PROGRAM and PROCEEDINGS

THE NEBRASKA ACADEMY OF SCIENCES

1880-2005

including the

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

125th Anniversary Year

One Hundred-Fifteenth Annual Meeting

April 22, 2005
OLIN HALL OF SCIENCE - NEBRASKA WESLEYAN UNIVERSITY
LINCOLN, NEBRASKA

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

2005 Annual NATS Fall Retreat

The 2005 Fall Retreat of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, October 27-29 (Thursday, Friday, and Saturday).

President: John Niemoth, DC West Community School, Waterloo, NE
President-Elect: Sheree Person-Panidil, ESU #3, Omaha, 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 22, 2005

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 13-15, 2005, Calamus Lodge, Burwell, NE
Fall Field Days September 9-11, 2005, South Central 4-H Center, Alma, 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://cid.unomaha.edu/~nasa/

THE NEBRASKA SPACE GRANT CONSORTIUM MADE A GENEROUS CONTRIBUTION TO THE ACADEMY TO 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 $15.00 for General Registrants and $5.00 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 30 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 22, 2005

7:30 a.m.	REGISTRATION FOR ACADEMY, Lobby of Lecture wing, Olin Hall
8:00	Aeronautics and Space Science, Session A, Olin 249
	Aeronautics and Space Science, Session B, Planetarium
	Biological and Medical Sciences, Session B, Smith Callen Conference Center
	Collegiate Academy, Biology Session A, Olin B
	Collegiate Academy, Chemistry and Physics, Olin 224
8:10	Chemistry and Physics, Session A, Chemistry, Olin A
8:30	Biological and Medical Sciences, Session A, Olin 112
	Junior Academy, Senior High REGISTRATION Olin Hall Lobby
9:00	Anthropology, Olin 111
	History and Philosophy of Science, Olin 325
	Junior Academy, Senior High Competition, Olin 124, Olin 131
11:00	MAIBEN MEMORIAL LECTURE, OLIN B
	Dr. Dennis Smith, Past-President of UNL
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 224
1:24	Collegiate Academy, Biology Session A, Olin B
	Collegiate Academy, Biology Session B, Olin 249
	Collegiate Academy, Biology Session C, Olin 325
1:30	Junior Academy, Junior High Competition, Olin 124, Olin 131
2:00	Biological and Medical Sciences, Session C, Olin 112
	NJAS Board/Teacher Meeting
3:00	Earth Science, Olin 111
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, University of Nebraska at Omaha
Olin Hall Room 249

8:00 a.m. 1. UNDERSTANDING CONSUMER PREFERENCE, THE KEY TO SUCCESS IN THE AIRLINE INDUSTRY: RESULTS FROM THE AIRLINE SURVEY. Nanette Scarpellini Metz and Brent Bowen*, Aviation Institute, University of Nebraska at Omaha.

8:15 2. SIMULATION OF TRANSIENT METHANOL DROPLET COMBUSTION. Raghavan Vasudevan* and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln.

8:30 3. INNOVATION IN SMALL COMMUNITY AIR SERVICE: AN EXAMINATION OF THE SMALL COMMUNITY AIR SERVICE DEVELOPMENT GRANT PROGRAM. Scott Tarry*, Lawrence Runana, Aric Thalman, and Jorge Montoya Victoria, Aviation Institute, University of Nebraska at Omaha.

8:45 4. NEBRASKA'S COMMUNITY AIRPORTS: A STUDY OF ORGANIZATIONAL, FINANCIAL, AND MANAGEMENT PRACTICES. Robert Blair*, Jerry Deichert, and Aleksandra Tepedelenova, School of Public Administration, University of Nebraska at Omaha.

9:00 5. APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM (GIS) IN THE ANALYSIS AND ASSESSMENT OF THE SMALL AIRCRAFT TRANSPORTATION SYSTEM (SATS) IN NEBRASKA. Massoum Moussavi* and Jaime Vargas, Department of Civil Engineering, University of Nebraska–Lincoln.

9:15 BREAK/POSTER PRESENTATIONS

9:45 6. NATIVE INSTITUTE FOR MANAGEMENT OF GEOSPATIAL EXTENSION. Jan Bingen*, Department of Computer Science, Little Priest Tribal College, Winnebago; and Hank Lehrer, Aviation Institute, University of Nebraska at Omaha.

10:00 7. EXPLORING KEPLER'S LAWS WITH SIMULATIONS. Adam N. Davis*, Christopher M. Siedell, and Kevin M. Lee, Center for Science, Mathematics & Computer Education, University of Nebraska–Lincoln.

10:15 8. REMOTE SENSING OF SELECTED BIOPHYSICAL PARAMETERS OF VEGETATION USING THE CALMIT ASIA HYPERSPECTRAL IMAGER. Nick Emanuel*, Don Rundquist, Anatoly Gitelson, and Rick Perk, School of Natural Resources, University of Nebraska–Lincoln.

10:30 9. CARTER LAKE ALGAL BLOOMS AND REFLECTANCE SPECTROSCOPY: HAS THE LAKE CHANGED STATE? Megan Machmuller*, John Gross, and John Schalles, Biology Department, Creighton University, Omaha.

10:45 10. CONTEXT-DIRECTED HIGH LEVEL INTERPRETATION OF REMOTELY SENSED URBAN IMAGES. Lin Lin*, Ashok Samal, and Sharad Seth, Department of Computer Science and Engineering, University of Nebraska–Lincoln.

11:00 11. SEDIMENTARY STRUCTURES OF MARS IN COMPARISON WITH THOSE ON EARTH. Ryan Morgan, Department of Geosciences, Chadron State College, Chadron.

11:15 12. DIFFERENCES IN THE SPATIO TEMPORAL INTERPOLATION BETWEEN PLAIN AND MOUNTAINOUS REGIONS. Jun Gao* and Peter Revesz, Department of Computer Science and Engineering, University of Nebraska–Lincoln.

11:30 13. WAVES IN THE AFRICAN EASTERLY JET IN SUMMER 2002. Jon Schrage, Department of Atmospheric Sciences, Creighton University, Omaha.

11:45 14. GENERAL AVIATION AND TRANSPORTATION SECURITY: ECONOMIC CONSEQUENCES OF REGULATORY POLICY ACTIONS AND PERCEPTIONS OF ACTION. Kimberly Senda and Brent Bowen*, Aviation Institute, University of Nebraska at Omaha.

AERONAUTICS AND SPACE SCIENCE

SESSION B

Chairperson: Mary M. Fink, University of Nebraska at Omaha
Olin Hall Planetarium

8:00 a.m. 1. APPLICATION OF COMPONENT IDENTIFICATION SYSTEMS IN TRACKING METALLIC COMPONENTS. Fasineh Samura* and E. Terence Foster, College of Engineering and Technology, University of Nebraska–Lincoln.

8:15 2. RFID TECHNOLOGY FOR TRACKING INVENTORY IN A SPACE SHUTTLE. Erick Jones* and Jayakumar Narasimhan, Department of Industrial Engineering, University of Nebraska–Lincoln

8:30 3. MODELS FOR THE USE OF SPACE IMAGERY IN TECHNOLOGY SUPPORTED LEARNING ENVIRONMENTS. Neal Grandgenett, Bill Schnase*, and Paul Clark, Department of Teacher Education, University of Nebraska at Omaha.

8:45 4. ANALYSIS OF IVA TASKS AND DEVELOPMENT OF A SOFTWARE TOOL FOR MISSION PLANNING. Shuvra Ghosh, Rajesh Shanmugam*, and Ram Bishu, Department of Industrial and Management Systems Engineering, University of Nebraska–Lincoln.

9:00 5. GRAVITATIONAL FORCES INFLUENCE THE LOCAL DYNAMIC STABILITY OF HUMAN GAIT PATTERNS. Max Kurz*, Nicholas Stergiou, HPER Biomechanics Laboratory, University of Nebraska at Omaha; and Jacob Bloomberg, Neuroscience Laboratory, NASA Johnson Space Center, Houston, TX 77058-3696.

9:15 BREAK/POSTER PRESENTATIONS

9:45 6. A COMPARISON OF PILOT PERFORMANCE USING TRUE FLIGHT TRACK VERSUS MAGNETIC HEADING NAVIGATION PARADIGMS. Mike Larson* and Parker Lucas, Aviation Institute, University of Nebraska at Omaha.

10:00 7. UTILIZING BALLOON SATELLITE DATA TO ENGAGE K-12 TEACHERS IN SCIENCE INQUIRY. Carol Mitchell*, College of Education, and Mike Larson*, Aviation Institute, University of Nebraska at Omaha.

10:15 8. THE FORMATION OF ERROR INTOLERANCE IN PUBLIC ORGANIZATIONS. Patrick O'Neil, Aviation Institute, University of Nebraska at Omaha.

10:30 9. THE ROLE OF HISTORICAL TRANSPORTATION PARTNERSHIPS IN THE DEVELOPMENT OF AMERICAN SPACE TRANSPORTATION. Patrick O'Neil*, Aviation Institute, and Carol Ebdon, School of Public Administration, University of Nebraska at Omaha.

10:45 10. A STUDY OF SIZE EFFECTS ON FERROELECTRIC SUPERLATTICES. Jiangyu Li and Quangen Du*, Department of Engineering Mechanics, University of Nebraska–Lincoln.

11:00 11. VARIATION IN EXPRESSION OF PAIN AND CLOCK GENES. Natalie Rasmussen* and Lynne Farr, College of Nursing, University of Nebraska Medical Center, Omaha; and Eufemia Jacob, Department of Hematology/Oncology, Baylor College of Medicine, Houston, TX.

11:15 12. PLANETARY EXPLORATION WITH THE CLIFF-BOT SYSTEM. Gale Paulsen, Nathan Wood*, and Shane Farritor, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE.

11:30 13. *IN VIVO* ROBOTICS. Mark Rentschler*, Department of Biomedical Engineering, University of Nebraska–Lincoln; Jason Dumpert, Stephen Platt and Shane Farritor, Department of Mechanical Engineering, University of Nebraska–Lincoln; and Dmitry Oleynikov, Department of Surgery, University of Nebraska Medical Center, Omaha.

11:45 14. PUBLIC SPACE TRAVEL: FAIR FARES OF TOMORROW. Steven Ryberg* and Brent Bowen, Aviation Institute, University of Nebraska at Omaha.

AERONAUTICS AND SPACE SCIENCE

Poster Session 9:15 - 9:45 a.m.
Olin 249

AIRBORNE REMOTE SENSING APPLICATION FOR AGRICULTURAL AND THE ENVIRONMENTAL STUDIES. Brian Bronson, Aviation Institute, University of Nebraska at Omaha.

UTILIZING GEOSPATIAL TECHNOLOGIES FOR EDUCATION AND OUTREACH ON THE WINNEBAGO AND SANTEE SIOUX INDIAN RESERVATIONS. Karisa Vlasek and Cindy Webb, Aviation Institute, University of Nebraska at Omaha.

USING HYPERSPECTRAL IMAGERY TO ADDRESS GRASSLAND CONSERVATION ISSUES IN LANDSCAPES OF THE CENTRAL MISSOURI RIVER VALLEY. Mary Ann Vinton, Biology Department, Creighton University, Omaha; and Joan Ramage, Department of Earth and Environmental Science, Lehigh University, Bethlehem, PA.

ANTHROPOLOGY AND GEOGRAPHY

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

9:00 a.m. 1. LITHIC FRAGMENTATION: EVALUATING PELCIN'S MODEL OF FLAKE SIZE AS A CORRECTION FOR POST-DEPOSITIONAL MODIFICATION. Matthew Douglass, Department of Anthropology and Geography,.University of Nebraska–Lincoln.

9:15 2. HUMAN IMPACT ON MEGAFAUNA: HISTORICAL AND CONTEMPORARY LOSS OF BIODIVERSITY. Sarah Sunderman, Department of Anthropology and Geography, University of Nebraska–Lincoln.

9:30 3. WHAT KILLED THE MEGAFAUNA? Nolan Johnson, Department of Anthropology and Geography, University of Nebraska–Lincoln.

9:45 4. HOPEWELLIAN EARTHWORKS OF SOUTHERN OHIO: WHAT THEY CAN TELL US ABOUT THE HUMAN-LANDSCAPE RELATIONSHIP. Eric Dempsey* and Elizabeth Spott, Department of Anthropology and Geography, University of Nebraska–Lincoln

10:00 5. VIEWSHED ANALYSES OF CAIRNS AT AGATE FOSSIL BEDS NATIONAL MONUMENT. Kyle Baxter, Department of Anthropology and Geography, University of Nebraska–Lincoln.

10:15 6. VARIABILITY IN THE CONTEXT AND CONTENT OF BIG HORN SHEEP DEPICTIONS IN THE ROCK ART OF THE DOLORES RIVER VALLEY. Amanda Davey, Department of Anthropology and Geography, University of Nebraska–Lincoln.

10:30 7. A THREE STATE ELECTION ANALYSIS OF ANTI-GAY MARRIAGE AMENDMENTS: MICHIGAN, OHIO, AND GEORGIA. Ryan Weichelt, Department of Anthropology and Geography, University of Nebraska–Lincoln.

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

12:00 LUNCH

1:00 p.m. 8. NAMING PRACTICE AMONG THE JU/'HOANSI SAN: MEASURING A CULTURAL PRACTICE. Christine Haney, Department of Anthropology and Geography, University of Nebraska–Lincoln.

1:15 9. NATIVE AMERICANS IN THE TWENTIETH-FIRST CENTURY: ROLES OF SCHOOLS IN MAINTAINING NATIVE CULTURES AND LANGUAGES. Nobuaki Kawakami, Graduate School of Education, Harvard University, Cambridge, MA.

1:30 10. FORAGING BEHAVIORS OF *ALLOUATTA PALLIATA*, MANTLED HOWLING MONKEYS. Jeffrey Baum, Department of Anthropology and Geography, University of Nebraska–Lincoln.

1:45 11. THEORY OF MIND IN CHIMPANZEES: PROBLEMS WITH PRESENT RESEARCH AND DIRECTIONS FOR THE FUTURE. Benjamin Purzycki, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:00 12. FEMALE AND MALE PERCEPTIONS OF ATTRACTIVENESS: WHAT IS ATTRACTIVE AND WHY? Ryan Schacht, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:15 13. POSTPARTUM DEPRESSION: AN EVOLUTIONARY PERSPECTIVE. Mark Tracy, Department of Anthropology and Geography, University of Nebraska–Lincoln.

2:45 MCGINNIS AWARD

BIOLOGICAL AND MEDICAL SCIENCES

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

SESSION A

Session Chairperson: Jim Platz, Creighton University
Olin 112

8:30 a.m. 1. RAPID IDENTIFICATION OF MEDICALLY IMPORTANT FUNGI USING ION-PAIR REVERSED-PHASE HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC ANALYSIS (IP-RP-HPLC) OF THE INTERNAL TRANSCRIBE SPACER (ITS) REGIONS. Sarfraz H. Chandio*, Department of Computer Sciences, University of Nebraska at Omaha; and Dhundy R. Bastola, Department of Pediatrics, and Steven H. Hinrichs, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha.

8:45 2. AN EXAMINATION OF THE MORPHOLOGICAL AND GENETIC DIVERSITY OF A COMMON DRAGONFLY SPECIES *(ERYTHEMIS SIMPLICICOLLUS)*. Mark A. Schlueter, Department of Biology, College of Saint Mary, Omaha.

9:00 3. BIOACOUSTICAL SIGNALS IN *RANA PRETISOA* AND *RANA LUTEIVENTRIS*: COMPARATIVE ANALYSES OF CALL COMPONENTS. James E. Platz* and Timothy White, Department of Biology, Creighton University, Omaha; and Janice Engle, US Fish and Wildlife Service, Boise, ID ; and Jay Bowerman, Sunriver Nature Center, Bend, OR.

9:15 4. BROWN-HEADED COWBIRD HOST SELECTION IN A RIPARIAN COMMUNITY. Josef Kren, Midland Lutheran College, Fremont, NE.

9:30 5. SEPARATION AMD MASS SPECTROMETRIC ANALYSIS OF THE CHEMICAL CONSTIUENTS OF THE CHINESE HERBAL TEA *SCUTELLERIA BARBATA*. Charles E. Freidline, Melinda J. McKenney*, and Brian Y. Wong, Union College, Lincoln.

9:35 BREAK

9:45 6. BUTTERFLY NECTAR USEAGE AT TWO EASTERN NEBRASKA PRAIRIES. Kelly L. Langan* and Theodore Burk, Biology Department, Creighton University, Omaha.

10:00 7. BUTTERFLY TRANSECT SURVEYS OF THREE SOUTHEASTERN NEBRASKA NATURAL AREAS. Quinton S. Kelly* and Theodore Burk, Biology Department, Creighton University, Omaha.

10:10 8. IMMUNOHISTOCHEMICAL ANALYSIS OF AMYLOID PRECURSOR PROTEIN IN THE HIPPOCAMPUS OF MICE FOLLOWING REPEATED MILK TRAUMATIC BRAIN INJURIES. J. A. Dobrowolska* and C. J. Gibson, Department of Psychology, Creighton University, Omaha.

10:20 9. MEASUREMENT OF THE RESPONSE OF OSTEOGENIC CELLS TO MECHANICAL STRESS APPLIED BY AN OPTICAL STRETCHER. Mary Adams, Department of Chemistry, Creighton University, Omaha.

10:30 10. QUORUM SENSING RESPONSE AND MEMBRANE LIPID COMPOSTION IN *PSEUDOMONAS AERUGINOSA*. Barbara J. Clement, Doane College, Crete.

10:45 SESSION CLOSED

11:00 MAIBEN MEMORIAL LECTURE, OLIN B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

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

8:00 a.m. 1. DEVELOPMENT OF AN *IN VITRO* MODEL OF BOVINE LEUKEMIA VIRUS INFECTION. Jeffrey A. Isaacson, Department of Biology, Nebraska Wesleyan University, Lincoln.

8:15 2. MICROARRAY ANALYSIS REVEALS SHARED GENOME BETWEEN *PARAMECIUM BURSARIA* CHLORELLA VIRUS-1 AND ITS ALGAL HOST. Garry Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln.

8:30 3. COMPARISON OF BOVINE VIRAL DIARRHEA VIRUS REPLICATION KINETICS *IN VITRO* USING QUANTITATIVE, REAL-TIME REVERSE-TRANSCRIPTION-POLYMERASE CHAIN REACTION. Yuko Mori*, Christina L. Topliff, and Clayton L. Kelling, Department of Veterinary Biomedical Sciences, University of Nebraska–Lincoln.

8:45 4. SERUM AMYLOID A (SAA) IN ATHEROGENESIS: AN INNOCENT BYSTANDER OR A GUILTY PERPETRATOR? Veneracion G. Cabana, Division of Science and Mathematics, Union College, Lincoln.

9:00 5. STRUCTURE AND REGULATION OF MUCIN MUC17 IN PANCREATIC CANCER. Wade M. Junker*, Nicolas Moniaux, and Surinder K. Batra, Department of Biochemistry, University of Nebraska Medical Center, Omaha.

9:15 6. MUC4 IN PANCREATIC CANCER: FROM DIAGNOSTICS TO THERAPEUTICS. Pallavi Chaturvedi*, Nicolas Moniaux, and Surinder K. Batra, Department of Biochemistry, University of Nebraska Medical Center, Omaha.

9:30 BREAK

9:40 7. DO ADAM PROTEINS ENCODED BY THE *mmd* GENE IN *DROSOPHILA MELANOGASTER* POSSESS A CATALYCALLY ACTIVE METALLOPROTEASE? Joel Rivas* and Bruce A. Chase, Department of Biology, University of Nebraska at Omaha.

9:50 8. FUNCTIONAL ANALYSIS OF NEURONALLY EXPRESSED *mind-meld* ADAM PROTEINS. Dan Reimer* and Bruce A. Chase, Department of Biology, University of Nebraska at Omaha.

10:00 9. STRUCTURAL DETERMINANTS OF VIRULENCE IN COXSACKIEVIRUS B3 RNA. Johanna M. Missak* and W. E. Tapprich, Department of Biology, University of Nebraska at Omaha.

10:10 10. A STRUCTURAL STUDY INVOLVING THE 5'UTR OF COXSACKIEVIRUS B3. Megan Nelson* and William Tapprich, Department of Biology, University of Nebraska at Omaha.

10:25 11. THE ROLE OF SUB2P AS A REGULATOR OF HETEROCHROMATIC AND rDNA SILENCING IN *SACCHAROMYCES CEREVISIAE*. Zachary W. Meyer* and Elaine Lahue, Department of Biology, University of Nebraska at Omaha.

