1, an inhibitor of cell migration. From these data, we hypothesized that erbB2 is required for normal adhesion and migration of cutaneous keratinocytes. This hypothesis was tested by abrogating erbB2 activity using erbB2-targeted siRNA or the erbB2 inhibitor AG825 in keratinocytes in culture. Keratinocyte attachment to tissue culture-treated dishes; or to dishes coated with collagen IV, laminin or fibronectin was reduced by 18-35% upon inhibition of erbB2 when compared to vehicle-treated controls. Similar results were obtained using erbB2-targeted and negative control siRNA with tissue culture-treated and collagen IV-coated dishes. Keratinocyte migration was measure using a scratch assay in keratinocytes pretreated with mitomycin C, an inhibitor of cell division. Migration was decreased by 98% and 85% upon inhibition or siRNA knockdown of erbB2, respectively, when compared to the appropriate controls. These results demonstrate that erbB2 is important in keratinocyte adhesion and migration, suggesting that erbB2 may be involved in skin tumor progression. Current experiments are designed to determine whether the mechanism by which erbB2 regulates migration involves its modulation of Thbs1 expression.

DNASE HYPERSENSITIVITY SITE MAPPING OF THE HUMAN N-CADHERIN GENE PROMOTER AND FIRST INTRON

Will Packard, Aspen Bricker, and Kate Marley, Doane College, Crete, NE 68333

Cadherins are glycoproteins that mediate calcium dependent cell-cell adhesion and assist in maintaining regular phenotypes of epithelial tissue. N-cadherin, which promotes the extension of nervous tissues through the body, is the primary focus of the research. Many highly invasive breast cancer tumor cell lines are found to be positive for N-cadherin expression. Thus far, little research is available on what drives the expression of N-cadherin. To identify regions of the promoter and first intron that may be important for regulation of expression we are mapping DNase hypersensitivity sites within that region. Nuclei were extracted from HeLa cells which do express N-cadherin and A431 cells which do not. The nuclei were treated with DNase I and DNA was extracted, digested, separated by electrophoresis and transferred to membrane by Southern blot. The probe was cloned by PCR from a Bacterial Artificial Chromosome spanning this region of the human genome and indicates the location of DNase hypersensitivity sites from 2 kb 5' to 2kb 3'of the translation start. This data will be essential in identifying regions to study further for DNA binding protein interactions that regulate N-cadherin expression. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

HIV-I SUBTYPE C ENVELOPE GLYCOPROTEIN EVOLUTION

Anita Stokes, Doane College, Crete, NE 68333; and Marzena Rola, Federico Hoffman, and John West, The Nebraska Center for Virology, University of Nebraska–Lincoln, NE 68588

HIV has spread to every corner of the globe and AIDS is responsible for millions of deaths every year. Since HIV is a retrovirus, genetic evolution occurs rapidly, especially in the Envelope portion of the genome. Envelope codes for the surface glycoprotein that allows HIV infection of CD4+ T cells to occur. Because Envelope glycoprotein is the primary determinant of viral transmission in disease pathogenesis, the goal of this project is to associate changes that occur longitudinally in Zambian subtype C Envelope sequences to biological properties of the glycoprotein, including alterations in fusion and tropism, and variations in replication time and neutralization escape. In preparation to perform experiments, chimeric DNA constructs were made by inserting Zambian HIV-I subtype C patient Envelope sequence into subtype B background. Functionality was then tested by transfecting COS-1 cells and mixing them with TZM-bl target cells. Functional DNA constructs cause fusion of the COS-1 and TZM-bl cells to form syncytia. Fusion is identified by using a b-galactosidase stain that turns the syncytia blue. Functional constructs will be used to perform future experiments investigating glycoprotein evolution. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

THE EFFECT OF ALFALFA MOSAIC VIRUS ON YEILD AND SEED QUALITY IN SOYBEAN

Erin J. Von Bonn, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504; and Amy Ziems, Plant Pathology, University of Nebraska–Lincoln, NE 68583

The reported incidence of alfalfa mosaic virus (AMV) has been slowly on the rise in Nebraska in the past five years. In 2001, 53% of soybean fields in the state tested positive for AMV. In 2002, that percentage rose to 55%. Currently, the effects of AMV on soybean are unknown. The purpose of this research was to determine if AMV has any detrimental effects on seed quality and yield in soybean using a split-plot field design with six replications and ten seed varieties. Inoculations were performed at growth stages V2, R1 and R3 during the summer of 2005. Enzyme Linked Immunosorbent Assays (ELISA) were run on approximately 1200 trifoliate leaves from the plots and only one showed that AMV had spread systemically through the plant. This plant was inoculated at growth stage R1 on July 13, 2005. Possible reasons for the failure of systemic infection include problems with the inoculum preparation and storage and excessively high temperatures at and following inoculation.

COLLEGIATE ACADEMY

CHEMISTRY AND PHYSICS

METHODS OF D* RECONSTRUCTION IN PROTON-PROTON COLLISIONS USING THE STAR DETECTOR AT RHIC

Stephen C. Hansen, Department of Physics, Creighton University, Omaha, NE 68178, representing the STAR Collaboration

Charged D* meson production was studied in proton-proton collisions at a center of mass energy of 200 GeV using the Solenoidal Tracker at RHIC (STAR) at Brookhaven National Laboratory. Methods for the identification of D* mesons will be outlined. In the decay channel considered, the charged D* goes into a charged pion and a D^0 meson. The D^0 further decays into a charged pion and a charged kaon. A background study of simulation data will be discussed and its uses for improving the statistical error will be shown. The study provides baseline data for charm production in heavy ion collisions.