10:35 12. REDOX REGULATION BY PEROXIREDOXINS AND GLUTATHIONE PEROXIDASES IN *SACCHAROMYCES CEREVISIAE*. Dave R. Montgomery*, Midland Lutheran College, Fremont; and Michael T. Jacobsen, Natalia Agisheva, and Vadim Gladyshev, Redox Biology Center, University of Nebraska–Lincoln.

10:45 SESSION CLOSED

11:00 MAIBEN MEMORIAL LECTURE, OLIN B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

Session Chairperson: John Schalles, Creighton University
Olin 112

2:00 1. THE EFFECT OF SALINITY IN IRRIGATION WATER ON GROWTH AND DEVELOPMENT OF DRY EDIBLE BEANS. Todd C. Shank*, H. Nagel, P. Twigg, and C. Bicak, Department of Biology, University of Nebraska at Kearney.

2:10 2. A STUDY OF THE ABILITY OF *DROSOPHILA VIRILIS* TO REMOVE *ESCHERICHIA COLI*. Michael W. Kling*, J. J. Shaffer, and W. W. Hoback, Department of Biology, University of Nebraska at Kearney.

2:20 3. AN INVESTIGATION OF CARCINOGENS IN COZAD, NEBRASKA. Maryann C. Markes*, H. Nagel, J. E. Steele, and K. A. Carlson, Department of Biology, University of Nebraska at Kearney.

2:30 4. CHARACTERIZATION OF THE ENZYMES IN THE ORAL SECRETION OF THE BURYING BEETLE, *NICROPHORUS MARGINATUS*. Wendi Middleton* and J. J. Shaffer, Department of Biology, University of Nebraska at Kearney.

2:40 5. A GLOBAL STUDY OF GENOMIC INTERRELATIONSHIPS BETWEEN *STAPHYLOCOCCUS AUREUS* ISOLATES CAUSING TOXIC-SHOCK SYNDROME. Anjeza Pashaj*, Department of Biology, University of Nebraska at Kearney; and R. Goering, Dempartment of Medical Microbiology and Immunology, Creighton University Medical Center, Omaha.

2:50 6. A FISH COMMUNITY STUDY OF THREE FARM PONDS IN NORTHEAST NEBRASKA. Brandon Viterna* and Marian Borgmann-Ingwersen, Wayne State College, Wayne.

3:00 7. OVERALL HEALTH OF FERAL CATS IN WAYNE, NEBRASKA COMPARED TO DOMESTICATED CATS. Melissa Thiele* and Marian Borgmann-Ingwersen, Wayne State College, Wayne.

3:10 BREAK

3:20 8. THE PRESENCE OF *LAPPULA FREMONTII* (TORR.) GREENE (BORANGINACEAE) IN THE GREAT PLAINS. Susan J. Rolfsmeier*, Steven B. Rolfsmeier, and Ronald R. Weeden, High Plains Herbarium, Chadron State College, Chadron.

3:35 9. THE STATUS OF *LIPARIS LOESELII* (L.) RICH. (ORCHICADEAE) IN NEBRASKA. Steven B. Rolfsmeier, High Plains Herbarium, Chadron State College, Chadron.

3:50 10. THE ANTIMICROBIAL EFFECTS OF *BIDENS ALBA* (L.) DC. VAR. *RADIATA* (SCH.BIP.) R.E. BALLARD, *BIDENS BIPINNATA* L., AND *BIDENS POLYEPIS* S.F. BLAKE (ASTERACEAE). Sarah C. Lockwood* and Ronald Weedon, High Plains Herbarium, Chadron State College, Chadron.

4:00 11. THE EFFECT OF LIGHT TREATMENTS ON CULTIVATED AMERICAN GINSENG GROWTH. Jennifer Baker, Department of Biology, University of Nebraska at Omaha.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

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

1:00 1. BIOFILMS: BIOMARKERS AND MEMBRANES. Troy Barrett*, Megan Lohmiller, Tracy Niday, and Cheryl Bailey, Department of Chemistry, Midland Lutheran College, Fremont, NE.

1:10 2. ETHANOL METABOLISM ALTERS STAT1 PHOSPHORYLATION IN RECOMBINANT HEP G2 CELLS. Andrea L. Stieren*, Midland Lutheran College, Fremont, NE; and Terrence M. Donohue, Jr. and Natalia Osna, VA Alcohol Research Center, Department of Veterans Affairs Medical Center, Omaha; and Department of Internal Medicine, University of Nebraska Medical Center, Omaha.

1:25 3. COLOCALIZATION OF CALCITONIN GENE-RELATED PEPTIDE AND CHOLECYSTOKININ IN THE ADULT MOUSE INFERIOR OLIVARY COMPLEX. Kathleen G. Tallman*, J. Daniels, C. Rupp, and A. Soterin, Department of Biology, Doane College, Crete.

1:40 4. TRANSCRIPTIONAL REGULATION OF THE HUMAN N-CADHERIN GENE. Kate Marley* and Josh Smith, Department of Biology, Doane College, Crete.

1:50 5. FUNCTIONAL MODEL OF THE *APOPTOSIS INHIBITOR-5* IN THE DEVELOPING ZEBRAFISH EMBRYO. Emily Baily* and Mathew Bateman, Department of Life Sciences, Chadron State College, Chadron.

2:00 6. MODEL OF SCHIZOPHRENIA: DYSBINDIN IN THE DEVELOPING ZEBRAFISH BRAIN. Abby Hielscher* and Mathew Bateman, Department of Life Sciences, Chadron State College, Chadron.

2:10 7. DETECTION OF IGA IN SALIVA OF HHV-8 INFECTED INDIVIDUALS. Suzanne K. Morse, Department of Life Sciences, Chadron State College, Chadron.

2:20 8. ROLE OF NITRIC OXIDE ON BARRIER PROPERTIES OF THE CAPILLARY BRAIN ENDOTHELIAL CELLS. Ethan Mann*, Department of Life Sciences, Chadron State College, Chadron; and Donald W. Miller, University of Nebraska Medical Center, Omaha.

2:30 BREAK

2:40 9. EMERGENCE OF FLUOROQUINOLONE RESISTANCE AMONG *PSEUDOMONAS AERUGINOSA*: IMPACT OF CARBAPENEM SUSCEPTIBILITY. Sean D. Whipple*, Department of Biology, University of Nebraska at Kearney; and P. D. Lister, Center for Research in Anti-Infectives, Creighton University School of Medicine, Omaha.

2:50 10. CONSTRUCTION AND CHARACTERIZATION OF A CDNA LIBRARY FROM SWITCHGRASS (*PANICUM VIRGATUM*) CALLUS TISSUE. Lindsay A. Vivian* and P. Twigg, Department of Biology, University of Nebraska at Kearney.

3:05 11. SEARCH FOR THE *DROSOPHILA MELANOGASTER* ANALOG OF HUMAN KRAB OTK18. Christa M. Sindelar* and K. A. Carlson, Department of Biology, University of Nebraska at Kearney.

3:20 12. THE EFFECTS OF VIACTIV® CALCIUM CHEWS ON CALCIUM ION CONCENTRATION IN SALIVA. Saili Moghe* and J. Hertner, Department of Biology, University of Nebraska at Kearney.

3:30 13. INFLUENCE OF EXERCISE ON REPAIR ENZYME SYSTEMS IN DIABETES MELLITUS. Karynn Kucera*, J. E. Steele, and S. Goedeken, Department of Biology, University of Nebraska at Kearney.

3:40 14. CONCENTRATIONS OF ADRENAL TESTOSTERONE IN CASTRATED MALE RATS BEFORE AND AFTER EXPOSURE TO A FEMALE IN ESTRUS. Crystal L. Frost* and J. E. Steele, Department of Biology, University of Nebraska at Kearney.

3:50 15. SOURCES OF CALCIUM CONTRIBUTING TO SYNAPTIC TRANSMISSION FROM VERTEBRATE ROD PHOTORECEPTORS. Cory Ciccone*, Department of Biology, University of Nebraska at Kearney; and W. B. Thoreson, Department of Ophthalmology and Pharmacology, University of Nebraska Medical Center, Omaha.

4:05 16. EFFECTIVENESS OF NP COAT FOR PREVENTION OF BOVINE RESPIRATORY DISEASE IN HIGH RISK CALVES. Merle Bierman* and C. J. Bicak, Department of Biology, University of Nebraska at Kearney.

CHEMISTRY AND PHYSICS

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

SESSION A, CHEMISTRY

2:00 p.m. Featured Speaker: Jonathon L. Vennerstrom
Olin A

8:10 a.m. WELCOME

8:15 1. FUNCTIONAL ANNOTATION OF HYPOTHETICAL PROTEINS BY NMR. Robert Powers, Department of Chemistry, University of Nebraska–Lincoln.

8:30 2. APPLYING MULTIVARIATE AND PATTERN RECOGNITION METHODS TO EVALUATE THE MOLECULAR PROPERTIES OF A HOMOLOGOUS SERIES OF NITROGEN MUSTARD AGENTS. Ronald Bartzatt* and Laura Donigan, Department of Chemistry, University of Nebraska at Omaha.

8:45 3. STRUCTURAL STUDIES OF CPRK FROM DESULFITOBACTERIUM DEHALOGENANS. Jodi M. Ryter* and A. Krueger, Department of Chemistry, Nebraska Wesleyan University, Lincoln; and B. Biehl, S. Pop, and S. W. Ragsdale, Department of Biochemistry, University of Nebraska–Lincoln.

9:00 4. STRUCTURAL CHARACTERIZATION OF A METABOLITE-RESPONSIVE RIBOZYME. Joshua Jansen*, T. McCarthy, G. Soukup, and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

9:15 5. STRUCTURAL CHARACTERIZATION OF LIGAND RECOGNITION AND ACTIVATION OF A METABOLITE-RESPONSIVE RIBOZYME. Juliane Soukup*, T. McCarthy, M. Plog, J. Jansen, and G. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

9:30 BREAK

9:45 6. THE INDUCTIVE EFFECT IN ORGANIC CHEMISTRY, PART II. C. A. Kingsbury*, Department of Chemistry, University of Nebraska–Lincoln.

10:00 7. A NEW MECHANISM FOR NUCLEOPHILIC AROMATIC PHOTOSUBSTITUTIONS PARA-TO-NITRO IN NITROPHENYL ETHERS. Kandra M. Johnson*, and Gene G. Wubbels, Department of Chemistry, University of Nebraska at Kearney.

10:15 8. FURTHER ZINC METAL REDUCTIONS OF ALKYNES. Erin Johnson* and Don Kaufman, Department of Chemistry, University of Nebraska at Kearney.

10:30 9. RHODIUM-CATALYZED ASYMMETRIC HYDROGENATION USING MONODENTATE AND SELF-ASSEMBLED LIGANDS. Kittichai Chaiseeda*, Shin A. Moteki, Di Wu, Kusum L. Chandra, D. Sahadeva Reddy, and James M. Takacs, Department of Chemistry, University of Nebraska–Lincoln.

10:45 BREAK

11:00 MAIBEN MEMORIAL LECTURE, OLIN B

12:00 p.m. LUNCH

1:00 10. XPS AND AES OF $Ni_{1-x}Zn_xO$ SOLID SOLUTIONS. Anne Starace*, Sarah Petitto, Harry Garcia-Flores, and M. A. Langell, Department of Chemistry, University of Nebraska–Lincoln.

1:15 11. SURFACE CHARACTERIZATION OF SINGLE CRYSTAL COBALT OXIDE SPINEL SURFACES. E. M. Marsh*, S. C. Petitto, M. A. Langell, Department of Chemistry, University of Nebraska–Lincoln.

1:30 12. AB INITIO COMPUTATIONAL STUDIES OF STRUCTURE AND ENERGETICS OF SINGLE WALLED ARMCHAIR AND ZIGZAG CARBON NANOTUBES. Kristy L. Kounovsky*, P. A. Karr, and A. Krause, Department of Physical Sciences and Mathematics, Wayne State College, Wayne; and F. D'Souza and M.E. Zandler, Wichita State University, Wichita, KS.

1:45 13. AB INITIO COMPUTATIONAL STUDIES OF STRUCTURE AND ENERGETICS OF QUINONE/HYDROQUINONE HYDROGEN BONDED SYSTEMS. Paul. A. Karr* and M. D. Beck, Department of Physical Sciences and Mathematics, Wayne State College, Wayne; and F. D'Souza and M.E. Zandler, Wichita State University, Wichita, KS.

2:00 14. SYNTHETIC PEROXIDES AS ANTIMALARIALS: PROGRESS SINCE THE DISCOVERY OF ARTEMISININ. Jonathon L. Vennerstrom, College of Pharmacy, University of Nebraska Medical Center, Omaha.

3:00 BUSINESS MEETING AND BREAK

3:15 15. EFFECTS OF VARYING SALT CONCENTRATIONS ON APTAMER BINDING IN SOLUTION. Annette C. Moser* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

3:30 16. DEVELOPMENT OF AFFINITY MONOLITHS FOR ULTRA-FAST IMMUNOEXTRACTION. Tao Jiang, Rangan Mallik*, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

3:45 17. ANALYSIS OF FREE HORMONE FRACTIONS BY AN ULTRAFAST IMMUNOEXTRACTION/DISPLACEMENT IMMUNOASSAY: STUDIES USING FREE THYROXINE AS A MODEL SYSTEM. John E. Schiel*, William Clarke, Annette Moser, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

4:00 18. CHARACTERIZATION OF GLYCATION SITES ON HSA BY MALDI-TOF MS USING MULTIPLE ENZYMATIC DIGESTION AND ZIPTIP FRACTIONATION. Chunling Wa*, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

4:15 19. AN AUTOMATED METHOD FOR THE DIRECT DETERMINATION OF FREE DRUG FRACTIONS USING AFFINITY CHROMATOGRAPHY AND MASS SPECTROMETRY. Corey M. Ohnmacht*, Chad Briscoe, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

4:30 20. INFRARED MICROSCOPY OF EXPLOSIVE RESIDUES. Lancia N.F. Darville*, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

4:45 21. IMMOBILIZATION OF α_1-ACID GLYCOPROTEIN FOR CHROMATOGRAPHIC STUDIES OF DRUG-PROTEIN BINDING. Hai Xuan*, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

5:00 CLOSING COMMENTS

CHEMISTRY AND PHYSICS

SECTION B, PHYSICS

Chairperson: Thomas H. Zepf, Department of Physics
Creighton University, Omaha
Planetarium

THE WORLD YEAR OF PHYSICS 2005
CELEBRATING THE 100th ANNIVERSARY OF EINSTEIN'S MIRACULUS YEAR

1:00 p.m. 1. ***KEYNOTE LECTURE***: 1905: EINSTEIN'S *ANNUS MIRABILIS*. Robert E. Kennedy, Department of Physics, Creighton University, Omaha.

1:45 2. DID A UNIVERSITY OF NEBRASKA EXPERIMENT INFLUENCE EINSTEIN'S THEORY OF RELATIVITY? M. Eugene Rudd and Roger D. Kirby,* Department of Physics and Astronomy, University of Nebraska–Lincoln.

2:00 3. THE HAFELE-KEATING EXERIMENT: FIRST DIRECT CONFIRMATION OF TIME DILATION, PERFORMED ON COMMERCIAL JET FLIGHTS BY A CREIGHTON UNIVERSITY GRADUATE. Thomas H. Zepf, Department of Physics, Creighton University, Omaha.

2:15 4. *INVITED*: TESTING EINSTEIN'S TWIST: THE RELATIVITY GYROSCOPE EXPERIMENT. Dan Wilkins, Department of Physics, University of Nebraska at Omaha.

2:45 BREAK

3:00 5. *INVITED*: THE 2004 TRANSIT OF VENUS - THE ROMANCE AND THE SCIENCE. Kenneth E. Kissell, Astro-Metrology Group, Department of Physics, University of Maryland, College Park.

3:30 6. ZENITH ANGLE DEPENDENCE OF PROMPT MUON AND NEUTRINO FLUXES IN HIGH ENERGY COSMIC RAY SHOWERS. Louis A. Licate* and Gintaras K. Duda, Department of Physics, Creighton University, Omaha.

3:50 7. LASER INDUCED HEATING IN THE OPTICAL STRETCHER. Joseph M. Huff* and Michael G. Nichols, Department of Physics, Creighton University, Omaha.

4:10 8. COHERENT ρ^0 PRODUCTION IN ULTRA-PERIPHERAL HEAVY ION COLLISIONS. Michael G. Swanger* and Janet E. Seger, Department of Physics, Creighton University, Omaha.

4:25 9. JET TRIGGER STUDIES FOR ALICE. Christopher D. Anson* and Michael G. Cherney, Department of Physics, Creighton University, Omaha.

4:35 10. COMPARING INTENSITY RATIOS OF L-SHELL X-RAYS TO THEORY VALUES FOR ELEMENTS RANGING FROM Z=39 TO Z=50. Jacob S. Hervert* and Sam J. Cipolla, Department of Physics, Creighton University, Omaha.

EARTH SCIENCE

Chairperson: Ryan D. Weber, Department of Geosciences
University of Nebraska–Lincoln
Olin 111

3:00 p.m. OPENING REMARKS: Ryan Weber

3:05 1. HYDROLOGICAL PROCESSES OF THE SAND HILLS OF NEBRASKA-A VIEWPOINT. Venkataramana Sridhar, School of Natural Resources, University of Nebraska–Lincoln.

3:25 2. A DIATOM RECORD OF LATE-HOLOCENE CLIMATE VARIABILITY IN THE NORTHERN ROCKY MOUNTAIN RANGE. Brandi B. Bracht*, Sheri C. Fritz, Lora R. Stevens, Department of Geosciences, University of Nebraska–Lincoln.

3:45 3. COMPARISON OF THE TRACE FOSSIL DAIMONELIX WITH MODERN BURROWS OF THE BLACK-TAILED PRAIRIE DOG. Trent Alberts, Department of Geosciences, Chadron State College, Chadron.

4:05 4. THE LAGOMORPH PALAEOLAGUS FROM THE ORELLAN MEMBER OF THE BRULE FORMATION, TOADSTOOL PARK, NEBRASKA. Amanda Dopheide, Department of Geosciences, Chadron State College, Chadron.

4:30 5. VISIBLE LIGHT SPECTROMETRY AS AN AID TO ROCK COLOR IN THE FIELD. Michelle Long, Department of Geosciences, Chadron State College, Chadron.

4:50 CLOSING REMARKS, STUDENT AWARDS, AND SECTION MEETING

HISTORY/PHILOSOPHY OF SCIENCE

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

9:00 a.m. 1. NEW AND EMERGING INFECTIONS: THE CREATION OF GENETIC VARIATIONS IN VIRULENCE OF *STREPTOCOCCAL A* AND *ESCHERICHIA COLI* O157:H7. Claire M. Oswald, Biology Department, College of Saint Mary, Omaha.

9:30 2. MULTIPLE PATHS TO CRITICAL REFLECTION: A FLEXIBLE MODEL OF TEACHER LEARNING AND ITS IMPACT ON 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, Omaha, NE 68131.

10:00 3. A BRIEF HISTORY OF THE DEVELOPMENTS IN THE FIELD OF MORPHOLOGY AND HUMAN DEVELOPMENT. Claire M. Oswald, Biology Department, 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. CRYSTALLIZATION OF A TETRANUCLEOTIDE REPEAT RNA: IMPLICATIONS TO MYOTONIC DYSTROPHY TYPE 2 (DM2). Matthew D. Shortridge*, Nebraska Wesleyan University, Lincoln; and J. Lounge and J.A. Berglund, Institute of Molecular Biology University of Oregon, Eugene, OR.

8:12 2. PC12 CELLS AS A MODEL FOR THE STUDY OF CATHECHOLAMINE SECRETION. Heather A. Hergott*, Nebraska Wesleyan University, Lincoln; and T. Luke and T. Hexum, University of Nebraska Medical Center, Omaha.

8:24 3. ANALYSIS OF P16 AS A CANDIDATE GENE FOR *EMCA1*, A GENETIC MODIFIER OF ESTROGEN-INDUCED MAMMARY CANCER IN THE ACI RAT. Erin M. Hughes*, Biology Department, Nebraska Wesleyan University, Lincoln; and Beverly Shaffer and James Shull, Department of Genetics, Cell Biology, and Anatomy, University of Nebraska Medical Center, Omaha.

8:36 4. DIFFERENTIAL GENE EXPRESSION IN B-CELL LYMPHOMA. Jamie Gilmore*, J.S. Joshi, Doug Christensen, and Shawn Pearcy, Wayne State College, Wayne, and University of Nebraska Medical Center, Omaha.