DFT STUDIES OF SOLVATOCHROMIC EFFECTS: THE π^* SCALE

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

The Solvatochromic Parameters, π^*, α, and β and the application of the parameters to Linear Solvation Energy Relationships (LSER) have been studied for nearly 30 years.[1,2] The π^* scale correlates solvatochromic effects on p $\rightarrow$ π^* and $\pi \rightarrow \pi^*$ electronic spectral transitions, while the α and β parameters relate LSER to solvent hydrogen bonding effects. Careful choice of non-hydrogen bonding solvents (NHB) allows the analysis of solvent effect on the π^* parameter. Employing TD-DFT theoretical methods coupled with various basis sets to form the following model chemistries: B3LYP/3-21G(*), B3LYP/6-31G(d), B3PW91/6-31G(d), PBEPBE/6-31G(d), PBEPBE/6-31+G(d) and the SCRF/PCM/ UAKS solvation model we completely optimized a representative set of molecules in a representative set of NHB solvents. The computed spectral shifts were used to calculate the π^* parameter and the resultant solvatochromic parameter compared to reported data.[1]

1. Kamlet, M. J.; Abboud, J. L.; Taft, R.W. "The Slovatochromic Comparison Method. 6. The p* Scale of Solvent Polarities" Journal of the American Chemical Society 1977, 99, 6027-6038
2. Kamlet, M. J.; Abboud, J. L.; Abraham, M. H.; Taft, R.W. "Linear Solvation Energy Relationships. 23. A Comprehensive Collection of the Slovatochromic Parameters, π^*, α, and β and Some Methods for Simplifying the Generalized Solvatochromic Equation" Journal of Organic Chemistry 1983, 48, 2877-2887

PREDICTING THE SITE OF ELECTRON TRANSFER USING DFT FRONTIER ORBITALS: STUDIES ON PORPHYRIN ATTACHED EITHER TO QUINONE OR HYDROQUINONE AND QUINHYDRONE SELF-ASSEMBLED SUPRAMOLECULAR COMPLEXES

Jared D. Jaeger, Michael D. Beck, and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787; and Amy L. McCarty, Phillip M. Smith, 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.

DFT calculations were performed on covalently linked porphyrin-quinone and porphyrin-hydroquinone dyads and quinhydrone (1:1 quinone-hydroquinone) paired self-assembled supramolecular complexes. The frontier HOMO's and LUMO's of the B3LYP/3-21G(*) and PBEPBE/6-31G(d) optimized structures in the ground state were utilized to probe the site of electron transfer (porphyrin or quinine centered redox reactions) and the results compared to the experimentally determined site of electron transfer. These studies revealed good agreement between the experimental results and computational predictions. The computed HOMO-LUMO energy gap also followed the trends of the electrochemical results. In the optimized structure of quinhydrone supramolecules, the quinine-hydroquinone entities were stacked on one another with an inter-planar distance of ~ 3.1 angstroms. The calculated O– H---O distances suggested the presence of hydrogen bonds. The favorable association energies calculated by both the B3LYP/3-21G(*) and PBEPBE/6-31G(d) model chemistries (energy difference between the sum of energies of individual entities and the energy of the quinhydrone complex) suggested quinhydrone as a viable self-assembly mechanism to form supramolecular complexes.

COORDINATION COMPLEXES IN CERAMIC GLAZES

Darissa E. Woodford and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787; and J. V. Anderson, 369 Union Rd., Boelus, NE 68820; and E. J. Simpson, P.O. Box 263, Norfolk, NE 68702

Ceramic glazes contain colorants to produce different tints and shades of color in the glazes after firing. A limited-toxicity alkaline, transparent ceramic glaze was used on ceramic samples with an added colorant to shade the glaze. Among the colorants used : hexaammine cobalt (III) sulfate, tris(ethylenediamine) cobalt (III) nitrate, and tris(acetylacetonato)chromium(III). Powdered copper metal was also added to selected glazes along with the colorant to affect changes in the color development of the glaze. Variable percentages of copper were added to a variety of colorants, including ones with chromium and cobalt, creating a wide variety of colors in the glazes both before and after firing. Temperature dependence of the glaze formation was explored as well as glaze stability.

POLYMERIZATION CHARACTERISTICS OF SELECTED OIL PAINT MEDIUMS

Kristina M. Cassell and M. L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

Throughout history, linseed oil has been used as an oil paint pigment suspension medium because of its favorable attributes. Historically, oils other than linseed oil have also been used including walnut, poppy seed, almond, and perilla as well as others. While artists have developed a qualitative sense of the maturing properties of oil media, the media have not been closely studied and characterized. A combination of spectroscopic methods and laboratory tests were performed to study and ascertain a set of comparative polymerization characteristics for walnut, linseed, and poppy seed oils.

PREDICTION OF THE OF pKa WEAK BASES FROM DFT STUDIES

Travis Maloley, Paul A. Karr, and Kirsty Kounovsky, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787; and Lou Hale, Melvin E. Zandler, and Francis D'Souza, Department of Chemistry, Wichita State University, Wichita, KS 67260-0051

The determination of the pKa of bases via experimental procedures can be very challenging. The experimental procedure involves obtaining pure samples and the proper determination of end points, which becomes more difficult for the weaker bases. A related problem is the determination of the protonation/deprotonation site for bases with multiple protonation sites. Recently, a procedure was devised in our laboratories to predict the pKa of protonated nitrogenous bases using HF methods and Cramer-Truhlar solvation schemes utilizing commercially available computational programs.1 We have extended this procedure by employing the B3LYP/3-21+G(*), B3LYP/6-31+G(d), B3PW91/6-31+G(d), PBEPBE/6-31G(d), and PBEPBE/6-31+G(d) model chemistries. The PBEPBE method was used to completely optimize a set of ten nitrogenous bases in solution via SCRF/PCM/UAKS and frequency calculations performed to ensure a minimum and provide free energies at standard conditions. The obtained free energies were then utilized to predict the pKa of the nitrogenous bases.

1. D'Souza, F; Zandler, M. E.; Deviprasad, G. R.; Kutner, W. "Acid-Base Properties of Fulleropyrrolidines: Experimental and Theoretical Investigations." Journal of Physical Chemistry A. 2000, 104, 6887-6893

RAPID ANALYTICAL METHODS FOR VEGETABLE OILS TESTING AND THEIR POTENTIAL NEW APPLICATIONS USING UV/VIS SPECTROPHOTOMETRY

Nicholas P. Stutzman, Zeb K. Martens, and Darius Agoumba, Department of Physical Sciences and Mathematics (PSCM), Wayne State College, Wayne, NE 68787

Palm, olive, soy, corn and canola oils were investigated. Crude palm oils from two western African countries and produced from two different methods were tested for their DOBI (Deterioration Of Bleachability Index) value which is used to characterize palm oil quality. The method was developed by Dr. P. A. T. Swoboda of the Palm Oil Research Institute of Malaysia, known as the Malaysian Palm Oil Board. It was found that one of them has a good DOBI while the other one does not. Another study was the investigation of the purity of several brands of olive oils (Extra Virgin Oils). In this case, inquiries were based on measuring absorbance of olive oils at several wavelengths as described in Regulations EE/2568/91 (1991) and EEC/2472/97 (1997). Results evidenced the presence of refined olive oils in the samples while there is no word from the manufacturer mentioning it. Lastly, soy, canola and corn oils were tested for their potential of being alternates to sunscreen lotions. It was found that some of the vegetable oils absorb in the UV-B region as regular sunscreens would. From the same investigation it was noticed that the efficiency of sunscreens should not be based only on their SPF values as advertised but a careful comparison of their absorption would be of great importance.
Methods of investigations, comments of our findings as well as future works will be elaborated and presented.

DEVELOPMENT PLANS FOR AN ELECTROMAGNETIC CALORIMETER CONTROL SYSTEM FOR THE ALICE EXPERIMENT

Colleen Hartsig, Department of Physics, Creighton University, Omaha, NE 68178

ALICE (A Large Ion Collider Experiment) is an experiment at the Large Hadron Collider (LHC) designed for the study of heavy-ion collisions. The aim of the experiment is to study the behavior of matter at high energy-densities. One of the component detectors is the Electromagnetic Calorimeter, designed to detect photon and electron signals. A control system has been designed to control and monitor the functionality of this detector. A requirements document has been written that details the detector specifications as well as PVSS (Prozessvisualisierungs- und Steuerungssystem), the control software through which the detector will be monitored. Preliminary software developments will be presented as well as future plans.

THE DESIGN, CONSTRUCTION, AND IMPLEMENTATION OF A RADIO TELESCOPE TO STUDY NEUTRAL HYDROGEN SPECTRAL EMISSIONS

Brian Kloppenborg, Physics Department, Hastings College, Hastings, NE 68902

Interstellar space is not an empty void. Besides the obvious objects, like planets and stars, there is also a significant amount of dust and gas. One prominent gaseous component is hydrogen. To investigate emissions from the hydrogen a radio telescope was designed and constructed and control software programmed. Utilizing this system a Doppler shift analysis of the 21-cm hydrogen emission line was done. The physical characteristics of the telescope, including: system noise, beam width, temperature spillover, aperture efficiency and positioning errors were determined. The radio telescope was then used to determine the angular velocity of our home, the Milky Way Galaxy.

ASSESSING THE RAPID SELF-CLEAVAGE KINETICS OF A METABOLITE-DEPENDENT RIBOZYME

Kevin Klawuhn, B. Hanisch, G. Soukup and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha, NE 68178

Control of gene expression usually involves protein factors. One exception, however, is the group of RNA elements termed riboswitches. Riboswitches are RNA sequence elements in the untranslated regions of messenger RNAs that have been identified to regulate gene expression by controlling transcriptional termination or translational initiation through interaction with specific metabolites. One member of the riboswitch family, the *glmS* riboswitch, binds to glucosamine-6-phosphate (GlcN6P), an amino-modified sugar. The *glmS* riboswitch is a ribozyme that catalyzes cleavage of the phosphodiester backbone of the glmS mRNA when activated by its metabolite GlcN6P. This ribozyme is found in at least 18 gram-positive bacteria. The *glmS* riboswitch undergoes self-cleavage in response to GlcN6P, which serves to down regulate the amino-sugar biosynthesis process which produces the GlcN6P ligand. The rate of self-cleavage in the presence of saturating ligand is ~1.5 min-1 with a rate enhancement of 110,000-fold over background cleavage. Therefore, the effects on gene expression of the *glmS* mRNA are dependent upon the rapid cleavage kinetics of the ribozyme.

In the cell there is a constant source of Mg^{2+}, a divalent metal ion essential to *glmS* ribozyme self-cleavage. Using polyacrylamide gel electrophoresis to analyze ribozyme reaction kinetics, in our assays we estimate that prefolding the ribozyme with Mg^{2+} and then initiating ribozyme cleavage with a saturating concentration of GlcN6P results in an additional rate enhancement of about 12-fold. To more accurately assess the kinetic affect of this divalent metal ion cofactor, and thus implicate mechanistic strategies employed by the ribozyme, it is necessary to develop a reactivity profile for Mg^{2+} dependent *glmS* ribozyme cleavage under various reaction conditions. We have performed ribozyme self-cleavage reactions at Mg^{2+} concentrations that range from 10 μM up to 100 mM. The results indicate that there is a minimal amount of Mg^{2+} (~100 μM) necessary for ribozyme activity. This data will aid in further studies that may implicate where Mg^{2+} is binding and how many Mg^{2+} ions are utilized for catalysis.

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.

ASSESSMENT OF HEATING OF LIVING CELLS DURING OPTICAL STRETCHING USING THE TEMPERATURE-DEPENDENT FLUORESCENT EMISSION SPECTRUM OF LAURDAN

Russell P. Wolfe, and M.G. Nichols, Physics Department, Creighton University, Omaha, NE 68178

Near infrared optical technology is widely used to manipulate and study living cells. Nevertheless, energy absorption by water can potentially lead to heating with significant biological consequences. To properly study the biomechanical properties of living cells by optical stretching, we have measured the increase in temperature using laurdan (6-dodecanoyl-2-dimethylaminonaphthalene). The fluorescence emission spectrum of laurdan is characterized by two bands at ~440nm and ~496. The ratio of the intensity of the two peaks is proportional to the local temperature of the molecule. Rat basophilic leukemia (RBL) and murine osteoblast-like (MC3T3-E1) cells incubated for four hours in a 5.3 μM laurdan solution displayed a linear correlation between the integrated generalized polarization

(IGP) and temperature. The IGP was calculated by integrating the photon intensities over two spectral windows, 429-451nm and 500-522nm. The experiment was first conducted on cells in a cuvette and then applied to cells trapped in an optical stretcher. We found the temperature increase to be ~15.6 °C/W for a typical stretcher configuration. Future experiments using Raman scattering will be performed to confirm these results. The consequences for non-invasive optical stretching with 1064-nm laser light will be discussed.

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 the NIH.

TRI-BLOCK BIODEGRADABLE POLYMERS FOR DRUG DELIVERY APPLICATIONS

Beth Muszynski and Stephen M. Gross, Department of Chemistry; and Somnath Singh, School of Pharmacy & Health Professions, Creighton University, Omaha, NE 68178

Our research involves the synthesis of two series of triblock copolymers consisting of poly(lactide)-b-poly(ethylene oxide)-b-poly(lactide). The two series differ in the stereopurity of the lactide segment. One copolymer is synthesized from a racemic lactide monomer. The other copolymer is synthesized from the pure l-stereoisomer of lactide. These materials are characterized by 1H NMR. We plan to compare the sol-gel properties of aqueous solutions of these materials. We are ultimately interested in determining the effect of stereopurity on drug release rates from gels comprised of these biodegradable materials.