8:48 5. GENETIC EFFECT OF EXPRESSION OF HUMAN DEAMINASES AID AND APOBEC3G IN YEAST. Elizabeth R. Worrall, College of Saint Mary, Omaha.

9:00 6. TRANSCRIPTIONAL REGULATION OF THE HUMAN N-CADHERIN GENE. Josh Smith* and Kate Marley, Biology Department, Doane College, Crete.

9:12 7. INCIDENCE OF ANESTHESIA RELATED DENTAL INJURY AND THE IDENTIFICATION OF FACTORS THAT INCREASE THE LIKELIHOOD OF INJURY. Jill R. Russell*, Biology Department, Nebraska Wesleyan University, Lincoln; and Myrna C. Newland, Sheila J. Ellis, K. Reed Peters, Jean Simonson, Tim Durham, and John H. Tinker, Department of Anesthesiology, University of Nebraska Medical Center, Omaha.

9:24 8. VIRUS-INDUCED GENE SILENCING USED TO IDENTIFY PLANT GENES THAT FUNCTION IN DISEASE RESISTANCE. Jessica R. Betten, Biology Department, Nebraska Wesleyan University, Lincoln.

9:36 9. EFFECTS OF THE GLUCOCORTICOID ASTHMA DRUG ON EPIDERMAL GROWTH FACTOR RECEPTORS IN THE AIRWAY CELLS. Jennifer A. Mihaljevic*, Biology Department, Nebraska Wesleyan University, Lincoln; and M.L. Toews and N.A. Schulte, University of Nebraska Medical Center, Omaha.

9:48 BREAK

10:00 10. CRYOPRESERVATION IN BOVINE OVIDUCT EPITHELIAL CELLS BY VITRIFICATION USING THE OPEN-PULL STRAW METHOD. Ann Janesch, Biology Department, Nebraska Wesleyan University, Lincoln.

10:12 11. COMPARATIVE IRRIGATION OF ZEA MAIZE. Ella Ruf, Biology Department, Doane College, Crete.

10:24 12. ALLOCHTHONOUS INPUT EFFECTS ON THE BACTERIAL COMMUNITY OF AN AQUATIC MESOCOSM. Lynette A. Pauly, College of Saint Mary, Omaha.

10:36 13. THE EFFECTIVENESS OF FORAMINIFERA AS ABIOTIC INDICATORS: THE ROLE OF FORMANIFERAL PRESERVATION. Elizabeth G. McKee, College of Saint Mary, Omaha.

10:48 14. PROVING TO MYSELF WHY RHESUS MONKEYS ARE USED IN DRUG TRIALS: CLADOGRAMS AS METHOD OF INQUIRY. Adeline L. Denniston, Chadron State College, Chadron.

11:00 MAIBEN MEMORIAL LECTURE, OLIN B

12:00 LUNCH

1:24 15. FOOD PREFERENCE AND FOOD CONSUMPTION RATES OF THE RED FLOUR BEETLE (*TRIBOLIUM CASTANEUM*). Chantelle M. Bicket*, K.M. Gaspers, W.R. Wolesensky, Department of Mathematics, College of Saint Mary, Omaha; and M.A. Schlueter, Department of Biology, College of Saint Mary, Omaha.

1:36 16. MORPHOMETERIC DATA ON THE EASTERN MASSASAUGA (*SISTRURUS CATENATUS CATENATUS*) IN SOUTHEAST NEBRASKA. Stephanie A. Hinman, College of Saint Mary, Omaha.

1:48 17. THE EFFECT OF TRAP HEIGHT ON MOSQUITO COLLECTION OF CULEX SPECIES COMPARED TO ALL OTHER MOSQUITOES COLLECTED VIA CDC LIGHT TRAPS AT 0.61, 1.52, 3.05, AND 4.57 METERS ABOVE GROUND. Aaron Morse, Biology Department, Nebraska Wesleyan University, Lincoln.

2:00 18. DETECTION OF ASH YELLOWS PHYTOPLASMA IN ASH (*FRAXINUS* SP.) TREES IN COMANCHE COUNTY, OKLAHOMA. Erin M. Divine* and Jerald S. Bricker, Biology Department, Nebraska Wesleyan University, Lincoln.

2:12 19. SCREENING OF DISEASE CAUSING ORGANIMS FROM ROTTING GLOXINIA (*SINNINGIA SPECIOSA*)TUBERS. Jennifer Peek*, Doug Christensen and Marian Borgmann-Ingwersen, Wayne State College, Wayne.

2:24 20. FUMONISIN AND ITS ABILITY TO INDUCE NEURAL TUBE DEFECTS IN THE SWV STRAIN OF MICE COMPARED WITH ITS EFFECTIVENESS ON LMBC MICE. Katie L. Deminski*, Biology Department, Nebraska Wesleyan University, Lincoln; and J. van Waes, Center for Human Molecular Genetics, University of Nebraska Medical Center, Omaha.

2:36 21. THE AL TRANSCRIPT ANTISENSE TO THE LAT REGION IN HERPES SIMPLEX VIRUS TYPE 1 GENOME INHIBITS ACTIVITY OF THE INTERFERON BETA PROMOTER. Casey A. Kotera, Biology Department, Nebraska Wesleyan University, Lincoln.

2:48 22. THE ROLE OF NK CELLS IN THE CLEARING OF A FACULTATIVE INTRACELLULAR PATHOGEN, *FRANCISELLA TULARENSIS*. Nathan L. Kotera*, Biology Department, Nebraska Wesleyan University, Lincoln; and T. Jerrells, D. Vidlak, and M. Burrows, University of Nebraska Medical Center, Omaha.

3:00 23. CHARACTERIZATION OF OPTIMAL ACTIVITY OF THE PUTATIVE PHOSPHOINOSITOL KINASE OPEN READING FRAMES A278L AND A282L IN PBCV-1 USING RADIOACTIVE -32P ATP IN VITRO METHODS. Quentin Stenger*, Biology Department, Nebraska Wesleyan University, Lincoln; and P. Valbuzzi, Dipartimento Di Biologia, Universitá degli Studi di Milano, Milano, Italy; and J.R. Gurnon and J.L Van Etten, Department of Plant Pathology, University of Nebraska–Lincoln.

3:12 BREAK

3:24 24. CHARACTERIZATION OF SET DOMAIN PROTEINS FROM AN ALGAE AND A BACTERIUM. John R. Eisenhart*, Departments of Biology and Chemistry, Nebraska Wesleyan University, Lincoln; and Karin van Dijk and Heriberto Cerutti, School of Biological Sciences, University of Nebraska–Lincoln.

3:36 25. THE EFFECT OF AZT AND INTERFERON ON CELLS. Jeffrey M. Zeckser, Biology Department, Nebraska Wesleyan University, Lincoln.

3:48 26. COMPARISON OF UNKNOWN SAMPLES OF *HELICOBACTER* TO *HELICOBACTER FENNELLIAE* AND OTHER KNOWN *HELICOBACTER* STRAINS. Jodi L. Allen, Biology Department, Nebraska Wesleyan University, Lincoln.

4:00 27. IDENTIFICATION OF PATHOGENIC ENTERIC SPIROCHETE BACTERIA IN TURKEYS (*MELEAGRIS GALLOPAVO*) USING LASER CAPTURE MICROSCOPY AND 16S rDNA PCR. Amanda J. Kruse, Biology Department, Nebraska Wesleyan University, Lincoln.

4:12 28. ESTABLISHMENT OF A COTRANSFECTED 2T3 MURINE CELL LINE. Erin Tourangeau, College of Saint Mary, Omaha.

4:24 29. THE EFFECTS OF CULTURE CONDITIONS ON THREE DIMENSIONAL COLLAGEN GEL CONTRACTION MEDIATED BY HUMAN FETAL LUNG FIBROBLASTS. Sara May*, Biology Department, Nebraska Wesleyan University, Lincoln; and Brad Rahaman, Xiangde Liu, Heather Olsen, and Stephan I. Rennard, Pulmonary and Critical Care Section, Internal Medicine, University of Nebraska Medical Center, Omaha.

4:36 30. EFFECT OF DIABETES ON THE INTRACELLULAR LEVELS OF GLUTATHIONE IN RAT OCULAR TISSUES. Tiffany Harms*, Biology Department, Nebraska Wesleyan University, Lincoln; and C. Toris, U. Kompella, and S. Fan, Department of Ophthalmology, University of Nebraska Medical Center, Omaha.

4:48 31. THE INDUCTION OF DIFFERENTATION IN TRANSITIONAL CELL CARCINOMA CELL LINE RT112 THROUGH THE ACTIVATION OF THE PEROXISOME PROLIFERATOR ACTIVATE RECEPTOR. Tiffany Tanner*, Biology Department, Nebraska Wesleyan University, Lincoln; and C. Varley, J. Southgate, and Jack Birch, Unit for Molecular Carcinogenesis, University of York, York YO10 5YW, UK.

COLLEGIATE ACADEMY

BIOLOGY

SESSION B

Olin 249

1:24 1. INFLUENCE OF N-GLYCANS OF THE ATTACHMENT (G) GLYCOPROTEIN OF BOVINE RESPIRATORY SYNCYTIAL VIRUS ON EXPRESSION. Holly Samson*, Chris Topliff, and Clayton Kelling, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln.

1:36 2. UBC9 ROLE IN THE BETARETROVIRUS LIFE CYCLE STUDIES USING SMALL INTERFERRING RNA. Gentry Lewis Rundle, Nebraska Center for Virology, University of Nebraska–Lincoln.

1:48 3. DISTRIBUTION OF ß-TUBULIN IN THE DEVELOPING AND ADULT RAT ORGAN OF CORTI. Ashlee S. Muller*, Biology Department, Nebraska Wesleyan University, Lincoln; and Rich Hallworth, Creighton University Medical Center, Omaha.

2:00 4. HUMAN HERPESVIRUS TYPE-8/KAPOSI'S SARCOMA-ASSOCIATED HERPESVIRUS SEROLOGY IN ZAMBIAN MOTHER/INFANT PAIRS. Andrea Eigenberg*, Biology Department, Nebraska Wesleyan University, Lincoln; and Charles Wood, Young S. Lyoo, Tendai M'Soka, and Saul Phiri, Nebraska Center for Virology, School of Biological Sciences, University of Nebraska–Lincoln.

2:12 5. EA SURVEY OF WILD RING-NECKED PHEASANTS IN NEBRASKA FOR INTERNAL HELMINTH PARASITES. Eric W. Andres*, Biology Department, Nebraska Wesleyan University, Lincoln; and David Oates, Game and Parks Commission, University of Nebraska–Lincoln.

2:24 6. EXCEPTIONS TO THE 12/23 RULE: THE EFFECTS OF USING MODIFIED 12/12 AND 23/23 RSS CONSTRUCTS ON V(D)J RECOMBINATION. Carla S. Church*, Biology Department, Nebraska Wesleyan University, Lincoln; and Patrick C. Swanson, Department of Microbiology and Immunology, Creighton University School of Medicine, Omaha.

2:36 7. CONFORMATIONALLY ALTERED RIBOSOMAL RNA REVERTS BACK TO THE WILD TYPE. Trisha L. Mullins, College of Saint Mary, Omaha.

2:48 8. THE INFLUENCE OF SHIGA-LIKE TOXIN ON INFLAMMATORY CYTOKINE PRODUCTION IN MACROPHAGE CELLS. Joel Michalski* and Doug Christensen, Wayne State College, Wayne.

3:00 9. THE EFFECTS OF BRADYKININ ON THE INSULIN DEGRADING ENZYME OF RAT LIVER AND MUSCLE ENZYME PREPS. Kristen Marteny, College of Saint Mary, Omaha.

3:12 BREAK

3:24 10. PRION STRAIN TARGETTING IN THE CENTRAL NERVOUS SYSTEM. Jessica Hutter*, Biology Department, Doane College, Crete; and Maria Christensen and Jason C. Bartz, Department of Medical Microbiology and Immunology Creighton University Medical Center, Omaha.

3:36 11. COMPARISON OF *ESCHERICHIA COLI* AND *PSEUDOMONAS AERUGINOSA* MEMBRANE LIPIDS GROWN UNDER INDUCED STRESS BY VARYING PH LEVEL. J. Gessel*, D. Smith, and B. Clement, Biology Department, Doane College, Crete.

3:48 12. STUDIES OF THE MUC1-DERIVED PEPTIDES BINDING TO CLASS I MAJOR HISTOCOMPATABILIGY COMPLEX (MHC). Will Packard*, Biology Department, Doane College, Crete; and Simon Sherman, Bioinformatics Core, University of Nebraska Medical Center, Omaha.

4:00 13. CENTRAL PACEMAKER-REGULATED GENE NETWORK IN THE HYPOTHALAMUS OF FEMALE MOUSE. Cristina L. Schroder*, Biology Department, Nebraska Wesleyan University, Lincoln; and Mark Ma, Department of Genetics, Cell Biology and Anatomy, University of Nebraska Medical Center Omaha.

COLLEGIATE ACADEMY

BIOLOGY

SESSION C

Olin 325

1:24 1. ROLE OF THIOL PEROXIDASES INVOLVED IN THE YEAST OXIDATIVE STRESS RESPONSE. Michael Jacobsen*[1,2], David Montgomery[2], Natalia Agisheva[2], Dmitri Fomenko[2], Vadim Gladyshev[2], Shawn Pearcy[1] and Doug Christensen[1]. [1]Department of Life Sciences, Wayne State College, Wayne, [2]Redox Biology Center, University of Nebraska–Lincoln.

1:36 2. EFFECTS OF PUERARIAE RADIX ON PUPS OF ALCOHOL-TREATED FEMALE MICE. Kerry Brader*, Kathleen Tallman, and Kate Marley, Department of Biology, Doane College, Crete.

1:48 3. THE USE OF RECOMBINANT HEP G2 CELLS IN THE STUDY OF ETHANOL METABOLISM BY ALCOHOL DEHYDROGENASE AND CYTOCHROME P450 2E1. Noah E. Porter, Biology Department, Nebraska Wesleyan University, Lincoln.

2:00 4. THE IMMUNOLOGICAL EFFECTS OF ALCOHOL ON THE CELL MEDIATED IMMUNE RESPONSE IN MICE INFECTED WITH GROUP B COXSACKIEVIRUS. Danielle N. Pell, Biology Department, Nebraska Wesleyan University, Lincoln.

2:12 5. THE EFFECTS OF CHRONIC ALCOHOL ABUSE IN A MOUSE MODEL ON THE IMMUNE SYSTEM'S ABILITY TO PRODUCE SPECIFIC ANTIBODIES. Corinna L. Gibbons, Biology Department, Nebraska Wesleyan University, Lincoln.

2:24 6. CONSTRUCTION AND QUANTIFICATION OF HINGE REGION DELETION MUTANTS OF VSV P-PROTEIN UNDER VARYING POLYMERASE CHAIN REACTION CYCLING CONDITIONS. Laura C. Pickering*, Biology Department, Nebraska Wesleyan University, Lincoln; and Asit K. Pattnaik and Subash C. Das, Nebraska Center for Virology, University of Nebraska–Lincoln.

2:36 7. KINASE SUPPRESSOR OF RAS AS A POTENTIAL REGULATOR OF GLUCOSE UPTAKE IN CELLS. Deann C. Settles*, Doug Christensen, and Shawn Pearcy, Wayne State College, Wayne; and Robert Lewis, University of Nebraska Medical Center, Omaha.

2:48 8. EVALUATING A CANDIDATE REGION INFLUENCING DYSLEXIA. Tara L. Boren, Department of Biological Sciences, University of Nebraska–Lincoln.

COLLEGIATE ACADEMY

CHEMISTRY AND PHYSICS

Chairperson: David Treichel
Nebraska Wesleyan University, Lincoln
Olin 224

8:00 a.m. 1. CALCULATED SURFACE ELECTROSTATIC POTENTIAL MAXIMA AS MEASURES OF THE STABILITIES OF CARBOCATIONS. Adele M. Robbins*, University of Nebraska–Lincoln; and Ping Jin, Jane S. Murray and Peter Politzer, Department of Chemistry, University of New Orleans, New Orleans, LA.

8:10 2. HARDWARE CONROL SYSTEM FOR THE STAR EXPERIMENT USING EPICS. Andrew Trapp, Department of Physics, Creighton University, Omaha.

8:20 3. IDENTIFICATION OF CHARMED MESON CANDIDATES USING DISTANCE OF CLOSEST APPROACH. Peter Dudley, Department of Physics, Creighton University, Omaha.

8:30 4. NEUTRALINO-NUCLEON SCATTERING RATES WITH REALISITIC FORM FACTORS FROM ELECTRON SCATTERING DATA. Ann Kemper* and Gintaras Duda, Department of Physics, Creighton University, Omaha..

8:45 5. MAGNETIC BIREFRINGENCE IN A LIQUID CRYSTAL. Tyler Doane, Physics Department, Hastings College, Hastings.

9:00 6. A MEASUREMENT OF THE WAVELENGTH DEPENDENCE OF RALEIGH AND MIE SCATTERING IN LIQUID SUSPENSIONS. Michael Mahoney, Physics Department, Hastings College, Hastings.

9:15 7. AN INVESTIGATION INTO THE PROPERTIES OF VARIABLE MASS OSCILLATORS. Heidi Miller, Physics Department, Hastings College, Hastings.

9:30 8. AN EXAMINATION OF PERFORMANCE CHARACTERISTICS OF BASEBALL BATS. Kyle Oakeson, Physics Department, Hastings College, Hastings.

9:45 9. CONSTRUCTION AND TESTING OF AN ELECTRIC GUITAR PICKUP. Michael Rust, Physics Department, Hastings College, Hastings.

10:00 10. A MEASUREMENT OF SUPERNOVA MAGNITUDE AND TYPE CLASSIFICATION. Jill Schmitz, Physics Department, Hastings College, Hastings.

10:15 11. HALL EFFECT MEASUREMENTS IN LOW DENSITY PLASMAS. Jeff Tonniges, Physics Department, Hastings College, Hastings.

10:30 12. EXTRACTION OF THE PAIR POTENTIAL FROM THE STRUCTURAL DATA OF LIQUIDS. Jessica Changstrom*, Department of Physics, Midland Lutheran College, Fremont; and Vadim Warshavsky and Xueyu Song, Iowa State University, Ames, IA.

10:45 BREAK

11:00 MAIBEN LECTURE (OLIN B)

12:00 p.m. LUNCH

1:00 13. THE PURPLE GENIE-THE REACTION OF TURPENTINE AND IODINE. Amanda Lytle, Department of Chemistry, Doane College, Crete.

1:15. 14. STUDIES IN THE SYNTHESIS OF A NEUROPEPTIDE Y Y_2 RECEPTOR-SELECTIVE ANTAGONIST. Dustin L. Simpson* and Martin Hulce, Department of Chemistry, Creighton University, Omaha.

1:30 15. GREEN AMIDATION: THE OPTIMIZATION OF AN ENVIRONMENTALLY FRIENDLY, HIGH-YIELDING AMIDE SYNTHESIS. Michael T. Wentzel* and Martin Hulce, Department of Chemistry, Creighton University, Omaha.

1:45 16. PRODUCING ASPIRIN FROM WILLOW BARK. Michael Stutzman, Department of Chemistry, Doane College, Crete.

2:00 17. ELECTROGENERATED CHEMILUMINESCENT INVESTIGATION OF ENROFLOXACIN AND TRIS (2, 2'-BIPYRIDYL) DICHLORORUTHENIUM (II) HEXAHYDRATE COMPLEX USING CYCLIC VOLTAMMETRY. Brian K. Kimura* and E.M. Gross, Department of Chemistry, Creighton University, Omaha.

2:15 18. A SYNTHESIS OF 4-BENZYL-L-HISTIDINE. Michael Mao* and Martin Hulce, Department of Chemistry, Creighton University, Omaha.

2:30 19. INTERACTION BETWEEN HUMAN ADENOSYL TRANSFERASE AND METHIONINE SYNTHASE REDUCTASE. Kassandra Douglas*, Department of Chemistry, Midland Lutheran College, Fremont; and Carmen Gherasim and Ruma Banerjee, Redox Biology Center, University of Nebraska–Lincoln.

2:45 20. STUDIES IN EXTENDED CONJUGATE ADDITION: 1-METHYL-5-(TRIMETHYLSILYLETHYNYL)BICYCLO[3.1.0]-2-HEXANONE. David Moody* and Martin Hulce, Department of Chemistry, Creighton University, Omaha.

3:00 BREAK

3:05 21. SYNTHESIS OF A LESS TOXIC COPPER-CONTAINING CERAMIC GLAZE. Rochelle M. Swanson* and M.L. Ettel, Department of Physical Sciences and Mathematics, Wayne State College, Wayne.

3:15 22. STRUCTURAL CHARACTERIZATION OF AN ALLOSTERIC RNA CATALYST. Shennen Floy*, T. McCarthy, J. Jansen, J. Greimann, A. Kertsberg, G. Soukup, and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

3:30 23. STRUCTURAL CHARACTERIZATION OF A GUANINE RIBOSWITCH THAT EXHIBITS METABOLIC CONTROL. Carolyn Green*, J. Jansen and J. Soukup, Department of Chemistry, Creighton University, Omaha.

3:45 24. COMPARING THE PRODUCTS OF THE ULTRASONIC INITIATION OF GRIGNARD REACTONS WITH CONVENTIONAL GRIGNARD REACTIONS. Abby Fenner, Department of Chemistry, Doane College, Crete.

4:00 25. INVESTIGATING THE ACTIVATION OF $ClONO_2$ ON THE SURFACE OF ICE USING QM/MM AND *AB INITIO* METHODS. Trenton L. Pruden* and Mark A. Freitag, Department of Chemistry, Creighton University, Omaha.

4:15 26. UNDERSTANDING THE PHOTOCHEMISTRY OF ATMOSPHERIC HALOGEN SOURCES, INTERMEDIATES, AND RESERVOIRS: EXCITED STATE DYNAMICS AND ENERGY PARTITIONING. Tracy Niday*, Department of Chemistry, Midland Lutheran College, Fremont; and Hahkjoon Kim and Simon W. North, Texas A&M University, College Station, TX.

4:30 27. WEAKLY POLAR INTERACTIONS IN MODEL HELICAL PEPTIDES. Nicholas Palermo*, Department of Computer Science, College of Information Science and Technology, University of Nebraska at Omaha; and Michael C. Owen, Richard F. Murphy, and Sándor Lovas, Department of Biomedical Sciences, School of Medicine, Creighton University, Omaha.

4:45 28. STUDIES OF THE EFFECTS OF SILICON ON ARENE-CHROMIUM BONDS. Phil Krzycki* and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.

5:00 29. EXPERIMENTAL AND THEORETICAL STUDIES OF THE UV/VIS AND FLUORESCENCE SPECTRA OF ACID-BASE INDICATORS. Erin Koch*, Ryan Becker*, Dan Froistad, Paul Karr, and David Peitz, Department of Physical Science and Mathematics Wayne State College, Wayne.

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)
1:30 - 4:30	Junior High Competition
2:00 - 3:30	NJAS Board/Teacher Meeting
5:00 - 5:30	General Awards Presentations - Smith 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

UNDERSTANDING CONSUMER PREFERENCE: THE KEY TO SUCCESS IN THE AIRLINE INDUSTRY RESULTS FROM THE AIRLINE SURVEY

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

The Airline Survey of Frequent Travelers provided insight into consumer preference in airline travel. This study was intended to provide a better understanding of consumer preferences and what issues they considered important when traveling. This may bring to light issues facing the airline industry as it struggles to improve customer satisfaction while making a profit. The survey explored several areas including the basis and range of quality based on the perceptions of frequent travelers. This section correlated with the Airline Quality Rating (AQR) which focuses on airline performance features significant to air travel consumers (Bowen & Headley, 2004). The second area provided insight into what factors go into selecting a specific airline. This included the level of importance participants assigned to key issues. For instance, having baggage arrive with the traveler ranked first, with the safety record of airline a distant second. At the other end of the spectrum, the size and type of aircraft, as well as the availability of upgradeable seats, ranked low in importance. The third area focused on consumer complaints and tied into the air travel consumer report for added validity. Complaints typically centered on the issues of handling cancellations or delays. Rude treatment by airline employees and loss of luggage also were significant problems. The fourth area explored the impact on airline travel from the terrorist attacks of September 11, 2001 (9/11). This included the number, if any, of business and or pleasure trips that were canceled in response to 9/11. The survey results indicated the majority of respondents did not cancel any trips. Of those that did cancel, typically only one trip was affected. Overall, the survey results provided an indication of consumer behavior within the demographic of frequent business and leisure travelers.

SIMULATION OF TRANSIENT METHANOL DROPLET COMBUSTION

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

Numerical investigation of methanol droplet combustion in a zero-gravity, low pressure and low temperature environment is presented. An axisymmetric model, including the effects such as droplet heating, liquid-phase circulation and absorption of water into the liquid droplet has been employed. Results are presented for a droplet combusting within a nearly quiescent environment, for the cases where surface tension effects have been included as well as ignored. The inclusion of surface tension effects creates complex flow patterns in the droplet

that aid the absorption of water by enhancing mixing within the droplet. If the surface tension effects are neglected, only diffusion aids water absorption and this result in an extinction diameter much smaller than that obtained experimentally. It is shown that for a 0.43 *mm* droplet combusting in dry air, the extinction diameter is 0.11 *mm* when surface tension effects are included and 0.054 *mm* when surface tension effects are neglected.

INNOVATION IN SMALL COMMUNITY AIR SERVICE: AN EXAMINATION OF THE SMALL COMMUNITY AIR SERVICE DEVELOPMENT GRANT PROGRAM

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

The US Department of Transportation recently introduced the Small Community Air Service Development Grant program to support innovation in the development and enhancement of air service and mobility for small communities. Our current research, which is funded by a NASA EPSCoR grant, assesses the effectiveness of the program in stimulating innovation and addressing the transportation needs of small communities that have not been well served by the airline business model. While the program offers the potential to augment the efforts of small communities to enhance their air service through innovative business models and technology strategies, most grants have been awarded to communities proposing to subsidize new or existing airline service. Travel banks, direct subsidies, subsidized marketing programs, and other traditional tools seem to fall short of true innovation and fail to address the need for new technologies and business models more closely matched to the small community market. Building on research conducted on the NASA sponsored Small Aircraft Transportation System initiative; we conclude that genuine and sustainable improvements in small community air service will only result from a more fundamental transformation of technology solutions and commercial strategies.

NEBRASKA'S COMMUNITY AIRPORTS: A STUDY OF ORGANIZATIONAL, FINANCIAL, AND MANAGEMENT PRACTICES

Robert Blair, Jerry Deichert, and Aleksandra Tepedelenova, School of Public Administration, University of Nebraska at Omaha, NE 68182

Rural public-use airports play a critical role in the economic development of communities in agricultural states and those with dispersed populations. Airports serve as a vital link to markets and resources for both agricultural and non-agricultural businesses operating in the community, and provide needed transportation options for area residents. These airports also provide needed health and medical transport services in non-metropolitan locations. Faculty from the Center for Public Affairs Research and the School of Public Administration collected information on Nebraska community airports as part of the 2003 Small Aircraft Transportation Systems (SATS) project. This study consists of an inventory of organizational approaches to airport governance, and a survey of airport managers and officials in non-metropolitan communities. This report summarizes the organizational structures and procedures used to govern, finance, and operate public-use airports in Nebraska. The report also describes survey findings and implications and concludes by listing a set of recommendations.

APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM (GIS) IN THE ANALYSIS AND ASSESSMENT OF SMALL AIRCRAFT TRANSPORTATION SYSTEM (SATS) IN NEBRAKSA

Massoum Moussavi and Jaime Vargas, Department of Civil Engineering, University of Nebraska at Omaha, NE 68182

The Environmental Systems Research Institute's ArcView 8.3 Geographic Information System (GIS) coupled with Nebraska's Small Aircraft Transportation System (SATS) Decision Support System (DSS) model is used to analyze and assess the SATS implementation in Nebraska. The current Nebraska SATS DSS model

includes demand forecasting, airfield design, terminal area, and ground transportation access sub-models. The results of the analysis shows that SATS can provide high-speed air transportation service to approximately 90% to 97% of the population within 15 to 30 minutes of driving distance from a SATS airport in Nebraska. The modal choice analysis shows that SATS is a viable competitive mode of transportation and enhanced technological capabilities of SATS will increase its market share and will induce a new demand for air transportation. SATS will provide transportation service as an alternative to air transportation services that are presently available in only five communities in Nebraska. The benefits and the impact of SATS in Nebraska can be viewed as enhanced accessibility and high-speed mobility with high reliability and better affordability. The benefits and impacts of SATS can also be viewed as induced economic development and business activities. SATS will provide the opportunity to better utilize the underutilized air transportation facilities in Nebraska.

NATIVE INSTITUTE FOR MANAGEMENT OF GEOSPATIAL EXTENSION

Jan Bingen, Department of Computer Science, Little Priest Tribal College, Winnebago, NE 68071; and Hank Lehrer, Aviation Institute, University of Nebraska at Omaha, NE 68182

Native IMAGE, the Native Institute for Management of Geospatial Extension, was established in January 2003 at Little Priest Tribal College in Winnebago, NE to further the desire of the college to become more actively engaged in the use of geospatial and remote sensing technologies. This presentation will describe the Institutes' involvement in the development of meaningful curriculum in science, mathematics, and technology that is focused in grades K - 14. Additionally, Native IMAGE has developed outreach programs with the Winnebago Public Schools and the Winnebago tribal government. Also included will be information on community outreach efforts and hands-on activities involving the entire Winnebago community. Native IMAGE has begun to be actively involved in national Native American geospatial efforts such as the Tribal College Forum, Native View, and the intertribal GIS consortium. Several local and national presentations at selected major educational conferences have resulted.

EXPLORING KEPLER'S LAWS WITH SIMULATIONS

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

The Nebraska Astronomy Applet Project (NAAP) is developing high-quality astrophysical simulations accompanied by a variety of supporting resources such as student guides and complete background information. NAAP materials are appropriate for use in both college and high school introductory astronomy courses and could be used in computer-based laboratories, homework projects, and classroom demonstrations. This presentation will illustrate a Planetary Motion Simulator designed to demonstrate both Kepler's three laws and Newtonian orbital concepts. Features include the ability to vary orbit sizes and eccentricities, display and manipulate area sweeps, and compare the simulation's orbit to real solar and extra-solar planetary orbits.

REMOTE SENSING OF SELECTED BIOPHYSICAL PARAMETERS OF VEGETATION USING THE CALMIT AISA HYPERSPECTRAL IMAGER

Nick Emanuel, Don Rundquist, Anatoly Gitelson, and Rick Perk, School of Natural Resources, University of Nebraska–Lincoln, NE 68588

Remotely sensed data collected for the purpose of monitoring and analyzing crop canopies 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 specific biophysical variables, vegetation cover and biomass. The spectral algorithms developed to estimate these parameters are presented, along with validation examples. AISA images acquired over the

University of Nebraska–Lincoln Agricultural Research and Development Center, located near Mead, NE were transformed, using the spectral indices, to provide an overview of field conditions at numerous points in time during the 2002 through 2004 growing seasons. The emphasis of the work is on the development of practical products for use by agriculturalists.

CARTER LAKE ALGAL BLOOMS AND REFLECTANCE SPECTROSCOPY: HAS THE LAKE CHANGED STATE?

Megan Machmuller, John Gross, and John Schalles, Biology Department, Creighton University, Omaha, NE 68178

In September, 2004 we began a study of phytoplankton and associated water quality conditions in Carter Lake. The lake is an oxbow on the Missouri River floodplain near Omaha. In 2004, cyanobacterial toxins were found in Carter Lake and other lakes in eastern Nebraska, which led to health advisories and user restrictions. Our research group performed extensive studies on Carter Lake between 1994 and 1998. We repeated our measures of algal pigments and reflectance spectroscopy to answer the question: has a state change occurred in the phytoplankton community of Carter Lake over the past decade? Although a pronounced bloom with high chlorophyll *a* concentrations and distinctive spectral reflectance features were present, our findings were inconclusive - i.e., our measurements fell within the range of variation encountered in the earlier study. We simply may need a longer observation period to answer the question, and will continue our measurements this spring and summer.

CONTEXT-DIRECTED HIGH LEVEL INTERPRETATION OF REMOTELY SENSED URBAN IMAGES

Lin Lin, Ashok Samal, and Sharad Seth, Department of Computer Science and Engineering, University of Nebraska–Lincoln, NE 68588

Extraction of features from remotely sensed urban imagery is an important problem in many application domains. Much effort has focused on the features of spectral signature at 10-100 meter resolution and single man-made objects at sub-meter level. Our research objective is to identify higher-level features, (e.g. residential, commercial and industrial area), as aggregates of the low level features, (e.g. single buildings and road segments), and understand the organization of the urban scenes. The high-level feature is defined by its characteristic distribution of its constituent features, and also by its relationship with other high and low level features, i.e. its geographic context. A framework for interpreting high-resolution satellite/aerial images of urban areas is proposed in this paper and a prototype system to implement this idea is built. The experimental result based on the GIS data of Austin, TX shows our approach is promising.

SEDIMENTARY STRUCTURES OF MARS IN COMPARISON WITH THOSE ON EARTH

Ryan Morgan, Department of Geosciences, Chadron State College, Chadron, NE 69337

Eolian processes on Mars move sediments in a manner similar to that on Earth. Mars' gravitational force is much smaller than that of Earth as is its atmospheric pressure. Martian winds commonly blow at 200 km/h and can gust to 600 km/h. These strong winds carry minute particles by saltation and suspension to create a variety of sedimentary structures. This, along with images from NASA orbital and roving probes indicates that wind plays a much more active role in creating Mars surface geology than it does on Earth. Although there are many differences between Mars and the Earth, they both exhibit similar types of sedimentary structures. Mars exhibits ripples, sand sheets, and dunes that are all very similar to Earth's, but on a much larger scale due to the lower gravity and higher wind speeds.

DIFFERENCES IN THE SPATIO TEMPORAL INTERPOLATION BETWEEN PLAIN AND MOUNTAINOUS REGIONS

Jun Gao and Peter Revesz, Department of Computer Science and Engineering, University of Nebraska–Lincoln, NE 68588

We propose a new adaptive spatio-temporal interpolation method that combines, either by a step or a line function, existing spatial and temporal interpolation methods. We test the new method using climate data obtained from weather stations in Colorado and Nebraska, for the time period from 1993 to 2003. The experimental results show that in mountainous regions our adaptive spatio-temporal method has a much better performance than both the Inverse Distance Weighting (IDW) and the temporal interpolation methods have in themselves.

WAVES IN THE AFRICAN EASTERLY JET IN SUMMER 2002

Jon Schrage, Department of Atmospheric Sciences, Creighton University, Omaha, NE 68178

The geography of West Africa establishes an unusual easterly jet stream during the summer monsoon season. This so-called "African Easterly Jet" is driven by temperature differences between the Sahara desert and the relatively cool Guinea coast. As this jet meanders north and south, it forms ridges and troughs that modulate precipitation in the climate-sensitive Sahelian and Soudanian climate zones. The nature of this modulation depends on, among other factors, the wavelength of the waves in this jet. In this paper, the characteristics of the African Easterly Jet will be discussed for the summer of 2002, when enhanced observations from the IMPETUS (Integrated Project for the Management of Scarce Freshwater Resources in West Africa) field campaign are available. In addition, the impact of these waves on the precipitation regimes of West Africa will be noted.

GENERAL AVIATION AND TRANSPORTATION SECURITY: ECONOMIC CONSEQUENCES OF REGULATORY POLICY ACTIONS AND PERCEPTIONS OF ACTION

Kimberly Senda and Brent Bowen, Aviation Institute, University of Nebraska at Omaha, NE 68182

Legislative mandates from the Transportation Security Administration and Federal Aviation Administration flowed rampantly in what was once known as the "weak link" in aviation security - general aviation. Pop-up temporary flight restrictions, loss of airport and airspace use, along with recommended security improvements created daily obstacles that small airports, fixed-base operators, and general aviation pilots must accommodate to ensure secured air travel. This study explored fiscal and economic consequences of security policy action within the general aviation component of the National Airspace System. The examination identified fiscal and economic impacts, executed or proposed, coupled with related issues from the perspective of the general aviation community through a key-informant inquiry of stakeholders. Results established a baseline perspective that provides regulators a basis for anticipated consequences prior to the announcement of regulatory mandates. These results give regulators a reference base of implications, tangible and intangible, that policy action imposes on general aviation activity.

AERONAUTICS AND SPACE SCIENCE
SESSION B

APPLICATION OF COMPONENT IDENTIFICATION SYSTEMS IN TRACKING METALLIC COMPONENTS

Fasineh Samura and E. Terence Foster, College of Engineering and Technology, University of Nebraska–Lincoln, NE 68588

Structural metal production and construction organizations, especially those working with steel and aluminum in the aerospace environment, look for ways to improve the supply chain and maintenance of components. Current methods of extracting data about metal components have serious limitations related to timelines, accuracy, and durability. Radio Frequency Identification (RFID) technology uses radio waves to acquire information without physical line of sight or contact. This intelligent technology has the automatic ability to identify and track the production, storage, transportation, delivery, operation, and maintenance of metal products. This paper discusses development and experimental testing of metallic components using the component identification system (CIS). This project's goal is to develop systems for exchanging information among all parties involved in the component life cycle process. Initial investigation indicates that, even though metals exhibit some interference with RFID signals, CIS has great potential in increasing efficiency of handling and access to accurate information.

RFID TECHNOLOGY FOR TRACKING INVENTORY IN THE SPACE SHUTTLE

Erick Jones and Jayakumar Narasimhan, Department of Industrial Engineering, University of Nebraska–Lincoln, NE 68588

The space ship carries many inventories, such as clothing, food and other essentials for crew members. These items are stored in a bag and transported into the shuttle cargo. The problems the crew members face during the flight are non-traceable inventory, lost inventory and insufficient replenishment. As a consequence there is a critical need to develop a new identification technology. Radio Frequency Identification (RFID) is a technology similar to the newly developed bar code system for identification. With RFID, the electromagnetic or electrostatic coupling in the RF portion of the electromagnetic spectrum is used to transmit signals. An RFID system consists of an antenna and a transceiver, which reads the radio frequency and transfers the information to a processing device, and a transponder, or tag, which is an integrated circuit containing the RF circuitry and information to be transmitted. The objective of this paper is to develop a system that can track the inner pack quantities. A method to write passive tag information to an active tag is also included.

MODELS FOR THE USE OF SPACE IMAGERY IN TECHNOLOGY SUPPORTED LEARNING ENVIRONMENTS

Neal Grandgenett, Bill Schnase, and Paul Clark, Department of Teacher Education, University of Nebraska at Omaha, NE 68182

This presentation describes several educational models for the effective use of space imagery in the grade 7-12 classroom. Current innovations of the DataSlate software, designed collaboratively by the NASA Jet Propulsion Laboratory and the University of Nebraska (Lincoln and Omaha), are integrated into the various educational models focusing on standards-based mathematics and science instruction. NASA Headquarters has recently announced that they will expand the distribution of DataSlate in 2005. Educational impacts of the various integration models are being monitored in several ways, including mapping to district benchmarks, detailing teacher and student perceptions, following the enrollment of students in upper level courses, and by

using various mechanisms for tracking student paths through the interactive learning process. In addition to examples of the various educational models underway, the expected future evolution of these learning environments, such as the incorporation of digital video, will also be discussed.

ANALYSIS OF IVA TASKS AND DEVELOPMENT OF A SOFTWARE TOOL FOR MISSION PLANNING

Shuvra Ghosh, Rajesh 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. The various Intra Vehicular Activities (IVA) tasks specific to a mission are presently scheduled after rigorous training, and are highly structured. However, tasks performed inside the International Space Station (ISS) have to be unstructured and need a different mission planning approach. This study used three distinct stages to obtain a more efficient mission planning approach. The first step towards this mission planning approach was to identify various tasks performed inside the ISS from available past mission videotapes. Tasks which were clearly identifiable and separable from each other were analyzed further using 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 Microsoft 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 critical mission planning. The software has been developed and needs to be validated.

GRAVITATIONAL FORCES INFLUENCE THE LOCAL DYNAMIC STABILITY OF HUMAN GAIT PATTERNS

Max Kurz and Nicholas Stergiou, HPER Biomechanics Laboratory, University of Nebraska at Omaha, NE 68182; and Jacob Bloomberg, Neuroscience Laboratory, NASA Johnson Space Center, Houston, TX 77058-3696

A custom built body weight suspension (BWS) system was used to explore the influence of gravity on the local dynamic stability of human gait. The BWS system supplied a constant upward force on the subject's center of gravity via a cable-spring-winch system that was monitored with a force transducer. Subjects walked on a treadmill for the following micro-gravities: 1.0, 0.9, 0.8, and 0.7 Gs. The largest Lyapunov exponent was calculated for the respective lower extremity joint angles to determine the local dynamic stability. Our results indicated that there was a linear relationship between the influence of gravity and local dynamic stability. The gait pattern became more random as gravity was reduced. Our future investigations are directed towards understanding how alterations in other Newtonian forces influence the local dynamic stability of human gait. This scientific information will serve as the foundation for the development of better counter-measures for long-term space flight.