FIRST DATA FROM THE CREIGHTON UNIVERSITY COSMIC RAY OBSERVATORY

Robert P. Thomen and Thomas S. McShane, Creighton University, Omaha, NE 68178

A Cosmic Ray Observatory Project (CROP) system has been installed consisting of four scintillation panels and associated electronics. Text files are generated that provide arrival times and durations of cosmic ray activity. Coincidences between the panel signals are recorded, as is the integrity of the records. Neural network pattern recognition techniques are used to detect regularities in the recorded events.

DETECTION OF EXOPLANETS USING THE TRANSIT METHOD

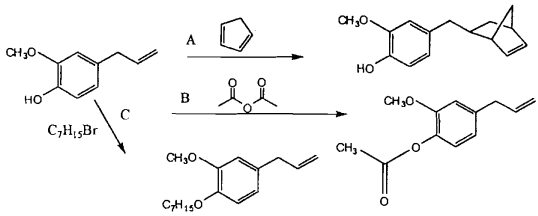
Emily Petermann, Physics Department, Hastings College, Hastings, NE 68902

The transit method is one of two ways in which exoplanets, planets that orbit around stars other than our sun, can be detected. The transit method detects an exoplanet by measuring the apparent drop in the star's brightness as a planet passes in front of it. Using a charge-coupled-device (CCD) attached to a small telescope the photometric plots from the stars 55 Cancri and TrES-1 were obtained. The plot of TrES-1 was then compared to theoretical results to confirm the transit of exoplanet TrES-1 "b." The plot of 55 Cancri was used to determine if the exoplanet 55 Cancri "e" has a detectable transit.

USING DRUG DISCOVERY AND DESIGN AS A MODEL FOR A RESEARCH BASED ORGANIC CHEMISTRY LAB CURRICULUM.

Jacob Mattson, Danielle Bradly, Jeremy Wilmes, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

Through the Nebraska EPSCoR State Colleges Undergraduate Research Experience grant program for small Nebraska colleges, sophomore chemistry undergraduates were provided with the opportunity to develop a research based organic chemistry lab curriculum at Wayne State College based upon a drug discovery and design model. Several herbs were extracted and screened for antibiotic activity and for suppression of antibiotic resistance in bacteria. Clove oil extract (primarily eugenol) was the first lead extract to be modified. The modified extracts were then compared to eugenol for antibiotic activity. Diels-Alder reactions (A), esterification (B), and Williamson ether synthesis (C) were some of the reactions used to modify eugenol, Diagram 1. Molecular modeling of the reactions was completed to aid in product identification (IR), types of products to be expected, and to help in determining which lead reactions to do. All geometry optimizations were done Using Spartan '04 at the B3LYP DFT 6-31G+(d) level of theory and IR spectra generated using DFT 6-31G* at the previously optimized geometries. Diagram 1.



IMPLEMENTATION OF A PC BASED CONTROLS SYSTEM FOR THE STAR EXPERIMENT

Matthew Brnicky, Physics Department, Creighton University, Omaha, NE 68178

The hardware controls system for the STAR (Solenoidal Tracker At RHIC) experiment is being upgraded to accommodate new detectors. The number of items monitored and controlled will increase from 25000 to 40000. While reliable, the current system uses processors designed when the first system tests were carried out in the mid-1990's. Such computing hardware is not appropriate for the new front end electronics. Specialized workstations are being replaced by new personal computers. Additionally, many aging processors housed in electronics crates will be replaced by PC's. A prototype upgrade is being tested during the Spring 2006 run. Software systems are currently being redesigned to require less operator intervention while maintaining backward compatibility. A stand-alone distribution kit has been developed to make the controls tools available to the new subsystems. Implementation and aspects of the new control hardware and software will be presented.

EXPERIMENTAL AND THEORETICAL STUDIES IN THE FORMATION OF ARENE CHROMIUM COMPLEXES

Lindsey Stockwell, Jill Reimer, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

Using a simple system of mixing an arene and $Cr(CO)_6$, solvent-free techniques were investigated to determine the effectiveness of UV radiation in the preparation of organometallic compounds and in using an ATR-IR for the analysis of these reactive substances. The simple synthesis and analysis of these interesting compounds will allow them to be apart of any traditional teaching laboratory. The mechanism for the formation of these complexes was modeled using Spartan '04 DFT computational method B3LYP/6-31+G(d) for structure optimization and B3LYP/6-31G* for IR prediction. The reaction was followed experimentally by UV/Vis and ATR-IR spectroscopy (3X diamond and germanium crystals were used) and then compared to the calculated mechanism, IRs, and literature data. Standard ATR-IRs of benzene $Cr(CO)_3$, o-toluidene, and $Cr(CO)_6$ were determined to ensure accuracy. Using a frequency correction from the standards, naphthalene $Cr(CO)_3$, pyrene $Cr(CO)_3$, and triphenylene $Cr(CO)_3$ were formed in the solid state and the experimental ATR-IRs compared to the calculated IRs.

STUDY OF EPOXY RELAXATION TIMES IN RELATION TO SIMILAR RELAXATIONS IN MOLTEN GLASS

Brandon Rodenburg and David Sidebottom, Department of Physics, Creighton University, Omaha, NE 68178

We report results of a photon correlation spectroscopy study of epoxy resins near their glass transition. Measurements track the viscoelastic structural relaxation of the resin at various temperatures in the liquid just above the glass transition as a function of the density of chemical crosslinks between polymer segments. The study was performed on samples of varying ratio of crosslinking hardener to base polymer. From our measurement we obtain important characteristic parameters of the relaxation (relaxation times, stretching exponent, non-ergodicity parameter, and fragility) for each solution. The dependence of these characteristics of the relaxation are then correlated to the relative polymerization of the epoxy.

MATHEMATICAL MODELING OF THE DUAL-BEAM OPTICAL STRETCHER

Carolyn L. Posey and M. G. Nichols, Creighton University, Physics Department, Omaha, NE 68178

The stretcher is a dual-beam optical trap that generates optical pressure to trap and stretch living cells. As light passes through the cell, the momentum transferred to the cell membrane through transmission and reflection of light causes a surface pressure. When the intensity of the light is relatively low, the cell is held in place. When the intensity is raised the pressure along the beam axis becomes greater and the cell is stretched. A geometrical optics model been developed to predict the equilibrium position, trapping force, and distribution of optical pressure on the surface of a spherical dielectric in the stretcher. This study has used the actual geometry and material properties of the stretcher chamber to predict the radial trapping force. The chamber consists of a 100 micron square glass capillary tube with a 25 micron wall thickness, which was filled with fluid to suspend objects and convey them to the stretcher. We found the peak strength of the trap to lie 3 microns radially away from the point of equilibrium when the optical fibers were separated by 110 microns. This peak force was 350 piconewtons per Watt. These predictions have been experimentally verified and suggest that the model is appropriate for biological studies.