A COMPARISON OF PILOT PERFORMANCE USING TRUE FLIGHT TRACK VERSUS MAGNETIC HEADING NAVIGATION PARADIGMS

Mike Larson and Parker Lucas, Aviation Institute, University of Nebraska at Omaha, NE 68182

A previous study by Larson proposed that a Geographic North navigation model replace the traditional Magnetic North model as the foundation of aviation navigation. The most recent Federal Radio-navigation Plan (FRP) posits the Global Positioning System (GPS) as the future primary navigational facility in the National Airspace System (NAS). Since GPS, position, velocity and time (PVT) navigation data is based on Geographic North; it seems logical that a navigation model based on Geographic North would be advantageous compared to one based on Magnetic North. The study concluded that the use of Geographic North did enhance the performance of flight planning by aviation students. Larson and Lucas propose to further explore the advantages of the Geographic North navigation model by comparing the performance of instrument qualified pilots conducting simulated cross-country flights using the two different navigation paradigms. Two different groups will use a Personal Computer Assisted Training Device (PCATD) to measure the efficacy of the performance of basic navigation tasks. The experimental group will use a True Flight Track (TFT) navigation display and the control group will use a traditional Magnetic Heading (MH) navigation display. The TFT group data is based on the actual flight path over the surface of the Earth in relation to the Geographic North Pole while the MH group data is based on the heading of the aircraft related to Magnetic North. The hypothesis of this study is that the TFT group will perform the navigation task more accurately and expeditiously than the MH group. A preliminary study, using aviation students at University of Nebraska at Omaha, did support this hypothesis. However, data research is ongoing to improve the statistical validity of the study.

UTILIZING BALLOON SATELLITE DATA TO ENGAGE K-12 TEACHERS IN SCIENCE INQUIRY

Carol Mitchell, College of Education, and Mike Larson, Aviation Institute, University of Nebraska at Omaha, NE 68182

Area Nebraska K-12 teachers worked together for three weeks during an Aerospace Education Workshop integrating their subject matter with aerospace concepts. The teachers constructed and launched balloon satellites. The importance of this engagement was the data collection from the balloon satellite. Teachers developed an experiment that was carried out after the balloon satellite was launched. The data collected from the balloon satellite was analyzed and used to develop lessons for K-12 classes during the academic year. This session will describe the experiences of the K-12 teachers and the multiple ways that the Balloon Satellite data can be used across grades levels and disciplines. A critical look at the data will be made to provide a model for other K-12 teachers who desire to engage students in an inquiry, standards-base learning experience.

THE FORMATION OF ERROR INTOLERANCE IN PUBLIC ORGANIZATIONS

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

This paper involves the reporting of dissertation research into how public organizations develop error tolerance attitudes and policies. Understanding how political and organizational administrative processes shape error tolerance standards in public organizations will contribute to the advancement of organizational theory, as well as provide a more comprehensive understanding of the social and political forces that shape policies and behaviors that control the operation of public agencies. Investigation centers on the identification of factors that determine error tolerance in organizations tasked with provision of public safety and security. The research is being accomplished by conducting comparative longitudinal case analyses of the Federal Aviation

Administration's (FAA) air traffic services program and the aviation security program prior to its incorporation within the Transportation Security Administration (TSA). This essay will discuss how theories of incrementalization, governmental decision-making and organizational behavior influence the formation of error intolerance in public organizations.

THE ROLE OF HISTORICAL TRANSPORTATION PARTNERSHIPS IN THE DEVELOPMENT OF AMERICAN SPACE TRANSPORTATION

Patrick O'Neil, Aviation Institute, and Carol Ebdon, School of Public Administration, University of Nebraska at Omaha, NE 68182

Public/private partnerships and intergovernmental interdependencies have played a critical role in the development of all transportation modes that are linked together to form the American transportation system. Transportation system development has been a slow and incremental process shaped by national security, private sector economic demands, and availability of technology, population density and geography. Whether the initial transportation mode began at the private or public level, all sustainable transportation modes evolved through shifting patterns of public/private involvement. The purpose of this paper is to use this pattern to analyze and understand how the formation of public/private relationships has contributed to American transportation development and how the absence of these historical partnerships has inhibited the evolution of American commercial space transportation. The essay provides an overview of the public and private partnerships in the formation of new transportation mode development, explains how the lack of these historical partnerships have hampered American space transportation growth and provides recommendations for space transportation policy change.

A STUDY OF SIZE EFFECTS ON FERROELECTRIC SUPERLATTICES

Jiangyu Li and Quangen Du, Department of Engineering Mechanics, University of Nebraska–Lincoln, NE 68588

Two different kinds of ferroelectric superlattices consisting of two or three ferroelectric materials are investigated based on the Landau-Ginsburg theory. We study the size effects on the spontaneous polarization, the Curie temperature, the dielectric susceptibility and hysteresis loops taking into account the interface and electrostatic energies. We find that when the film size is decreased to the nanoscale, the interface coupling effects increase greatly and change the material properties dramatically. A critical size for ferroelectricity is also captured during the simulation.

VARIATION IN EXPRESSION OF PAIN AND CLOCK GENES

Natalie Rasmussen and Lynne Farr, College of Nursing, University of Nebraska Medical Center, Omaha, NE 68198; and Eufemia Jacob, Department of Hematology/Oncology, Baylor College of Medicine, Houston, TX 77030

Analgesics, such as morphine, are used to treat both acute and chronic pain. A variation in the pain response, effectiveness and side effects of some analgesics has been noted in humans and animals. Differences within and between species/strains may be due to pharmacokinetic and rhythmic factors that are influenced by genetic factors. Also, little is known about the effect that analgesics have on the expression of genes related to pain and rhythms. This information will assist in determining the timing and dosing of analgesics to provide the most effective level of analgesia with the least amount of disruption of endogenous mechanisms.

PLANETARY EXPLORATION WITH THE CLIFF-BOT SYSTEM

Gale Paulsen, Nathan Wood, and Shane Farritor, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

The Cliff-bot system consists of three planetary rovers that work as a team to explore the surface of a cliff. Two of the rovers, designated "Anchor-bots," assist the motion of a third rappelling "Cliff-bot" down and along a cliff face using tethers. A decentralized control technique is used to control the motion of the three rovers. The objective of this study is to develop several control algorithms that will create a robust Cliff-bot system. More specific developments have included a low level controller that combines data for the "Cliff-bot" velocity and tether tension to control the position of the "Cliff-bot" on the cliff. Additional developments in this study have been the construction of a fully functional prototype system at UNL. Development of both low level and high level control algorithms have resulted in robust navigation of terrain slopes of more than 70 degrees for the prototype system.

IN VIVO ROBOTICS

Mark Rentschler, Department of Biomedical Engineering, University of Nebraska Medical Center, Omaha, NE 68198; and Jason Dumpert, Stephen Platt, and Shane Farritor, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588; and Dmitry Oleynikov, Department of Surgery, University of Nebraska Medical Center, Omaha, NE 68198

Laparoscopy is abdominal surgery performed with long tools inserted through small incisions. The use of small incisions reduces patient trauma, but also eliminates the surgeon's ability to view and touch the surgical environment directly. These limitations generally restrict the application of laparoscopy to less complex procedures than those performed during open surgery. Large robots external to the patient have been used to aid in the manipulation of the tools and improve dexterity, but are still constrained by the entry incision. To help realize the full potential of laparoscopic surgery, miniature robots were created that were controlled remotely within the abdominal cavity. These in vivo robots provide the surgeon with an enhanced field of view from arbitrary angles as well as provide dexterous manipulators not constrained by the entry incisions. Successful prototype trials have shown great promise and the projected outcomes have the potential to make important advancements in minimally invasive surgery.

PUBLIC SPACE TRAVEL: FAIR FARES OF TOMORROW

Steven Ryberg and Brent Bowen, Aviation Institute, University of Nebraska at Omaha, NE 68182

Space tourism is the term that has come to be used to represent the idea that ordinary members of the public are able to purchase tickets and travel to space. Many people find this idea futuristic, but over the past few years, a growing volume of professional work has been done on the subject laying claim that setting up commercial space tourism services is a realistic target for business today. Perhaps "space tourism" is not the correct terminology; perhaps what is really important isn't just the aspect of putting people into space, but making space travel an affordable and efficient operation. Space economics can show us what can be gained by building a robust space transportation system. The question becomes, "How can the space industry bring space travel to the masses by offering fair fares?" While there is not a single solution, perhaps the air cargo industry holds the key. By understanding that payloads do not consist solely of satellites, the space industry can usher in a new era of travel for the masses.

AERONAUTICS & SPACE SCIENCE
POSTER SESSION

AIRBORNE REMOTE SENSING APPLICATION FOR AGRICULTURAL AND THE ENVIRONMENTAL STUDIES

Brian Bronson, Aviation Institute, University of Nebraska at Omaha, NE 68182

The University of Nebraska–Lincoln's (UNL) remote sensing program and the University of Nebraska at Omaha (UNO) Aviation Institute have collaborated in the development of the Nebraska Airborne Remote Sensing Facility. The remote sensing program at UNL consists of approximately 30 faculty members and is very competitive with other institutions in the depth of the work that is accomplished. UNO has strong aviation science and technology programs which facilitate the air operations for the project. The combined strength of these two institutions provides a unique specialized resource for Nebraska and several other States. The development of an airborne remote sensing facility targeted at applications, commercialization, and education programs in the area of precision agriculture provides a valuable opportunity. One primary focus is the use of airborne remote sensing data for estimating agricultural parameters of interest, such as crop stress and soil moisture. Another focus of work is in the area of hail damage to crops, where the ability to rapidly monitor hail-damaged areas and estimate the loss would be a tremendous asset to those in the agricultural industry. The Facility's modified Piper Saratoga accommodates the remote sensing equipment to include, at minimum, the following sensors: Kodak color-infrared digital camera; Analytical Spectral Devices (ASD) spectroradiometer; SPECIM Hyper spectral pushbroom scanner (AISA); NASA Airborne Laser Polarimeter System (ALPS); UNL developed noise radar scatterometer; Canon 2500 digital video camera. The major goal is to enhance the ways in which airborne remote sensing technology can be utilized in agricultural applications, with special consideration given to applications involving precision agriculture and environmental concerns.

UTILIZING GEOSPATIAL TECHNOLOGIES FOR EDUCATION AND OUTREACH ON THE WINNEBAGO AND SANTEE SIOUX INDIAN RESERVATIONS

Karisa Vlasek and Cindy Webb, Aviation Institute, University of Nebraska at Omaha, NE 68182

The NASA Nebraska Space Grant & EPSCoR programs have been successfully partnering on education and outreach initiatives with Native American communities in Nebraska for more than seven years. The overall goal of the program is to improve math and science scores and to keep kids interested in school. In 2004 a new pilot project, Family Geoscience Night, was launched on the Winnebago and Santee Sioux Indian Reservations. The program consists of students, parents, teachers, and often community members gathering for a lesson on geospatial technologies. Students are learning the three basic geospatial technologies; remote sensing, geographic information systems, and the global positioning system. The Nebraska Remote Sensing Program, a partnership between the Center for Advanced Land Management Information Technologies and the Aviation Institute, has allowed access to airborne imagery. Several overflights of the Winnebago and Santee Sioux Reservations have been conducted and utilized in the Family Geoscience Night lessons. The pilot program has produced exciting outcomes, such as community dialogue about the Reservations' resources, increased parental involvement, and student enthusiasm for geospatial technologies and learning.

USING HYPERSPECTRAL IMAGERY TO ADDRESS GRASSLAND CONSERVATION ISSUES IN LANDSCAPES OF THE CENTRAL MISSOURI RIVER VALLEY

Mary Ann Vinton, Biology Department, Creighton University, Omaha, NE 68178; and Joan Ramage, Department of Earth and Environmental Science, Lehigh University, Bethlehem, PA 18015

The landscapes of the Central Missouri River Valley in eastern Nebraska and western Iowa include some of the Midwest's few remaining natural areas. Rugged, steep topography and unstable, loess soils have prevented large scale conversion to row-crop agriculture, especially on the eastern side of the valley, making this region particularly important for preservation. Among the rarest natural landscapes in this region is tallgrass prairie; an ecosystem once blanketing the Midwest, but with less than 1% remaining due to large-scale farming and human settlement. Tallgrass prairie remnants are under threat from non-native, invasive species and lack of requisite fire and grazing regimes under which the native flora and fauna evolved. We used hyperspectral imagery to address conservation issue in this unique landscape. Data were acquired via aircraft and include approximately 20 bands from 440 nm to 850 nm, with fine coverage in portions of the spectrum that are most useful for discriminating vegetation. Ground truthing was done in selected areas and included measurements of plant species composition and abundance. Our results suggest that hyperspectral imagery was successful at 1) discriminating native tallgrass prairie patches from smooth brome fields, 2) describing patch development in bison-grazed prairie and 3) providing an indication of fire history. Remote sensing using hyperspectral imagery is a promising technique to describe and manage this unique landscape.

ANTHROPOLOGY AND GEOGRAPHY

LITHIC FRAGMENTATION: EVALUATING PELCIN'S MODEL OF FLAKE SIZE AS A CORRECTION FOR POST-DEPOSITIONAL MODIFICATION

Matthew J. Douglass, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

Recent experimental knapping studies have greatly increased understanding of the factors responsible for variation in flake attributes. Of particular significance is the finding that characteristics of the striking platform, from which a flake is struck, are largely responsible for the size of the resulting flake. Consequently, it has been demonstrated that these same dimensions can be used to accurately reconstruct original flake size even when the flake has undergone considerable modification. This paper evaluates the utility of these methods as a potential means of characterizing assemblages of chipped stone that have undergone considerable fragmentation as a result of post-depositional processes.

HUMAN IMPACT ON MEGAFAUNA: HISTORICAL AND CONTEMPORARY LOSS OF BIODIVERSITY

Sarah L. Sunderman, Department of Anthropology, University of Nebraska–Lincoln, NE 68502

Over the last 543 million years of earth's geologic time evidence has shown five mass extinctions. Although each has various theorized causes, defining these events as mass extinctions is universally accepted. The parameters of this definition seem vague as contemporary application of the term is problematic. A definition of what constitutes a mass faunal extinction, with consideration of identifying factors in historical extinction periods, is necessary to address the magnitude of impact recent extinctions have on global stability. This paper evaluates the hypotheses for late Pleistocene (18,000 years ago) and early Holocene (10,000 years ago) extinction events, including Martin's overkill hypothesis any popular contradictory hypotheses. Primary objectives include assessment of the magnitude of human impact on these extinction events as well as differentiating between the

types of human influence: ranging from hunting patterns to habitat destruction and range displacement. Specific issues addressed will be North American megafaunal extinction through examination of the archaeological record during the late Pleistocene and early Holocene. Assessment of whether a current mass extinction event is persisting and the implications this may have for both local ecological systems and loss of global diversity is included.

WHAT KILLED THE MEGAFAUNA?

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

The end of the last ice-age brought many changes to the landscape of prehistoric North American. With it came the migration of *Homo sapiens* into the continent. Also the large mammals that had dominated the landscape disappeared in a few short thousands of years; those species that did not die were reduced in size. Numerous answers to the question "What Killed the Megafauna" have been proposed, including over-hunting, climate change, disease, vegetation change, and a host of others. This paper considers the facts and information for and against each theory and reaches a conclusion for the question "What Killed the Megafauna."

HOPEWELLIAN EARTHWORKS OF SOUTHERN OHIO: WHAT THEY CAN TELL US ABOUT THE HUMAN-LANDSCAPE RELATIONSHIP

Erin C. Dempsey and Elizabeth K. Spott, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

Large prehistoric earthworks were once common in North America and were built for centuries, functioning as resting places for the dead and religious and commercial centers. The Hopewell, based in the Ohio Valley, was one of the many cultures to create such earthworks. They have astounded archaeologists for years and while we become closer to understanding the physical form of the earthworks, the function, for the most part, still eludes us. This paper focuses on the correlation between the physical and cultural landscape of Ross County, Ohio, where numerous earthwork sites occur, and also the human-landscape relationship, the reasoning behind building the earthworks, and how archaeology can show the generational differences in the structure of the earthworks.

VIEWSHED ANALYSES OF CAIRNS AT AGATE FOSSIL BEDS NATIONAL MONUMENT

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During a 1994 pedestrian survey of Agate Fossil Beds National Monument in Nebraska, ten confirmed and two probable cairns were found. All of the cairns were located on ridges or buttes and were generally small in size and lower to the ground. There are several possible explanations for the creation of the cairns. These include bison jump paths, natural resource markers, vision quests, territory markers, and fence posts. Using the ArcGIS, viewshed analyses were performed to discover the visible area from each cairn. The data gained from these viewshed analyses will be used to approach an understanding of how the cairns may have been used.

VARIABILITY IN THE CONTEXT AND CONTENT OF BIG HORN SHEEP DEPICTIONS IN THE ROCK ART OF THE DOLORES RIVER VALLEY

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

Aboriginal rock art is found across the globe in a variety of environmental settings. Images are commonly found on cliff faces, boulders, rock shelters, and the inside stone structures. Current archaeological studies have focused on determining the age, cultural affiliation, function, and the motivation for rock art cre-

ation. This paper will attempt to examine the context and content of big horn sheep depictions in the rock art of the Dolores River Valley located in Southwestern Colorado. An analysis of 26 rock art sites using Geographic Information Systems to determine spatial relationships between individual sites along the river and projected big horn sheep habitat will be conducted.

A THREE STATE ELECTION ANALYSIS OF ANTI-GAY MARRIAGE AMENDMENTS: MICHIGAN, OHIO, AND GEORGIA

Ryan Weichelt, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

Even though the 2004 Presidential Election was dominated by debate centered on terrorism and the war in Iraq, the issue of gay marriage became a close second as a top issue facing American voters. A CNN exit poll taken after the 2004 presidential election indicated that interviewed voters were more concerned about issues of morality than terrorism or the war in Iraq. By November 2nd eleven states placed ballot initiatives effectively banning state-sanctioned gay marriages. Democrats argued that these ballot initiatives gave unfair advantages to Republican candidates throughout the eleven states. This paper will examine the issue of anti-gay marriage ballots in three states: Michigan, Ohio, and Georgia. The goal of this paper is to determine if Republican gains were made in each of the states and if the anti-gay marriage ballots had any significant impact on candidate selection and voter turnout for the Presidential candidates in 2004 when compared to the 2000 Presidential Election.

NAMING PRACTICE AMONG THE JU/'HOANSI SAN: MEASURING A CULTURAL PRACTICE

Christine E. Haney, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

The Ju/'hoansi San maintain a cultural tradition of naming among their people. This tradition holds that fathers name their first-born children for paternal grandparents with later children named for maternal grandparents (namesakes). By testing the numbers of children named for paternal and maternal grandparents, we will see if the Ju/'hoansi are in fact following the cultural standard. The hypotheses were analyzed for evidence of the proclivity of this naming process using Nancy Howell's detailed 1968 interview data set. Hypotheses have been drawn to determine if men are more successful in samenaming than women; if male children will have higher rates of samenaming than female children; if men will be more successful in 're-naming' for paternal grandparents than women for maternal grandparents; if live grandparents will have a higher frequency of namesakes; and, if birth order of either the parents or the children will have an affect on the frequency of samenaming. Understanding the answers to these questions may offer insights to the cultural continuity of the Ju/'hoansi with added analysis from further, later data sets. As well, the testing may direct an understanding of the factors leading to any noted variation in following the standard. This may assist in the specific identification of changes in Ju/'hoansi cultural practice over time due to those factors of, for example, sedentization.

NATIVE AMERICANS IN THE TWENTIETH-FIRST CENTURY: ROLES OF SCHOOLS IN MAINTAINING NATIVE CULTURES AND LANGUAGES

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Indigenous peoples worldwide currently face challenges to maintain their cultures and native languages. According to UNESCO, approximately half of over 6,000 languages spoken worldwide are endangered. There has been extensive academic and popular documentation of indigenous peoples' efforts to preserve their

cultures. This paper reviews empirical evidence on schools' attempts to assist Native Americans in maintaining their cultures and languages, addressing the question: can schools contribute effectively to preserving Indian cultures and languages. Data collected from a series of interviews reveal mixed perspectives of a school's function. Overall, there is little empirical evidence to corroborate the roles of schools in maintaining Native American cultures and languages.

FORAGING BEHAVIORS OF *ALLOUATTA PALLIATA*, MANTLED HOWLING MONKEYS

Jeffrey A. Baum, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

Research was conducted at the El Zota biological field station to determine the amount and type of food processing exhibited by *Alouatta palliata* prior to the consumption of food items. Mantled howling monkeys have been labeled as behavioral folivores with some anatomical adaptations to assist in foliage digestion. Primates such as colobus monkeys and gorillas have been observed modifying food items prior to consumption to fit their folivorous nutritional needs. The purpose of this study was to determine if a New World facultative folivore displays any food manipulations and to evaluate differences based on sex based on feeding and foraging behaviors. Results showed no behaviors that could be classified as manipulative to assist in digestion. The types and quantities of food items consumed by El Zota *A. palliata* were consistent with previously published data on the species. *A. palliata* was shown to select food items smaller than their hand. Female selectivity may be greater with regards to food inspection with this species; however, further studies would be necessary to test this finding. A focal sampling methodology was used in the study and 434 full feeding bouts were observed over 32.5 observation hours.

THEORY OF MIND IN CHIMPANZEES: PROBLEMS WITH PRESENT RESEARCH AND DIRECTIONS FOR THE FUTURE

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

The question of whether chimpanzees possess the ability to mentally represent others' mental states produced years of research with little progress. While it is well-established that humans have a "theory of mind," extending this faculty to other species poses a number of theoretical and methodological problems with attempts to understand this phenomenon beyond our own species. The two main camps rely on similar approaches that produce different results. This "either/or" approach forecloses on the possibility of progress in future research of primate cognition, including our own. An alternative should examine the degree to which chimpanzees understand each other as agents.

FEMALE AND MALE PERCEPTIONS OF ATTRACTIVENESS: WHAT IS ATTRACTIVE AND WHY?

Ryan N. Schacht, Department of Anthropology and Geography, University of Nebraska-Lincoln, NE 68588

The reproductive success of an individual is based on not only their genes and ability to invest in an offspring, but also on these characters in their mate. The genetic quality of a potential mating partner can generally be seen through their expressed phenotype. These physical features must be understood and responded to properly for enhanced reproductive success (RS). Undesirable characteristics in a mate must be avoided so not to depress RS and desirable characteristics must be sought out so as to enhance RS. Visual cues regarding mate desirability and RS differ between the sexes and include facial and bodily symmetry, facial feature proportions, age, waist-hip ratio (WHR), body mass index (BMI), as well as other features. All of these

features are the reflection of the fitness of a potential mate as well as their genetic quality. This paper will examine these visual cues for attractiveness, compare and contrast differences between male and female attractiveness, and explain why certain features are more attractive than others.

POSTPARTUM DEPRESSION: AN EVOLUTIONARY PERSPECTIVE

Mark Tracy, Department of Anthropology and Geography, University of Nebraska–Lincoln, NE 68588

There is no common consensus among theorists regarding the nature and purpose of postpartum depression (PPD). Evolutionary theorists have proposed that the onset of PPD is an adaptive function that signals a potential fitness cost to the mother (i.e., the investment in the child will cost more then the evolutionary benefits to be gained from rearing this child). In this paper I outline an evolutionary understanding of PPD and review four cross-cultural studies in an attempt to provide evidence that 1) PPD is universally experienced (under certain conditions) and 2) that an evolutionary perspective can accurately account for the occurrence of PPD.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION A

RAPID IDENTIFICATION OF MEDICALLY IMPORTANT FUNGI USING ION-PAIR REVERSED-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC ANALYSIS (IP-RP-HPLC) OF THE INTERNAL TRANSCRIBE SPACER (ITS) REGIONS

Sarfraz H. Chandio, Department of Computer Sciences, University of Nebraska, Omaha, NE 68106; and Dhundy R. Bastola, Department of Pediatrics and Steven H. Hinrichs, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha, NE 68198

Medically relevant fungi have traditionally been very difficult to identify to the species level. Traditional identification techniques involve macroscopic and microscopic visualization of an actively growing culture. However, use of nucleic acid amplification by Polymerase Chain Reaction (PCR) has allowed for rapid identification of organism with out the need for a growing culture. In the present study, we describe a rapid, sensitive, and specific nucleic acid-based procedure that permits the identification of medically important fungi by PCR amplification of ITS regions. The procedure is further enhanced when it is combined with restriction fragment length polymorphism (RFLP) and a searchable relational database, which allows discrimination among closely related fungal species. PCR amplification was performed with a pair of universal primers selected on the basis of the conserved fungal nucleotide sequence of the 16S and 23S rDNA, which flanks the ITS regions. The RFLP procedure was carried out by digesting the PCR-amplified products with either ClaI or a double digest with XmaI-EagI. The digested samples were analyzed with commercially available IP-RP-HPLC system called the WAVE. The retention time value obtained from the WAVE was put in a relational database and the database made available for query using a graphical user interface (http://phylogeny.ist.unomaha.edu).

Results show that different species of fungi produce fingerprint-retention time pattern and unknown species of medically important fungi can be reliably identified by searching this database with the data obtained from PCR-WAVE analysis.

AN EXAMINATION OF THE MORPHOLOGICAL AND GENETIC DIVERSITY OF A COMMON DRAGONFLY SPECIES (ERYTHEMIS SIMPLICICOLLUS)

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Erythemis simplicicollus, better know as the green pondhawk, is one of the most abundant species of dragonflies in United States. It is a wide-ranging species occurring in 44 of the 48 continental states. The green pondhawk, a major predator of mosquitoes, plays several important roles in the environment.

In the following study, dragonflies were collected from 20 collection sites in five different states. Twenty-five to fifty dragonflies were collected per site. Morphological and genetic data were collected from each dragonfly.

Several morphological characteristics (hind wing size, abdomen length, total body length, and weight) were measured. Female dragonflies were found to be much heavier than both the green males (immature and young reproductively mature males) and the blue males (older reproductively mature males). Differences were also observed among the males. Green males were on average 20-25% lighter than blue males. One possible explanation for the decreased weight in the green males may be that they were constantly traveling between established mating territories. This study shows that there are significant size differences between the different sexes as well as between green and blue male dragonflies.

Genetic diversity was also investigated in these dragonflies. Over twenty-five enzyme (allozyme) systems were investigated. Fourteen enzyme loci were resolved adequately to be scored, using standard allozyme electrophoresis methods. Eleven enzymes were found to be variable among individual dragonflies. The allozymes that showed the greatest variation were: esterase, lactate dehydrogenase, malate dehydrogenase, peptidase, and phosphogluconate dehydrogenase. Genetic variation was observed among each population and among the 20 different collection sites.

In conclusion, the results of this study show significant morphological and genetic differences within the same population and among different populations of the green pondhawk (Erythemis simplicicollus).

BIOACOUSTICAL SIGNALS IN *RANA PRETISOA* AND *RANA LUTEIVENTRIS*: COMPARATIVE ANALYSES OF CALL COMPONENTS

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Vocal signals of *R. pretiosa* from Bend, Deshutes Co., Oregon were recorded in March of 2002 and compared with those of *R. luteiventris* from the Owyhee Mountains, Owyhee Co., Idaho recorded in March and April of 2001. Both species called from submerged pools, confirming underwater signal propagation thus adding two more species of North American ranids to the list of those known to utilize this mode of mate recognition system. Calls of both species were very similar in waveform and produced only one type, a slow snore; a less complicated vocal repertoire than other ranids from the Pacific Northwest. The mean pulse rates were distinct at similar water temperatures revealing an approximate two-fold difference (5.1 pulses per second for pretiosa and 10.6 for *luteiventris*). Female choice experiments in several other anuran species have shown pulse rate to permit females to discriminate between conspecific and non-conspecific males. Our findings are therefore consistent with an earlier conclusion, based on molecular data, recognizing *R. pretiosa luteiventris* as a valid species distinct from *R. pretiosa pretiosa*. One of us (JE) made additional observations confirming that females also vocalize underwater.

BROWN-HEADED COWBIRD HOST SELECTION IN A RIPARIAN COMMUNITY

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I investigated patterns of Brown-headed Cowbird host selection in a small (7,5 ha) riparian community in Keith County, NE. To determine whether parasitism rates are due to factors associated with nest placement or host species-specific traits, I studied a community of 10 host species, with a total number of 76 nests built between May 23 and July 26, 1996. Out of 76 nests, 20 nests (26.3%) were parasitized. The highest percentage of parasitized nests was found in Orchard Oriole (75%) and common Yellowthroat (66.7%). No Brown-headed Cowbird eggs were detected in the nests of Brown Thrasher (2 nests) and Gray Catbird (4 nests). The highest percentage of newly built nests was parasitized in the middle of the breeding season (June 28-30). Distance among nests and nest height was measured to find out association between parasitism rates and nest placement across all 10 species. During the 1996 breeding season I found a negative association across all 10 species between mean height and parasitism rate.

SEPARATION AND MASS SPECTROMETRIC ANALYSIS OF THE CHEMICAL CONSTIUENTS OF THE CHINESE HERBAL TEA SCUTELLERIA BARBATA

Charles E. Freidline, Melinda J. McKenney, and Brian Y. Wong, Union College, Lincoln, NE 68506

Scutelleria barbata is an herb that has been traditionally used in Chinese medicine. Previous data by Wong et al. have shown that *S. barbata* provides probable inhibition against the growth of tumors and current studies suggest tumor-inhibiting activities of *S. barbata* in cultured cell line and mouse models of prostate cancer (unpublished). There are obvious reasons, thus, to focus on this herb as a source for chemicals that combat cancer. The object of this research was to prepare hexane and ether extracts of the aqueous tea and analyze the contents using mass spectrophotometry and various forms of chromatography. Mass spectrometric analysis in conjunction with the use of the commercially available NIST and Wiley chemical libraries has led to the identification of a number of relevant constituents. Some of these include benzaldehyde - which is known to have pharmacological activity, and other aromatic aldehydes. In addition, pharmacologically active chemicals such as 2-heptanone and d-limonene have been identified from the extracts.

BUTTERLY NECTAR PLANT USAGE AT TWO EASTERN NEBRASKA PRAIRIES

Kelly L. Langan and Theodore Burk, Biology Department, Creighton University, Omaha NE 68178-0103

We conducted standard Pollard transects to census butterfly populations at two prairie sites near Omaha in eastern Nebraska. Counts were performed for twenty consecutive weeks from early June to mid-October in 2002, 2003, and 2004. Study sites were Allwine Prairie (a restored prairie owned and managed by the University of Nebraska-Omaha) and Bauermeister Prairie (a prairie remnant owned and managed by the City of Omaha). While conducting these surveys, we recorded all instances of nectar feeding by the butterflies observed, noting the species of butterfly as well as that of the nectar plant. We present information on the nectar plants used by butterfly species of interest, including prairie endemic species, the community of butterflies observed nectaring on individual plant species, differences in plant/butterfly interactions between habitat types at each site. Butterfly usage of native vs. introduced plants will be discussed, as well as effects of flower characteristics (such as color) on butterfly nectaring visits. Between-year differences in usage of particular plant species by specific butterfly species will also be discussed.

BUTTERLY TRANSECT SURVEYS OF THREE SOUTHEASTERN NEBRASKA NATURAL AREAS

Quinton S. Kelly and Theodore Burk, Biology Department, Creighton University, Omaha NE 68178-0103

We conducted standard Pollard transect surveys to census butterfly populations at three natural areas near Lincoln in southeastern Nebraska. The sites were Ninemile Prairie, a native prairie owned and managed by the University of Nebraska-Lincoln; Spring Creek Prairie, a native prairie owned and managed by the Audubon Society; and a restored prairie area at Pioneers Park Nature Center, owned and managed by the City of Lincoln. Surveys were conducted between June and September 2004; each site was censused once every three weeks. Results from 2004 will be compared with those from similar surveys in 2001-2003. We present data on the butterfly communities of each site, the butterfly communities of specific habitat types within sites, habitat preferences of particular butterfly species, and the seasonal phenology of the selected butterfly species. Where sites were managed with controlled burns, the relationship between butterflies numbers and year in the 3-year burn cycle will be discussed. Results from butterfly species of special concern, such as Regal Fritillaries and Monarchs, will be highlighted.

IMMUNOHISTOCHEMICAL ANALYSIS OF AMYLOID PRECURSOR PROTEIN IN THE HIPPOCAMPUS OF MICE FOLLOWING REPEATED MILD TRAUMATIC BRAIN INJURIES

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

The emergence of amyloid ß (peptide) plaques has been found in both Alzheimer's disease (AD) and traumatic brain injury (TBI), and there is some evidence that TBI increases the likelihood of later AD pathology (for review see: Graham et al., 1996 and Selkoe, 2001). The amyloid ß plaques are a result of the cleavage of amyloid precursor protein (APP) by ß - and γ-secretases and are now known to be central to the degeneration of neurons during AD (Plant et al., 2003). Increased expression of precursors to amyloid ß plaques, such as APP, have been found in *pugilistica dementia* (punch-drunk syndrome) (Graham et al., 1996), in severe brain injury in humans (Roberts et al., 1994), and in the controlled cortical impact (CCI) model of brain injury in rats (Ciallella et al., 2002). Ciallella et al. found increased APP levels in rat hippocampal tissue after CCI. The highest levels of APP were nearly double the baseline and occurred one day post-injury, and despite some decrease during the study still remained elevated by about 50% above baseline 28 days post-injury. Multiple mild injuries may produce cumulative damage similar to a single, more severe injury (CDC, 1997). A controlled animal model of repeated mild TBI and its relationship to APP has thus far not been examined. The repetitive nature of the injury may increase APP formation, similar to the effects observed in *pugilistica dementia*. The results from this study may provide a model for investigating pathologies that represent people who have had repeated mild TBIs and may be at greater risk for AD. Therefore, this study examines the expression of APP staining 15 or 30 days post-injury in mice subjected to 0, 1, 4 or 6 mild TBIs. The results will discuss the comparison of APP expression among the experimental groups and the potential implications of any changes in APP expression.

MEASUREMENT OF THE RESPONSE OF OSTEOGENIC CELLS TO MECHANICAL STRESS APPLIED BY AN OPTICAL STRETCHER

Mary Adams, Department of Chemistry, 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. Recently, we have built an optical stretcher to study the mechanical properties of individual cells. High intensity near-infrared laser light conveyed by two

collinear optical fibers forms and optical trap that holds and deforms isolated cells. This instrument allows well defined and controlled mechanical stress to be applied to a single cell and provides a quantitative measure of the mechanical stiffness of an individual cell. Changes in gene expression are then quantified using real RT-PCR. Preliminary RNA analyses and calibration experiments will be discussed.

QUORUM SENSING RESPONSE AND MEMBRANE LIPID COMPOSITION IN *PSEUDOMONAS AERUGINOSA*

Barbara J. Clement, Doane College, Crete, NE 68333

Quorum sensing (QS) is a mechanism by which many prokaryotes are able to sense and respond to the environment by modification of gene expression. Responses are population dependent and are dependent on the presence of an autoinducer molecule (AI), which diffuses across the cell membrane from the environment and elicits modification of gene expression. Such signal reception is critical for the increase in pathogenicity of bacteria such as *P. aeruginosa* during colonization of the lung in cystic fibrosis. To determine the role of membrane lipid composition in QS signal reception, membrane lipid profiles were obtained from cells of log phase *Pseudomonas aeruginosa* strains PAO1 and PAO-JP2 grown under standard laboratory conditions. Membrane lipids were extracted, esterified, identified and quantitated using GC-MS. Profiles from PAO1 and the AI mutant PAO-JP2 were identical, indicating that the AI- strain did not contain altered membrane composition under normal growing conditions. Fresh cultures of PAO-JP2 were then subjected to a variety of stressful growing conditions (low pH, high salt, antibiotics) until the membrane lipid fractions showed a compositional change, indicating that the cells were responding to the environmental stress by modification of membrane lipids. Cultures of PAO-JP2 were grown to log phase under both normal and stressful conditions, AI added to the culture, and the cells incubated for 1 hour. Differences in gene expression between cells grown under normal and stressful conditions were analyzed using DNA microarray analysis, which can detect differences in gene expression between the two treatments.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

DEVELOPMENT OF AN *IN VITRO* MODEL OF BOVINE LEUKEMIA VIRUS INFECTION

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Bovine leukemia virus (BLV) is an exogenous, oncogenic retrovirus that infects cattle. It is closely related to the human T-cell leukemia viruses, although BLV primarily infects B cells rather than T cells. Most BLV-infected cattle remain clinically healthy, but about 30% develop a persistent lymphocytosis, and 2-5% eventually develop lymphosarcoma. In previously published work, we demonstrated a significant increase in the percentage of B cells expressing MHC class II molecules in BLV-infected cattle. In order to investigate the mechanism(s) by which BLV enhances MHC-II expression, an *in vitro* model of BLV infection is now being developed. The target cells for BLV infection in this model are BL-3 cells, a bovine B cell lymphosarcoma cell line, and the source of virus is cell-free supernatant from persistently BLV-infected FLK-BLV cells. BL-3 cells were shown to be initially BLV-negative by PCR, and they became BLV-positive by 7 days after the addition of FLK-BLV supernatant. Currently, the amount of BLV in the FLK-BLV supernatants is being determined by a syncytium assay using CC81 cat cells. BLV titers in FLK-BLV supernatants harvested seven days after passaging the cells appear to be relatively low, approximately 10^2 to 10^3 syncytium forming units per ml. Interestingly, preliminary results also suggest that cell-free supernatant from BLV-infected BL-3 cells contains higher levels of BLV than the original FLK supernatants, suggesting that BLV may be replicating to higher titers in the B cell line. This work was supported by NIH grant number 2P20RR016469-04.

MICROARRAY ANALYSIS REVEALS SHARED GENOME BETWEEN *PARAMECIUM BURSARIA* CHLORELLA VIRUS-1 AND ITS ALGAL HOST

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Paramecium bursaria chlorella virus (PBCV-1) is a large and ancient double-stranded DNA virus that infects the green alga *Chlorella*. The 331 kb genome of PBCV-1 has been sequenced and is comprised of 11 tRNA genes and ~375 large open reading frames (ORFs) that appear to encode proteins. Only 50% of the gene products of these PBVC-1 ORFs have been functionally identified by alignment methods. The ORFs appear to have both prokaryotic and eukaryotic origins, some of which were previously undocumented in any virus. 50-mer single-stranded DNA probes were designed and synthesized for each of the 375 PBVC-1 ORFs and spotted onto microarray slides. Total RNA was extracted from the uninfected algal host, *Chlorella*, reverse transcribed into cDNA and labeled with Cy3 and Cy5 dyes. The algal cDNA was then hybridized to the PBCV-1 DNA microarray probes. Microarray image analysis revealed that approximately 10% of the PBCV-1 genome is shared with the algal host. The shared ORFs have been mapped and functionally identified. This work was supported by NIH grant number 2P20RR016469.

COMPARISION OF BOVINE VIRAL DIARRHEA VIRUS REPLICATION KINETICS IN VITRO USING QUANTITATIVE, REAL-TIME REVERSE-TRANSCRIPTION-OLYMERASE CHAIN REACTION

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Bovine viral diarrhea virus (BVDV) is an important viral pathogen that causes severe economic losses in the cattle industry by infecting the fetus and causing reproduction failure and by immunosuppression due to its lymphotropism. The objective of this study was to determine the replication kinetics of eight BVDV genotype-2 isolates with varying virulence in bovine testicular cells (RD420) by comparing levels of mRNA. A single-tube, fluorogenic probe-based, real-time quantitative reverse transcription-polymerase chain reaction (Q-RT-PCR) assay was used to measure viral mRNA levels in BVDV-infected cell lysates at ten time points (1.5, 3,6, 9, 12, 24, 36, 48, 60, and 72 hours) post-infection. A standard curve of cycle threshold (Ct) versus standard ten-fold serial dilutions of cRNA of known concentration was plotted to quantify the viral mRNA levels. A three hours post-infection a decrease in the level of viral mRNA was recorded in seven to eight isolates. All isolates showed a three-fold log increase in viral mRNA and the plateaued at 36 hours post-infection. Comparative evaluation of the replication kinetics of each isolate based on mRNA levels at each time point will be presented and discussed. Evaluation of the RNA kinetics among various BVDV isolates may help elucidate the pathogenesis of BVDV in the host.

SERUM AMYLOID A (SAA) IN ATHEROGENESIS: AN INNOCENT BYSTANDER OR A GUILTY PERPETRATOR?