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 the NIH.

INVESTIGATION AND OPTIMIZATION OF THE REACTION MECHANISM AND SETUP OF AN ELECTROCHEMILUMINESCENCE REACTION WITH FLUOROQUINOLONES AND TRIS(2,2'-BIPYRIDINE)RUTHENIUM(III)

Marcel Fallet and Erin M. Gross, College of Arts and Sciences, Creighton University, Omaha, NE 68178

A study was conducted on the various electrochemical properties of fluoroquinolones. Various compounds similar to enrofloxacin were studied for their electrochemical behavior. The optimization of the electrochemiluminescence (ECL) process with tris(2,2'-bipyridine)ruthenium(III) was performed inside of a controlled setup. Factors such as pH and optimum potential were measured. The mechanism of electron transfer was found to be an electron system similar to tripropyl-amine (TPrA) and was optimized at a pH of 7.4 with a maximum potential of 1.2V. Extended, stable ECL with a photomultiplier tube (PMT) was observed in a nitrogen environment.

INCORPORATION OF NAFION INTO CAPILLARY ELECTROPHORESIS WITH DETECTION BY ELECTROGENERATED CHEMILUMINESCENCE

Rohesh Fernando and Erin Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

A setup with electrogenerated chemiluminescence (ECL) as a means of detection and determination of fluoroquinolones by capillary electrophoresis (CE) is being developed. The ion-exchange polymer Nafion can be used in the interest of simplifying experimental design while maintaining efficiency. Nafion coatings of varying degrees of thickness were applied to glassy carbon and indium tin oxide electrodes. After dipping the electrodes in a solution of 0.05M ruthenium(II) tris(2,2'-bipyridine) / 2.5mM H_2SO_4, cyclic voltammetry was used to determine if the uptake of the solution of was successful. Data indicate that both a micro glassy carbon and indium tin oxide electrode were coated with Nafion and ruthenium(II) tris(2,2'-bipyridine) was successfully incorporated into the film.

REDOX IMAGING OF MULTIPLE CELL TYPES USING TWO-PHOTON MICROSCOPY OF ENDOGENOUS CELLULAR FLUOROPHORES

Nishant Chauhan, L. Tiede, S.M. Rocha-Sanchez, K.W. Beisel, and M.G. Nichols, Department of Physics and Biomedical Sciences, Creighton University, Omaha, NE 68178

Multiphoton microscopy employs a non-linear process whereby a molecule is excited by simultaneously absorbing two or more photons. Fluorescence is observed as the molecule relaxes back to the ground state. NADH and flavoproteins are fluorescent molecules that occur naturally in living cells. NADH fluoresces when reduced and flavoproteins fluoresce when oxidized. Ratios of the fluorescence of these proteins can be used to determine the energy status of living cells. We have used mitochondrial uncouplers and inhibitors to cause maximal reduction and oxidation of these fluorophores in several cell types. We have found that mitochondrial cells are 58% reduced in cultured rat basophilic leukemia cells. Results will also be presented for murine osteoblast-like MC3T3 cells. Mouse inner and outer hair cells from the Organ of Corti show different distributions of NADH and flavoproteins. Results for the oxidation and reduction of these cells will be discussed.

This work was performed at The Nebraska Center for Cell Biology (NCCB) at Creighton University (RR17417-01, NSF – EPSCOR EPS – 0346476). M.G.N & L.T. received support from NCCB. This work was also supported by The National Organization of Hearing Res. (NORH). S.M.R received support from NIH DC 4279.

NONVOLATILE TWO-TERMINAL MOLECULAR MEMORY

J. Snodgrass[1], G.P. Li[1], J. Lu[1], W.N. Mei[1,2], and R. F. Sabirianov[1,2]. [1]Department of Physics, University of Nebraska, Omaha, NE 68182-0266, and [2]Center for Materials Research and Analysis, University of Nebraska–Lincoln, NE 68588-0111

An electronic nano-device composed of one or few monolayer of polar molecules sandwiched between two asymmetric electrodes made of different semiconductors or metals is designed as a nonvolatile two-terminal memory with two resistance states. As an initial model we propose to use Gd metallofullerene as a prototype of molecule because of its reversible dipole moment. Then, we use Thomas-Fermi model to calculate the potential profile across the device and tunneling current through the proposed structure. We have solved this model exactly and show that bi-stable resistance switching occurs upon applied voltage due to the electromigration of Gd atom inside of the cage and different screening potentials in asymmetric electrodes.

POLYMER GELS FOR USE IN LITHIUM POLYMER BATTERIES

John Hamilton and Stephen M. Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

Poly(methyl methacrylate) composites containing ionic liquids were prepared. Polymerizations of methyl methacrylate in the presence of a series of ionic liquids based on the 1-ethyl-3-methylimidazolium cation were performed in various ratios of polymer to ionic liquid. The resulting homogeneous composites were either gel like or glassy depending on the ratio of ionic liquid to methyl methacrylate. Differential Scanning Calorimetry was used to measure the thermal properties. We plan on measuring the conductivity of these materials using the AC impedance technique.

MEASUREMENT OF HEATING IN THE OPTICAL STRETCHER BY RAMAN SPECTROSCOPY

Nicholas Camacho and M.G.Nichols, Department of Physics, Creighton University, Omaha, NE 68178

The optical stretcher is a dual-beam optical trap which uses 1064 nm near infrared light to trap and stretch living cells. Because the medium absorbs at this wavelength, optical heating may be problem for non-invasive studies of living cells. To measure the heating of a living cell within the optical stretcher we have developed a system, using Raman scattering, which is capable of doing this measurement with spatial resolution of approximately 1pL. Raman scattering occurs when light inelastically interacts with a molecule. The light wave can transfer energy which affects the frequency of the wave. This difference can be used to measure the heat transferred by the light wave. A 488nm Argon Ion laser is used and focused by a high NA microscope objective and scattered light is collected by the same objective and analyzed by a grating spectrograph. We have developed a confocal detection system to select light from the volume at the centre of the stretcher. By taking a ratio of two wavelengths of the Raman spectrum, the water temperature can be accurately measured. The wavelengths that are used for the ratio are 580nm and 592 nm. To date we have calibrated the measurement over a temperature ranging from 10 – 50 °C. In the future we will assess the heating under conditions used for optical stretching.