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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 SAA are unique among these proteins with their >1000-fold increase within 24 to 48 hr following induction. The biological significance of their massive increase remains unknown. Recent data suggest that that elevated levels of CRP and SAA may relate to the risk of cardiovascular diseases. Whether they are direct participants in disease process or are simply markers of inflammation are not yet clear. Chronically elevated levels of SAA are a prerequisite for the pathogenesis of secondary amyloidosis, a progressive and fatal disease characterized by the deposition in major organs of insoluble AA fibrils proteolytically

cleaved from SAA. It is well known that high levels of HDL and apoA-I, its major apoprotein, are inversely related to the development of atherosclerosis and its fatal consequence, heart disease. Our results focused mainly on SAA[1] have shown that: (1) during the APR in laboratory animals, or in human diseases characterized by high levels of SAA, HDL decrease to <10% of baseline; the remaining particles become enlarged and SAA-enriched, with density heavier than HDL2. (2) HDL containing SAA as the sole apoprotein are produced *in vivo during APR* induced by lipopolysaccharide in apoA-I-containing and apoA-I gene deficient mice. SAA is also produced *in the absence of the APR* by infection of apoA-I gene deficient mice or the rat hepatoma (McArdle RH7777) cells with recombinant adenovirus containing the human SAA1 gene suggesting that SAA is capable of assembling HDL particles independent of apoA-I. (3) All SAA in plasma is lipid-bound. In the presence of apoA-I or apoE, SAA floats in the HDL density range; when both apolipoproteins are absent in the apoA-I/apoE double gene knockout mice, SAA floats with VLDL. (4) SAA may displace from HDL the anti-oxidant, possibly atheroprotective enzyme, paraoxonase, carried in HDL. (5) SAA-HDL with or without other apoproteins bind to proteoglycans, molecules that play critical roles in amyloidogenesis and atherogenesis (7) Recombinant human SAA1 formed fibrils *in vitro* similar to prion proteins as analyzed by atomic force microscopy suggesting that SAA could be deposited in tissues. The relation of SAA to atherosclerosis is further suggested by observations from other laboratories[2] that: (1) SAA may alter the level and function of HDL and displace apoA-I from the particles; (2) During the APR, HDL becomes proatherogenic; (3) SAA apparently binds cholesterol and affects the transfer of cholesterol from the tissues to HDL thereby altering a process called "reverse choleterol transport" for the elimination of excess cholesterol; (4) dietary cholesterol evoked increases in SAA and atherosclerosis in mice; (5) SAA is found in the fatty deposits of blood vessels; (6) SAA is produced by endothelial cells, the cells that line and protect the lumen of blood vessels; (7) SAA induces the migration, adhesion, and infiltration of monocytes, the cells involved in the deposition of fatty streaks in the blood vessels. All these results point to a role of SAA in the initiation/progression of atherosclerosis, possibly involving the disruption of the atheroprotective function of HDL. Elucidation of the molecular mechanism of this as yet unclear process may contribute to preventive and therapeutic interventions in atherogenesis.

[1]The results listed here were mostly from the laboratories of Drs. Veneracion G. Cabana, Catherine A. Reardon and Godfrey S. Getz at the Department of Pathology of the University of Chicago and included in the following publications: Cabana, et al (1989) *J Lipid Research*, 30:39; Cabana, et al. (1996) *J Lipid Research* 37:2662; Cabana, et al. (1999) *J Lipid Research* 40:1090; Cabana, et al. (2004) *Jour Lipid Research*, 45:317; Blackman, et al. (1993) *J Intern Med* 233:201; Cabana, et al. (1997) *Pediatric Research* 42:651; Cabana, et al. (2003) *Jour Lipid Research* 44: 780; Xu, et al. (2005) *Biochemistry*, in press.
[2]Results from other laboratories: Van Lenten et al. (1995) *J Clin Invest* 96:2758; Tam et al. (2002) *J Lipid Res* 43:1410; Lewis et al. (2004) Circulation 110:540; Liang and Sipe (1995) *J Lipid Research* 36:37; Banka et al. (1995) *J Lipid Research* 36:1058; Meek et al. (1994) PNAS 91:3186; Badolatto et al. (1995) *J Immunol* 155:4004; Mahley et al. (1984) *J Lipid Research* 25:1277.

STRUCTURE AND REGULATION OF MUCIN MUC17 IN PANCREATIC CANCER

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Pancreatic adenocarcinoma is a neoplasm with relatively high incidence and an extremely poor prognosis. In order to improve early diagnosis and differentiation between malignant tumors and benign chronic pancreatitis, a screening of mucins was conducted. Among the mucins investigated (MUC1-MUC19), MUC17 and MUC4 appears to be differentially expressed in pancreatic cancer compared to normal pancreas. We hypothesize that MUC17 is associated with pancreatic cancer; therefore, the expression pattern of MUC17

may be a valuable marker for the diagnosis of pancreatic disease. Only a partial sequence of MUC17 was previously known. RACE-PCR was used to complete the full-length coding sequence and the genomic organization of the molecule. MUC17 maps within a cluster of at least three other mucins at chromosome 7q22. The regulatory sequence for the gene was positioned within the cluster between MUC12 and MUC17. Reporter constructs were made to assess the transcriptional influence of this sequence. The gene is transcribed as two alternatively spliced mRNAs that code for membrane-bound and secreted forms of the protein. Southern blotting analyzed the polymorphic Variable Number of Tandem Repeats present in the central domain/extracellular structure. RT-PCR showed expression exclusively in 16 pancreatic adenocarcinoma tissues, whereas no expression was detected in 8 pancreatitis tissues or in 2 normal pancreas samples. MUC17 is aberrantly expressed in pancreatic cancer. Two cell lines, AsPC-1 (pancreatic adenocarcinoma) and LS174 (colorectal adenocarcinoma) are highly positive. A rabbit polyclonal antibody (pAb) was generated for use in western blotting and immunohistochemistry of positive cell lines and pancreatic adenocarcinoma tissue sections. An estimated molecular weight of ~ 510 kD for the MUC17 protein was confirmed. In conclusion, our new results show that MUC17 is aberrantly expressed in pancreatic adenocarcinoma where its exact implication will be determined in the near future.

MUC4 IN PANCREATIC CANCER: FROM DIAGNOSTICS TO THERAPEUTICS

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MUC4 is a membrane-bound mucin, consisting of two subunits, a mucin type subunit known as MUC4 and a growth factor like transmembrane subunit called MUC4ß . The MUC4 mucin is overexpressed in pancreatic cancer while it is undetectable in the normal pancreas. It is also expressed specifically in the PBMCs of the pancreatic cancer patients, making it a valuable tool for diagnostic purpose. Recently, we showed that MUC4 is associated with pancreatic cancer, and the downregulation of MUC4 by siRNA resulted in a reduced tumorigenicity and metastatic potential *in vivo*. To further understand the role of MUC4 in pancreatic cancer, a cell model overexpressing recombinant MUC4 was generated. Since, it was not feasible to clone full length MUC4 in an expression vector because of its large size of mRNA (26.5 kb). Therefore, a construct (mini-MUC4) was designed containing all the unique sequences of MUC4, but the size of the tandem repeat domain represents 10% of the size of the wild-type MUC4. When the mini-MUC4 cDNA was overexpressed in Panc-1 and MiaPaCa (MUC4 negative cell line) the transfected cells mimicked the properties of MUC4 overexpressing cells, including increased tumorigenicity and metastatic potential *in vivo*. Transfection studies of mini-MUC4 in the Capan-1 (MUC4 overexpressing cell line) showed inhibition of endogenous MUC4. All these observation led us to hypothesize that the size of the MUC4 tandem repeat is acting as an inhibitor for endogenous MUC4 expression and can be useful for therapeutic purposes. The following observations strengthen our hypothesis: 1) Inhibition of endogenous MUC4 in the Capan-1 cell line, following transfection with mini-MUC4, 2) the only difference between the endogenous MUC4 and mini-MUC4 is the size of the tandem repeat, and 3) the MUC4 negative cell line harbors the smallest allele of MUC4. To validate our hypothesis, different constructs corresponding to MUC4 domains, like MUC4? , MUC4ß , and MUC4 tandem repeat have been generated in the pSectagC vector. A time course experiment was performed by transient transfection of different domains using an electroporation technique. The MUC4 expression was examined by RT-PCR, Western Blotting, and confocal analysis. The preliminary results showed that the inhibition of endogenous MUC4 is dependent on the size of the tandem repeat and is not cell-type specific. Stable transfection studies in the Capan-1 cell line (showing reduced endogenous MUC4 in the presence of mini-MUC4) exhibited decreased tumorigenicity and metastasis *in vivo*. In conclusion, all of these findings suggest a novel way of inhibiting endogenous MUC4 by using its own sequence repeat in tandem. These studies will be useful in designing inhibitors for MUC4, which can ultimately be used for the treatment of pancreatic cancer.

DO ADAM PROTEINS ENCODED BY THE *mmd* GENE IN *DROSOPHILA MELANOGASTER* POSSESS A CATALYCALLY ACTIVE METALLOPROTEASE?

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ADAMs proteins (proteins with A Disintigren-like And Metalloprotease domain) have the potential to regulate cell-cell and cell-matrix interactions through their disintegrin, metalloprotease and cysteine-rich extracellular domains. Not all ADAMs have active metalloprotease domains however. Those with functional metalloproteases can cleave extracellular and matrix proteins to affect signaling processes. The *mind-meld* gene in *Drosophila* encodes at least four different ADAM protein isoforms that are express in the nervous system of developing and adult animals. It has nearly the consensus for an active metalloprotease. We are testing whether it and site directed mutants that improve the consensus sequence, encode active metalloprotease by constructing Myc-tag fusion proteins, expressing them in COS-7L cells where they are secreted, and then assaying for metalloprotease activity in the media using an alpha-2-macroglobulin-based metalloprotease assay.

FUNCTIONAL ANALYSIS OF NEURONALLY EXPRESSED *MIND-MELD* ADAM PROTEINS

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ADAM proteins are involved in the regulation of cell-cell and cell-matrix interactions, with demonstrated roles in muscle formation, neuronal pathfinding, tumorigenesis, metastases, and cancer progression. ADAM22 is differentially expressed in human gliomas and knockout mutants in mice die as embryos. The *mind-meld* (*mmd*) gene in *Drosophila* is expressed in the nervous system and shares homologous domains with ADAM22. Its primary transcripts are alternatively spliced, and produce three membrane-bound and one secreted protein isoforms. To understand *mmd's* function within the nervous system, we are undertaking a mutational analysis. We are using a targeted gene knockout method utilizing the mechanisms of homologous recombination to analyze *mmd's* loss-of-function phenotype. To assess the role of individual isoforms, we are using RNA-interference to down-regulate mRNAs expressing specific isoforms. Analysis of these *mmd* mutants will help us better understand the role of ADAM proteins in neuronal development and tumor formation.

STRUCTURAL DETERMINANTS OF VIRULENCE IN COXSACKIEVIRUS B3 RNA

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Coxsackievirus B3 (CVB3) is a positive-sense RNA virus responsible for causing myocarditis, pancreatitis, meningitis and possibly type I diabetes. Virulence has been mapped to the 5' nontranslated region (5' NTR) of the viral genome. The 5' NTR is a highly structured region of the CVB3 RNA thought to mediate internal assembly of the translation initiation complex in the host cell by use of an internal ribosomal entry site. An avirulent, infectious isolate of CVB3 called CVB3/GA contains many nucleotide substitutions from the virulent sequence in the 5' NTR that attenuate virulence and reduce replication of the virus in murine cardiomyocytes. I have used chemical modification followed by reverse transcriptase DNA primer extension to detect solvent-exposed and solvent-protected nucleotides in virulent and avirulent CVB3 5'NTR RNA in order to determine structural differences between these two strains that may account for virulence in the virus.

A STRUCTURAL STUDY INVOLVING THE 5'UTR OF COCKSACKIEVIRUS B3

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Infection with Cocksackievirus B3 (CVB3), a picornovirus in the same category as polio, can result in myocarditis and a protracted immune response eventually leading to cardiomyopathy. Our current research is focusing on the effects of the 5' non-translated region (NTR) in virulence and pathogenesis. Specifically, the effects of conformational changes induced by the binding of poly(C) binding protein (PCBP) to stem loop 1 of the 5'NTR. Future studies hope to yield the exact structure of the protein bound NTR through the use of x-ray crystallography. Chemical modifications can then be introduced into the CVB3 sequence to further analyze the effects of PCBP. The pMAL-px2 plasmid was used to express the PCBP bound to 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 wild strain 59 DNA and primers complementary to the 5'NTR were used in a PCR to amplify the stem loop 1 region. mRNA of STL1 was then transcribed using Ambion's MegaSCRIPT kit. The mRNA was then dephosphorylated and end labeled with 32P. Binding reactions and gel electrophoretic mobility shift assays are currently underway. We soon hope to have enough bound complex to be analyzed using x-ray crystallography. The total effects of PCBP in CVB3 virulence will take many further studies to fully understand.

THE ROLE OF SUB2P AS A REGULATOR OF HETEROCHROMATIC AND rDNA SILENCING IN *SACCHAROMYCES CEREVISIAE*

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Overexpression of Sub2p, a Saccharomyces cerevisiae RNA helicase, is capable of overcoming telomeric silencing and acts similarly to its *Drosophila* homolog Hel1. Gene silencing is a normal part of eukaryotic development, and mis-regulation of silencing can affect cell-cycle regulation, differentiation, and genome stability, contributing to cancer.

In addition to affecting silencing at telomeres, it has also been suggested that Sub2p affects silencing at rDNA as well but has the opposite effect where the overexpression of Sub2 reduces rDNA expression (increased silencing). In order to support these findings we used ChIP assays to determine whether the Sub2 protein can be localized to telomeres and rDNA and if this effect on silencing is indirect or direct.

REDOX REGUULATION BY PEROXIREDOXINS AND GLUTATHIONE PEROXIDASES IN *SACCHAROMYCES CEREVISIAE*

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The Yap1 transcription factor and 8 thiol peroxidases (5 peroxiredoxins and 3 glutathione peroxidases) present in yeast cells were cloned and introduced into yeast cells. An HA-tag for the thiol peroxidases and a Myc-tag for Yap1 were implemented to study the interactions between 8 thiol peroxidases and Yap1 through co-immunoprecipitation methods. In order to study the oxidative/reductive responses of these thiol peroxidases, knockout yeast strains were tested for the presence or absence of the desired genes, and will be subjected to oxidative/reductive stimuli.

BIOLOGICAL AND MEDICAL SCIENCES
SESSION C

THE EFFECT OF SALINITY IN IRRIGATION WATER ON GROWTH AND DEVELOPMENT OF DRY EDIBLE BEANS

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Four varieties of dry edible beans were grown in flats of potting soil and watered with solutions containing concentrations of 0, 1000, 2000, 5000, and 7000 ppm NaCl. Growth was measured each week, and the fresh and dry weights of the shoots and fruits were measured at the end of the experiment. The mean height of the plants was plotted and an analysis of variance was performed to identify significant differences. Increasing salinity levels significantly reduced the growth rate of the beans and the mass of both the shoots and the fruits. This is important to agricultural production, especially in arid regions, since continued irrigation can lead to increasing salt accumulation in the soil. This research was supported by the University of Nebraska at Kearney (UNK) College of Natural and Social Sciences and the UNK Biology Department.

A STUDY OF THE ABILITY OF *DROSOPHILA VIRILIS* TO REMOVE *ESCHERICHIA COLI*

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The goal of this study is to explore and more thoroughly understand the ability of *Drosophila virilis* to vector bacterial pathogens. The potential of various flies to vector disease by aiding the transfer of bacteria from waste sources to human subjects has been documented. This experiment is an attempt to further quantify just how effectively *D. virilis* can remove bacteria that it has contracted after landing on a surface containing high levels of *Escherichia coli*. After exposing *D. virilis* to cultures of GFP containing *E. coli*, the flies were allowed to clean themselves for specific time intervals: 0, 2, 5, and 10 minutes. Following the cleaning period, the bacterial contamination on the surface of the flies was quantified by washing the flies in a saline solution and then diluting and plating the resultant solutions on sterile Kanamycin plates. The colonies that resulted were counted and compared using a one-way ANOVA. These numbers show, along with fluorescent images taken of exposed flies, that *D. virilis* is adept at eliminating bacterial contamination and estimates of disease transfer may be inflated. This project was supported by NIH Grant #2 P20 RR16469 from the Nebraska INBRE Program of the National Center for Research Resources, the University of Nebraska at Kearney (UNK) College of Natural and Social Sciences, and the UNK Biology Department.

AN INVESTIGATION OF CARCINOGENS IN COZAD, NEBRASKA

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Many areas across the United States have problems with all types of cancer. One of these locations is Cozad, Nebraska. Through previous research, Cozad has shown increased rates of cancer cases. These cancers could be due to many factors including the waste products, from certain industrial plants, that have leaked into the town's water supply or that are being inhaled by the residents of the town. Water from various areas in and near Cozad will be tested for arsenic, hexavalent chromium, and lead. Concentration levels of contaminates will be compared with accepted safe levels. The results of this water testing will be discussed. By conducting this research, we hopefully will be able to pinpoint the cause or source of the cancer and possibly in the future eliminate that source.

CHARACTERIZATION OF THE ENZYMES IN THE ORAL SECRETION OF THE BURYING BEETLE, *NICROPHORUS MARGINATUS*

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Antibiotic resistant strains of bacterial pathogens have become a global problem. In order to combat these resistant microbes, many scientists are looking at natural products secreted from other organisms for antimicrobial agents. One insect that shows promise is the burying beetle. Previous studies have shown that the oral secretion of the bury beetle, *Nicrophorus marginatus*, contains antimicrobial compounds that are proteinaceous in nature. The aim of this work is to characterize the proteinaceous compound(s) that exist in the oral secretions of the *N. marginatus*. The protein content was quantified by BCA assay. Enzyme assays were then performed in 96 well microtiter plates and by gel electrophoresis procedures using chromogenic and non-chromogenic substrates. From these assays, it was ascertained that the secretion contains alkaline phosphatase, peptidase, and peroxidase. Additional enzyme assays, testing inhibitors against different substrates, were performed. From these assays, it was determined that aspartic proteases and cysteine proteases are present in the secretions. These findings were to be expected since proteases of this type are normally found in insects that feed on blood and tissue. These proteases are generally found in the gut where they would assist in protein digestion. This research was supported by National Institutes of Health grant number 1 P20 RR16469 from the BRIN Program of the National Center for Research Resources, the University of Nebraska at Kearney (UNK) College of Natural and Social Sciences, and the UNK Biology Department.

A GLOBAL STUDY OF GENOMIC INTERRELATIONSHIPS BETWEEN *STAPHYLOCOCCUS AUREUS* ISOLATES CAUSING TOXIC-SHOCK SYNDROME

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Staphylococcus aureus is a bacterium that lives on skin, in the nose, mouth and other mucosal membranes. Most of the time this bacterium is harmless to humans, but when the skin is punctured or broken, it can enter the wound and cause diseases. It is the main cause of nosocomial infections, food poisoning and toxic-shock syndrome (TSS). The objective of this research was to study different S. aureus isolates that have been implicated in causing toxic-shock syndrome to determine the genomic interrelationships between these isolates. The isolates were originally from different countries, including the UK, India and Spain. These isolates were compared with previously studied US isolates. In this study, pulse field gel electrophoresis and DNA sequencing were used to obtain the genomic sequences of the isolates. Multilocus sequence typing was used to assign a sequence type to the isolates and determine the relationship between the isolates. The results showed that some of the isolates were members of the same clone but others were not. This study is important in the genomic characterization of TSS producing *S. aureus*, which is important in understanding the spread of these isolates between patients and treatment of the disease. This research was supported by National Institutes of Health grant number 1 P20 RR16469 from the BRIN Program of the National Center for Research Resources.

A FISH COMMUNITY STUDY OF THREE FARM PONDS IN NORTHEAST NEBRASKA

Brandon Viterna and Marian. Borgmann-Ingwersen, Biology Department, Wayne State College, Wayne, NE 68787

Fish community characteristics of three farm ponds near Verdigre, Nebraska were determined using conventional mark and recapture techniques. Each pond was sampled three times and the fish were marked uniquely for each capture event. Each fish collected was identified, measured, marked and aged. Scale analysis of growth rates will be used to document niche competition as may occur if predators are lacking or resources are limited in some other way. Species diversity indices will indicate the overall productivity and stability of the fish community.

OVERALL HEALTH OF FERAL CATS IN WAYNE, NEBRASKA COMPARED TO DOMESTICATED CATS

Melissa Thiele and Marian Borgmann-Ingwersen, Biology Department, Wayne State College, Wayne, NE 68787

An estimate of the overall health of the feral cat population in Wayne, Nebraska was investigated by examining 27, free-roaming, feral cats. Information was recorded about each cat including weight, approximate age, markings, and a body score. Each cat was then examined for external and internal parasites including earmites, fleas, and intestinal worms. This feral cat sub-population was then compared to house cats using the same parameters.