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 the NIH.

USING SOUND WAVES TO DETECT NOBLE GASES

Adam Peterson and Todd S. Young, Wayne State College, Wayne, NE 68787

In order to gain insight into the reflection, transmission, and absorption of sound waves, we investigated the possibility and applicability of ascertaining the properties of a gas inside a glass container using sound waves. A transducer, with a proper couplant, emits a sound wave through the glass and at glass/gas interface the sound wave is partially absorbed, transmitted, and reflected. Proper analysis of the reflected sound wave provides information about the properties of the gas. Temperature, pressure, and various mixtures of the gas were also investigated.

NOVEL IONIC LIQUID ELECTROLYTE MATERIALS FOR DYE-SENSITIZED SOLAR CELLS

Elizabeth S. Sterner and Stephen M. Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

Four ionic liquids of the 1-ethyl-3-methylimidazolium cation with a variety of anions have been considered as replacements for the volatile organic solvent in the electrolyte layer of dye-sensitized solar cells. UV-Vis spectroscopy and fluorimetry results will be presented, exploring the photochemical behavior of the individual ionic liquids and our dye as well as the behavior of an ionic liquid/dye mixture. A Stern-Volmer analysis will be presented to measure the efficiency of the dye in the presence of ionic liquids.

EXPLORING THE EFFICACY OF SELF-HEALING DENTAL RESINS

Chris Wirowek and Stephen M. Gross, Department of Chemistry, and Mark Latta, School of Dentistry , Creighton University, Omaha, NE 68178

The goal of this research is to improve the fracture toughness and lifetime of dental restorations. We are synthesizing an additive that could possibly be included in dental composite systems to achieve this aim. An emulsion is used to prepare the additive, which is an encapsulated monomer capable of ring opening metathesis polymerization in a polymeric shell. Results will be presented on the preparation and characterization of these micro-sized capsules that could be used as healing agents for dental resins.

CALIBRATION OF THE OPTICAL STRETCHER FOR BIOMECHANICAL STUDIES OF LIVING CELLS

Meg M. Marquardt and M. G. Nichols, Department of Physics, Creighton University, Omaha NE 68178

The optical stretcher is a novel dual-beam optical trap capable of trapping and exerting a surface force sufficient to stretch living biological cells. The elasticity of the cell can be measured by applying known stretching stress and measuring the elongation of the cell. A mathematical model has been developed to predict the stress pattern on a spherical cell, but this model must be confirmed experimentally. In this study, we have compared the predicted radial trapping force with the measured force required to pull a sphere from the stretcher. Polystyrene spheres of a known diameter and index of refection slowly flowed down a microcapillary tube and were trapped between the diverging beams of 1064-nm light delivered by two optical fibers. Using a high speed CCD camera, the position and speed of the sphere were ascertained. The fluid flow was then incrementally increased until the drag force of the fluid exceeded that of the trap, pulling the sphere from the stretcher. By measuring the terminal speed of the sphere as it escaped from the stretcher, the trapping force was determined. We found excellent agreement with the predicted forces for various separation distances of the fibers. The next phase of the experiment will be to stretch red blood cells to ascertain their elasticity. 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 the NIH.

CONSTRUCTION OF A DYNAMOMETER AND THE MEASUREMENT OF SMALL ENGINE PERFORMANCE

Dwight Easterly, Physics Department, Hastings College, Hastings, NE 68902

Engine dynamometers of many types are utilized in the automotive, industrial, and agricultural fields. From testing of consumer passenger vehicles to industrial motors and agricultural equipment, dynamometers are used to determine capabilities of engines and electric motors. A dynamometer was constructed from an AC Delco Remy DC generator and coupled to a small engine. Varying loads were placed on the engine and in turn across the generator. The engine's performance characteristics were then determined. Measured quantities included current, torque, revolutions per minute and power.

THE STUDY OF PERFORMANCE CHARACTERISTICS FOR A REMOTE CONTROL SUBMARINE

Landon Haack, Physics Department, Hastings College, Hastings, NE 68902

Remote control water craft have been used for reconnaissance missions for many years. Perhaps the most renowned use of this type of vehicle was the discovery of the Titanic in 1985. A remote control submarine was constructed and its performance characteristics determined. Measurements of ballast tank size and location, with respect to the submarine body, terminal velocity with varying prop configurations, and stability control by means of assorted rudder sizes were made.

NEUTRALINO-NUCLEON SCATTERING RATES WITH REALISTIC FORM FACTORS FROM ELECTRON SCATTERING DATA

Anne Kemper and G. Duda, Creighton University, Omaha, NE 68178

Theoretical calculations of neutralino cross sections with various nuclei are of great interest to various direct detection dark matter searches such as CDMS, EDELWEISS, and others. However, these cross sections and direct detection reates are computed with standard nuclear form factors such as Woods-Saxon or exponential models, which may not fit the nucleus in question exactly. As well known, elastic electron scattering can allow for very precise determinations of nuclear form factors and hence nuclear charge densities for spin-zero, spherical nuclei. Using electron scattering data we extract form factors and charge densities for various spin-zero nuclei important in direct dark matter searches such as Si, Ge, and S. Using DarkSUSY, a publicly available dark matter code, we re-calculate neutralino-nucleon cross sections and detection rates using the form factors extracted from the data. We will show that the "realistic" form factors can alter the cross sections and rates significantly and will compare our calculations to those computed with standard form factors.

TEACHING OF SCIENCE AND MATHEMATICS

USING DYNAMIC SYSTEMS MODELING IN HIGH SCHOOL AND COLLEGE CURRICULUM

Ashley Bruegman, Jillian Wevel, Angela Wheeler and Josef Kren, Midland Lutheran College, Fremont, NE 68025

We used Stella, a dynamic modeling system, to develop various models ranging from management of deer population to effect of antibiotics on bacterial growth. These models are used to demonstrate how complicated problems can be put into simplified graphical representation. We are presenting a model focusing on the dynamics of bacterial growth under the effect of antibiotics. Development of such models promotes critical thinking and leads students to paths of discoveries. Development of dynamic models is a process which can be used in teaching high school and college students.

A STUDY OF THE IMPACT OF INSTRUCTIONAL SETTING ON STUDENT MOTIVATION IN MATHEMATICS

Connie S. Colton, Mathematics Teacher for the Omaha Public Schools, McMillan Magnet Center, 3802 Redick Street, Omaha, NE 68112

Many of the multiple factors that affect students' motivation to learn lie outside the classroom teacher's control, but certain strategies can be implemented by the teacher that result in either positive or negative consequences on students' desire to succeed. The purpose of this study was to evaluate the

impact that variance in instructional settings would have on student motivation in mathematics. This study was conducted in response to an invitation for teachers in the Omaha Public School system to participate in the Banneker 2000: CEMS (Community of Excellence in Mathematics and Science) professional development program.

Measurements were taken in participation, attitude, and achievement to assess the impact of instructional setting on student motivation. Within each of the three areas of measurement, triangulation of data occurred through the use of teacher observations, student exit responses, and composite scores of assignments and tests. This study included both quantitative and qualitative measurements.

Interpretation of the data demonstrated a positive, though slight, impact of variance in classroom settings on student participation, attitude, and understanding. One implication of the study is that allowing students to collaborate as much as possible during the learning process will have on overall positive effect. During the course of the study small groups appeared to have the most impact, but partners also allowed students to improve in all areas. Whole group instruction combined with individual practice continues to be the least effective strategy of those measured. Further data gathered following the conclusion of the study has yielded small but significant differences between success in small groups when compared to peer tutoring in that the peer tutoring currently appears to be more effective. Future action research will focus on the impact of peer tutoring on student achievement.

DIAGRAMMATIC MODELS INTRODUCE SCIENCE VOCABULARY: STUDENTS USE DIAGRAMS TO SCAFFOLD FUTURE LEARNING

Robyn J. Carter, Third Grade Teacher, Omaha Public Schools, NE 68131

Student learning occurs in phases or stages. The building of the pre-learning phase prepares students to scaffold future information and strengthen both the interactive and reflective stages of learning. (Barton & Jones, 2001) The purpose of this study was to evaluate the effectiveness of diagrams as a method of introducing science vocabulary.

Students independently followed a teacher generated diagrammatic model within a literacy center. They differentiated and labeled models to demonstrate parts of a science concept and to become familiar with new science vocabulary. The independent student instruction allowed the teacher to effectively incorporate science vocabulary within the reading instruction schedule.

Data were collected from student models and classroom assessments after students had first completed their model independently and then again with teacher guidance within the classroom.

The research showed that use of teacher-guided diagrammatic models that allow introduction of science vocabulary during independent student work to be effective at increasing student conceptual understanding while being an efficient method of bringing science into the reading curriculum.

THE IMPACT OF COOPERATIVE LEARNING ON STUDENTS ABILITIES IN INQUIRY AND ON THEIR UNDERSTANDINGS OF SCIENCE CONCEPTS

Nina Hewitt, Walnut Hill Elementary School, 4370 Hamilton Street, Omaha, NE 68131-1023

The purpose of this study was to research cooperative learning strategies during the inquiry process and to establish effective group collaboration during science experiments and activities. Cooperative learning strategies were implemented in the researcher's classroom and research was conducted to determine the impact of these strategies on students' abilities in inquiry and understandings of science concepts.

Measurements of students' perceptions, teacher perceptions and student understandings were taken. Data were triangulated through use of student journals, the teacher-researcher's journal, and Criterion Referenced Tests (CRTs). These forms of data were collected by the teacher-researcher during lessons that incorporated cooperative grouping. Understanding of science concepts was determined using Criterion Referenced Tests and reviewing student journal entries. Positive impact on student perceptions and understandings were demonstrated.

TRAVELING THE INQUIRY CONTINUUM: LEARNING THROUGH TEACHER ACTION RESEARCH

Alyssia Martinez-Wilkinson, Seventh Grade Science, Bryan Middle School, 8210 So. 42nd Street, Omaha, NE 68147

Inquiry is a term that has been thrown around science education and encouraged to be included in the classroom with little explanation or training for the teacher or student. As a classroom teacher of around 150 students per year I experienced a growing lack of student participation and motivation in lab. Students expected to sit back passively and let science come to them. I wanted to see my students actively participate and take responsibility for their education. My growing concern for the lack of student motivation and ability to think for themselves led me to focus my research on scientific inquiry, mainly open-ended labs.

I participated in the Banneker 2000 CEMS project two years ago. According to the OPS website, "Banneker 2000 CEMS is based on an agreement with the National Science Foundation to substantially increase student achievement of challenging academic standards in mathematics and science and prepare a greater number and more diverse group of students for advanced studies in science, mathematics, engineering and technology." As a portion of the project each participant had to complete an action research project.

During my action research project I worked with inquiry and student ownership. I used the term DIY from the home improvement craze of Doing It Yourself. I slowly moved students along the inquiry continuum from preprinted labs to student generated inquiry-based experiments. The goal was for students to take ownership of what they are doing and not just fill in the blanks. Data collection was triangulated through the use of teacher observations, student work, and surveys three different times throughout the year. The content was different for each unit but the methods of data collection remained the same.

Research results indicated that the DIY lab activities did impact student motivation and autonomy. The students were able to generate and conduct an experiment to test a hypothesis. The students achieved better CRT scores than years past and I felt they truly understood the concepts better because of their feelings of ownership.

CRITICAL REFLECTION: SCHOOL CHANGE, TEACHER DEVELOPMENT AND STUDENT ACHIEVEMENT

Carol T. Mitchell, College of Education, University of Nebraska at Omaha, NE 68182; and
Susan B. Koba, Urban Systemic Program, Omaha Public Schools, NE 68131

The National Research Council (2000) called for extensive and additional research that demonstrates successful applications of research on learning and teaching to classroom practice and student learning. The purpose of this ongoing study is to evaluate the impact of a flexible but intensive teacher development program on teacher change and on student achievement in mathematics and science. This research continues previous research and provides additional data from 2005 to present. Banneker 2000: CEMS (Community of Excellence in Mathematics and Science), an Urban Systemic Program initiative in the Omaha Public Schools, implemented a professional development model that provided flexibility for teachers through choice of learning path, but maintained high standards and unified processes that focused teachers' learning in three areas: beliefs and philosophy, content, and instructional pedagogy. All teacher participants, over 18 months, were not only required to focus learning in these three areas but also to implement their learning in phases in the classroom and critically reflect on the impact of their learning on student achievement via action research.

To determine teacher change, triangulation of the qualitative data was assured through teacher observations, interviews, action research, curriculum units and videotapes of instruction, teacher portfolio reflections, pre- and post-profiles of teacher perceptions, and exit surveys. Impact of teacher learning on student achievement at the school level was determined by trend analysis of student achievement as demonstrated on Criterion Referenced Tests at each grade level in a particular school over time. To determine program impact, Cohort #3 data were compared to data from non-participants; comparisons were drawn on Average AYP Score, Average Number of Standards Mastered, and Success Rate for each teacher. Finally, pathway comparisons (CEMS-supported, Independent, Team and University paths) were studied to include mean AYP Science Scores and Average Standards Mastered.

At the time of this writing the USP initiative is complete, with a total of 58 participating schools. Qualitative data indicate that change of teacher beliefs was critical to change in philosophy and instructional pedagogy. Teacher reflections, action research and exit surveys indicate the importance of critical reflection to the change process and to improved instruction at the classroom level. Teacher reports of student success, using teacher assessments and Criterion Referenced Tests, indicate enhanced student understanding and achievement. More importantly, schools in which a critical mass (70%) of teachers was engaged in this intensive professional learning showed increased student achievement. 17 of these schools have been named Exemplary, based on consistent improvement of student understanding across grade levels as demonstrated on Criterion Referenced Tests. Banneker trained teachers showed significant mean increases in Math Standards Mastered, Math Success Rate, Average AYP Science Scores, Science Standards Mastered and Science Success Rates from the years 2002-2003 to 2004-2005. None were significantly larger than non-participants, though science participants showed slightly greater gains. Pathway comparisons show that CEMS-supported teachers outperformed Team-pathway teachers on all measures of math and science achievement.

Implications from the research include 1) the importance of the school as the unit of change in order to impact achievement and 2) the necessity of critical reflection and ongoing, embedded professional development in order to translate theory into practice, impacting teacher change and student achievement.

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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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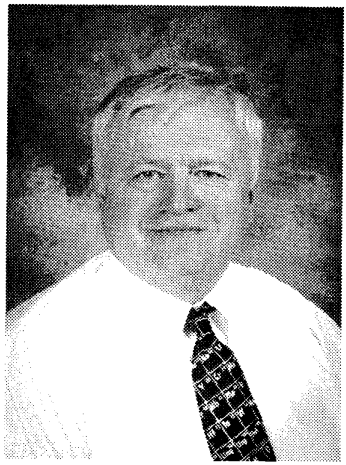
FRIEND OF SCIENCE AWARD TO EDWIN M. BROGIE



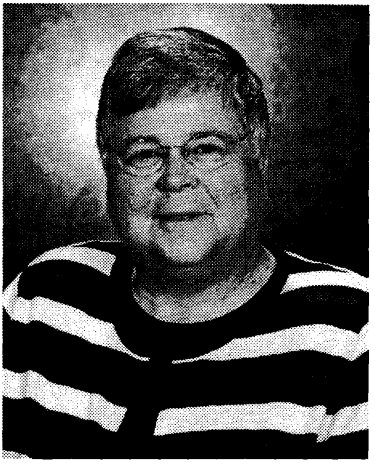
Ed M. Brogie is a resident of Wayne, Nebraska. For the past 29 years he has been the Science Chairman and high school science teacher for the Laurel-Concord Public Schools in Laurel, Nebraska. Mr. Brogie has served as an adjunct professor at Nebraska Wesleyan University, Wayne State College, and Northeast Nebraska Community College.

Born in 1952 in Norfolk, Nebraska, Ed attended grade school in Hoskins and High school in Norfolk. He received an Associates of Arts degree from Northeast Nebraska Junior College in 1972, a B.S.E. in Biology and Chemistry from Wayne State College in 1975. He received his M.S.E. in Biology and Chemistry from Wayne State College in 1990.

Mr. Brogie is the Past-President of both the Nebraska Academy of Science (NAS) and the Nebraska Association of the Teachers of Science (NATS). He is a current board member for the Nebraska Junior Academy of Science (NJAS), the American Junior Academy of Science (AJAS) and Nebraska's Building a Presence (NBaP). He is currently the Immediate-Past-President for the National Associations of the Academies of Science (NAAS).

Mr. Brogie actively promotes quality science programs that involve students doing in-depth research. He is involved in a variety of Teacher Outreach Programs on the state and National level. He is one of the instructors in the Howard Hughes Medical Institute's Science Teacher Leadership Program at Nebraska Wesleyan University and was an instructor for both the Flinn Scientific Foundation's National Chemistry Workshop as well as the Woodrow Wilson National Chemistry Workshop. A few of his professional awards include the Sigma Xi Science Teaching award, the Tandy Technology Scholars National Award, the H. Dudley Wright Prize for Innovative Science Teaching from Tufts University, two Woodrow Wilson Fellowships to Princeton, the Presidential Award for Excellence in Science Teaching, the National Association of the Academies of Sciences Distinguished Service Award, the Nebraska Association of Science Teachers Catalyst Award, and the National Association of Biology Teachers Outstanding Biology Teacher Award. Ed is married to Lee Ann and has two sons, John and Joe.

FRIEND OF SCIENCE AWARD TO JUDY WILLIAMS



Judy Williams graduated from Ogallala High School and received her B. S. and M. S. in Education degrees from Kearney State College. She was a high school science teacher in Nebraska for 36 years—three years in Shelton and 33 years in Central City—before taking early retirement in 2000. Currently she works part-time as a science education consultant.

Ms. Williams has been involved in science education activities for forty years. Judy was a member of the team of educators who developed the first draft of the "Nebraska K-12 Science Standards". She led the team of high school science educators who worked on the Nebraska Mathematics and Science Frameworks Project for three years. Judy was a lead teacher nationally for the NASA CUE-TSIPS Project and a lead teacher in Nebraska for the SEER Water Education Project and the SEER Radon Project. She has facilitated professional development workshops annually for teachers at the state and national levels. Contributions to printed curriculum materials include three biology activities published by the Nebraska State Department of Education and a bioethics activity published in Favorite Labs from Outstanding Teachers-Volume II by the National Association of Biology Teachers

For the past six years Judy has directed the Nebraska Junior Academy of Sciences and served as the president. She is a current board member for the Nebraska Association for Teachers of Science and the Nebraska Academy of Sciences and serves on the Teacher Advisors Committee for the American Junior Academy of Sciences.

Judy was selected by the National Science Teachers Association to participate in the first Access Excellence Program. Other honors she has received include the Frieda Battey Distinguished Educator Award from UNL, three Excellence in Teaching Awards from the Nebraska Department of Education, the Tandy Technology Scholars National Award, the National Association of Biology Teachers Outstanding Biology Teacher Award, and the Presidential Award for Excellence in Science Teaching. In 2003 Judy received the Catalyst Award from the Nebraska Association of Science Teachers for her contributions to science education in Nebraska.

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