Initial information indicates that the feral cats harbor the following parasites: roundworms, tapeworms, coccidia, earmites, and fleas and that body scores were usually within the average range except for kittens which tended to be low in weight for their size. It is anticipated that the house cats will have fewer parasites and have body scores at or above normal.

THE PRESENCE OF *LAPPULA FREMONTII* (TORR.) GREENE (BORAGINACEAE) IN THE GREAT PLAINS

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Although the genus *Lappula Moench* (Boraginaceae) contains far fewer species in North America than in the Old World, there has been little agreement as to how many North American species should be recognized. One of these species, *Lappula cenchrusoides* A. Nelson is often not distinguished from the introduced Eurasian *Lappula squarrosa* (Retz.) Dumort. in floristic works. In 2003, over 180 individuals representing at least twelve populations of *L. cenchrusoides* and eight populations of *L. squarrosa* were collected from five states in the northern Great Plains, including the extreme NW portion of Nebraska, and preliminary morphological data suggest that fruit characters can predictably separate the two species, which also differ in habitat and phenology.

In 2004, type specimens of *Echinospermum fremontii* Torr. were borrowed from the New York Botanical Garden. It was determined that the sheet Torrey based his description on is a mixed collection of this entity and *Lappula redowskii* (Hornem.) Greene, collected by John Frémont, supposedly in California. Another specimen included in the original publication was collected by George Suckley along the 47th parallel and represents a complete fruiting specimen of *E. fremontii*. Material observed from the northern Great Plains appears identical to both the fragment on the Frémont sheet and the Suckley specimen. Since *Echinospermum fremontii* predates publication of *L. cenchrusoides* by 39 years, the name *Lappula fremontii* (Torr.) Greene should be applied to specimens from our region that were formerly recognized as *L. cenchrusoides*. Recent field work in Wyoming and Utah yielded specimens that may represent additional entities within this complex, and more work is needed in order to determine which names should be applied to them.

THE STATUS OF *LIPARIS LOESELII* (L.) RICH. (ORCHIDACEAE) IN NEBRASKA

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With 19 recorded occurrences, Nebraska is home to the largest known concentration of *Liparis loeselii* (Loesel's twayblade) in the Great Plains, where it is found primarily in the Nebraska Sandhills and Niobrara River valley. Nebraska populations of this inconspicuous orchid are disjunct from the main range of the species in the formerly glaciated portions of the northeastern U.S. & adjacent Canada. Ten populations have been observed within the last 25 years, with all but one made up of fewer than 10 individuals. *L. loeselii* is a short-lived perennial found primarily in peaty or mucky soils of fens and seeps in Nebraska. It is a poor competitor that thrives on bare, wet, nutrient-poor soils, and requires periodic disturbance to create suitable sites for germination. Its scarcity may be due to a lack of disturbances such as fire and moderate grazing from many of these sites, as well as threats from herbivores and ditching of wetlands. Further inventory of potential habitat and monitoring of known sites is necessary to assess its long-term viability within the state.

THE ANTIMICROBIAL EFFECTS OF *BIDENS ALBA* (L.) DC. VAR. *RADIATA* (SCH. BIP.) R.E. BALLARD, *BIDENS BIPINNATA* L., AND *BIDENS POLYLEPIS* S.F. BLAKE (ASTERACEAE)

Sarah C. Lockwood and Ronald R. Weedon, High Plains Herbarium, Chadron State College, Chadron, NE 69337-2690

The genus *Bidens* L. (beggar-ticks) is distributed throughout the United States and Canada, usually in wet areas. In 2004, material of *Bidens alba* (L.) DC. var. *radiata* (Sch. Bip.) R.E. Ballard from Louisiana and Florida, *Bidens bipinnata* L. from eastern Kansas, and *Bidens polylepis* S.F. Blake from southeastern Nebraska was collected to determine the antimicrobial effects of these species and to generate drug response curves.

The leaves from these plants were ground to a powder which was then autoclaved to prevent the growth of *Bacillus* spp., which has been found on non-autoclaved plant material. *Bacillus* spp. are bacteria that are typically rod shaped and often found in soils. The autoclaved material was used in antimicrobial testing against *Staphylococcus aureus* ATCC#6538, *Escherichia coli* ATCC#13048, and *Candida albicans* ATCC#10231. This experiment was a continuation of previous tests conducted last year with other species of *Bidens* but with the same microbes. Tests were run to determine if there would be inhibition zones around the new plant material after inoculation of petri dishes with *Staphylococcus aureus, Escherichia coli,* and *Candida albicans.*

THE EFFECT OF LIGHT TREATMENTS ON CULTIVATED AMERICAN GINSENG GROWTH

Jennifer A. Baker, Biology Department, University of Nebraska at Omaha, NE 68182

American ginseng (*Panax quinquefolius* L.) is an herbaceous perennial which prefers the heterogeneous light habitat provided by mid- to- late successional deciduous forest. Cultivation for industry commonly occurs in a homogenous shade environment ranging from 5%-20% of ambient light levels. The purpose of this study was to test if variation in light intensity affected growth and survival. Three-year old cultivated ginseng plants were grown under six light treatments. Light treatments varied in the amount of light available and by the heterogeneity of the light. Morphological measurements were used to indicate plant response. Plant height, stem weight, root length and relative chlorophyll were all significantly increased by light level. Exposure to heterogeneous light levels produced significantly longer roots, heavier flowers and increased the root to shoot ratio. Leaf and prong area did not show a significant change but followed the trend of largest leaf areas in moderate and heterogeneous light and the smallest in high, homogeneous light. Chlorophyll a, b and total decreased as light-level increased but were not significant. At the end of the experimental growing season,

survival was similar among light treatments. Although American ginseng is a shade-adapted species, it was tolerant of relatively high light levels (29% full sun) in this experiment. For the morphological traits that showed significant differences among light treatments, the middle light-level (7-19% full sun) and a heterogeneous shade environment were optimal. Understanding the conditions required for *P. quinquefolius* establishment will help preserve natural populations and improve cultivation methods for the ginseng industry.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

BIOFILMS: BIOMARKERS AND MEMBRANES

Troy Barrett, Megan Lohmiller, Tracy Niday 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 (Fuqua C and Greenberg EP, 2002). To form biofilms, 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 (Greenberg EP, 2003; Ganz T, 2003). This mature structure is clinically and agriculturally relevant because biofilms have been shown to be more resistant to antibiotics and clearance by the animal and plant host immune system (Yarwood et al., 2004; Pesci EC and Iglewski BH, 1997). We are interested in developing bioluminescent biomarkers specific to the stages of biofilm development and understanding the role of membrane fatty acids and proteins in biofilm formation by testing the effect of plant tannins and short chain fatty acids (SCFA) on biofilm formation, development and maintenance.

ETHANOL METABOLISM ALTERS STAT1 PHOSPHORYLATION IN RECOMBINANT HEP G2 CELLS

Andrea L. Stieren, Midland Lutheran College, Fremont, NE 68025; and Terrence M. Donohue, Jr., and Natalia Osna, VA Alcohol Research Center, Department of Veterans Affairs Medical Center, Department of Internal Medicine, University of Nebraska Medical Center, Omaha, NE 68198

Background: Interferon gamma is a major pro-inflammatory cytokine naturally released in the lever, and its signal is transduced in cells through the activation of the JAK-STAT1 pathway. Previous studies in our and other laboratories have suggested that ethanol can suppress the pSTAT1/STAT1 ration in Interferon gamma treated VL-17A cells. Purpose: In this study we examined the effects of ethanol exposure on transduction of the interferon gamma signal in two cell lines: ethanol non-metabolizing Hep G2 cells and ethanol metabolizing VL-17A cells. Results: Our results showed that CYP2E1 inhibitors (4-MP and DAS) as well as uric acid, a PN scavenger, reversed the negative effects of ethanol on STAT1 phosphorylation. Our results also showed that VL-17A cells treated with both ethanol and BSO, a glutathione depletor, showed a suppression of STAT1 phosphorylation. The same results were obtained from VL-17A cells treated with SIN1 indicating that the presence of PN causes a suppression of STAT1 phosphorylation.

COLOCALIZATION OF CALCITONIN GENE-RELATED PEPTIDE AND CHOLECYOSTOKININ IN THE ADULT MOUSE INFERIOR OLIVARY COMPLEX

Kathleen G. Tallman, J. Daniels, C. Rupp, and A. Soterin, Biology Department, 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 further investigates possible colocalization using double-labeling immunofluorescence. These data demonstrate faintly double-labeled cell bodies throughout all regions of the inferior olivary complex. In the dc, vlo, and some cells of the caudal MAO and rostral DAO, it is evident that CGRP labels the nucleus, but CCK does not. Double-labeled varicosities are localized to the dc, vlo, the lateral dorsal accessory olive (DAO) and the lateral, caudal MAO. Single-labeled varicosities are also present in these areas. These studies suggest that CGRP and CCK may serve dual as well as independent functions within the IOC. These data serve as a foundation for future studies addressing the functional role of these peptides in the IOC. This publication was made possible by NIH Grant Number P20 RR16469 from the BRIN Program of the National Center for Research Resources.

TRANSCRIPTIONAL REGULATION OF THE HUMAN N-CADHERIN GENE

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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. Only the chicken N-cadherin gene has been studied to date and that work was only a preliminary evaluation. 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. We are also testing luciferase reporter constructs to evaluate the functional role of these hypersensitive sequences *in vitro*. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

FUNCTIONAL MODEL OF THE *APOPTOSIS INHIBITOR-5* IN THE DEVELOPING ZEBRAFISH EMBRYO

Emily Baily and Mathew Bateman, Department of Life Sciences, Chadron State College, Chadron, NE 69337

A recent study has shown that the apoptosis inhibitor 5 (api-5) gene may be involved with fish macrophage hematopoiesis. Because little is actually known about this gene, the aim of this study is to establish the function of the api-5 gene during the development of the zebrafish embryo. The gene was cloned, sequenced, and amplified using a maternal and shield stage library. The gene is shown to be present at the earliest stages of development of the zebrafish.

MODEL OF SCHIZOPHRENIA: DYSBINDIN IN THE DEVELOPING ZEBRAFISH BRAIN

Abby Hielscher and Mathew Bateman, Department of Life Sciences, Chadron State College, Chadron, NE 69337

The dysbindin gene is a novel gene that has been recently found to have a connection with schizophrenia. It has been found that dysbindin in connection with its binding partner ß-dystrobrevin is reduced in presynaptic sites in the hippocampus, an area of the brain associated with memory and learning, in individuals with

schizophrenia. Since the exact function of the dysbindin gene during the development process is not known, the aim of this study is to determine the function of the dysbindin gene during the development of the zebrafish embryo. The zebrafish ortholog of dysbindin and ß-dystrobrevin were cloned and gene sequencing of the genes were performed. Dysbindin and ß-dystrobrevin genes were amplified from a shield stage library. Gene sequencing analysis proved that the genes are highly conserved across species. These results are indicative that the dysbindin and ß-dystrobrevin genes are present during the early stages of zebrafish development, which is critical for neurological patterning and development.

DETECTION OF IGA IN SALIVA OF HHV-8 INFECTED INDIVIDUALS

Suzanne K. Morse, Department of Biology, Chadron State College, Chadron, NE 69337, and University of Nebraska–Lincoln, E249A Beadle, Lincoln, NE 68588-0666

The main focus of the lab is to investigate HHV-8 and HIV-1 virus-host interaction and interaction between these two viruses in transmission and disease. Analyses have been performed for specimens obtained from participants in a longitudinal cohort studying transmission of HHV-8 in patients from Zambia. From these samples, immunohistochemical analyses have been performed to determine the prevalence of secretory IgA in HHV-8 positive saliva samples. The detection of HHV-8 in saliva suggests horizontal transmission from mother to infant. Further tests need to be performed to detect IgA in HHV-8 and HIV-1 positive longitudinal cohorts and also to determine whether HIV-1 infection correlates with IgA titers.

ROLE OF NITRIC OXIDE ON BARRIER PROPERTIES OF THE CAPILLARY BRAIN ENDOTHELIAL CELLS

Ethan Mann, Chadron State College, Chadron, NE 69337; and Donald W. Miller, 986025 Nebraska Medical Center, Omaha, NE 68198

Controlling permeability properties of the Blood Brain Barrier (BBB) is helpful in the delivery of substances into the brain tissue. Specific modulators affect the movement of the molecules and solutes from the blood to the brain across the endothelial cells responsible for maintaining the biological barrier. The effects of nitric oxide (NO) have been shown to increase BBB permeability in stimulated primary culture brain microvessel endothelial cells (BMEC). Examination of the BMEC in the presence of NO inhibitor N-mono-methyl arginine (NMMA) influences basal BMEC monolayer permeability with similar conditions. The unstimulated BMEC are also of interest specifically during inhibition of the NO signaling pathway.

EMERGENCE OF FLUOROQUINOLONE RESISTANCE AMONG *PSEUDOMONAS AERUGINOSA*: IMPACT ON CARBAPENEM SUSCEPTIBILITY

Sean D. Whipple, Biology Department, University of Nebraska at Kearney, NE 68849; and P. D. Lister, Center for Research in Anti-Infectives, Creighton University School of Medicine, Omaha, NE 68178

This study sought to develop an *in vitro* pharmacokinetic model to evaluate pharmacodynamic interactions between antibiotics and *Pseudomonas aeruginosa*. The goal was to examine if the use of fluoroquinolones used to treat *P. aeruginosa* infections led to the selection of mutant subpopulations exhibiting dual resistance to both fluoroquinolones and carbapenems through overexpression of multi-drug efflux pumps. The results demonstrated that fluoroquinolone resistance is more likely to emerge during therapy with levofloxacin than ciprofloxacin. Levofloxacin does not have the propensity to select for dual resistance to both fluoroquinolones and carbapenems. Imipenem and ertapenem hypersusceptibility was likely due to the overproduction of the MexCD-OprJ operon that encodes the multi-drug efflux pump. This research was supported by National Institutes of Health grant number 1 P20 RR16469 from the BRIN Program of the National Center for Research Resources.

CONSTRUCTION AND CHARACTERIZATION OF A CDNA LIBRARY FROM SWITCHGRASS (*PANICUM VIRGATUM*) CALLUS TISSUE

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

Switchgrass (*Panicum virgatum*) is a perennial native grass with significant potential as a bioenergy crop. It is, however, largely uncharacterized at the genomic level. To help with this effort, we have constructed a cDNA library from switchgrass callus tissue. A cDNA library allows one to find what exactly being expressed at the time of tissue extraction. Callus tissue is undifferentiated, and thus there should be a broad range of sequence types upon analysis. For example, we may find genes responsible for rapid growth in the plant, or perhaps find metabolic and regulatory genes. Our cDNA library began by extracting total RNA from 8g of callus tissue. We then isolated mRNA, synthesized cDNA, transformed *E. coli* cells, and then plated the bacteria on selective medium. Our finished library was comprised of approximately 475,000 clones. Once consolidated, our library had a titer of approximately $1x10^{10}$ cfu/mL. We have begun randomly sequencing the 5' end of the clones to make EST's. At the time of this writing, we have analyzed 84 clones, and plan to analyze many more. We plan to present our findings, an overall grouping of the gene types, the functions of their products, and their importance. This project was partially supported by NIH Grant Number 1 P20 RR16469 from the BRIN Program of the National Center for Research Resources, the USDA-ARS Genomics and Gene Discovery Unit (Albany, CA), and the UNK Biology Department.

SEARCH FOR THE *DROSOPHILA MELANOGASTER* ANALOG OF HUMAN KRAB OTK18

Christa M. Sindelar and K.A. Carlson, Biology Department, University of Nebraska at Kearney, NE 68849-1140

Transcription factors are involved in gene regulation. Krüppel-associated boxes (KRAB) are the most common zinc finger transcription factors in the human genome. The human gene OTK18 is a zinc finger/KRAB containing transcription factor. Expression of OTK18 occurs in brain mononuclear phagocytes during the later stages of severe human immunodeficiency virus type one (HIV-1) encephalitis. The *Krüppel* (Kr) gene was found in *Drosophila melanogaster* and is related to human KRAB proteins. In this study, we are studying the relatedness between the human KRAB-containing genes and *Kr* genes of *D. melanogaster*. Southern blot analysis, polymerase chain reaction, and cDNA library screening were used to determine if there is any nucleic acid sequence similarity or evolutionary relationship between the gene families of interest. The results of these analyses will be discussed in detail. The results from this study will provide insights into the evolution of HIV-1 related disease genes. This research was supported by National Institutes of Health grant number 1 P20 RR16469 from the BRIN Program of the National Center for Research Resources, the University of Nebraska at Kearney (UNK) Research Services Council Mini-Grant and Creative Activity Grant, UNK College of Natural and Social Sciences, and the UNK Biology Department.

THE EFFECTS OF VIACTIV® SOFT CALCIUM CHEWS ON CALCIUM ION CONCENTRATION IN SALIVA

Saili Moghe and J. Hertner, Biology Department, University of Nebraska at Kearney, NE 68849

Calcium in saliva is a possible factor in protection against dental decay; therefore the intake of calcium in the diet may be beneficial if it increases the levels of calcium in saliva. The purpose of this study is to determine if there is any significant difference in the concentration of calcium ions in saliva, after the regular intake of calcium in the diet. The source of calcium used is an over-the counter supplement Viactiv® soft calcium chews. Atomic absorption spectroscopy is used to determine the concentration of calcium in the saliva collected. Saliva will be collected from healthy human subjects between the ages of 19-25, before and after the intake of the calcium supplements. Results obtained will be discussed. This research was supported by the University of Nebraska at Kearney (UNK) College of Natural and Social Sciences and the UNK Biology Department.

INFLUENCE OF EXERCISE ON REPAIR ENZYME SYSTEMS IN DIABETES MELLITUS

Karynn Kucera, J.E. Steele, S. Goedeken, Department of Biology, University of Nebraska at Kearney, NE 68849

The diseased heart undergoes a remodeling process that increases the likelihood of ventricular arrhythmias. Recent studies suggest that alterations in K+ channels are involved in this remodeling process. These channels are vital in repolarization and refractoriness, so their remodeling increases the probability of premature reentry. Oxidative stress has been identified as a key factor in this process, and repair enzyme systems, including glutathione and members of the thioredoxin superfamily, have been identified as critical regulators of ion channel function. The hypothesis of this study is that prior exercise training will attenuate the changes in the activity of various repair enzyme systems in the diseased heart and other tissues. Female Sprague-Dawley rats were exercise-trained by following an eight-week swimming regimen. Half these animals and an equal number of age-matched controls were made morbidly diabetic via streptozotocin injection. Two weeks later the animals were sacrificed, and glutathione and thioredoxin repair systems were examined in cardiac, liver, kidney, and skeletal muscle tissue. Preliminary results suggest that exercise training improves the efficiency of these enzyme repair systems in both diabetic and non-diabetic animals. This research was supported by National Institutes of Health grant number 1 P20 RR16469 from the BRIN Program of the National Center for Research Resources, the University of Nebraska at Kearney (UNK) College of Natural and Social Sciences, and the UNK Biology Department.

CONCENTRATIONS OF ADRENAL TESTOSTERONE IN CASTRATED MALE RATS BEFORE AND AFTER EXPOSURE TO A FEMALE IN ESTRUS

Crystal L. Frost and J.E. Steele, Biology Department, University of Nebraska at Kearney, NE 68849

The purpose of this study was to examine the testosterone production by the adrenal cortex in castrated male rats when introduced to female rats in estrus. Five male Sprague Dawley rats were castrated at age 4 weeks once the testes started to descend. The rats were allowed to rest for about a month, and at 8 weeks, a femoral artery catheter was placed in five intact adult male rats and in the castrated male rats. Following recovery from surgery, the rats were exposed for 60 minutes to a female rat in estrus and blood samples were withdrawn before the introduction and at 20 minute intervals for the measurement of plasma testosterone via the ELISA technique. The hypothesis for this experiment was that there would be no elevation of testosterone in castrated males when introduced to females in estrus. This research was supported by National Institutes of Health grant number 1 P20 RR16469 from the BRIN Program of the National Center for Research Resources, the University of Nebraska at Kearney (UNK) Research Services Student Research Grant, UNK College of Natural and Social Sciences, and the UNK Biology Department.

SOURCES OF CALCIUM CONTRIBUTING TO SYNAPTIC TRANSMISSION FROM VERTEBRATE ROD PHOTORECEPTORS

Cory Ciccone, Department of Biology, University Nebraska at Kearney, Kearney, NE 68849; and W.B. Thoreson, Ophthalmology and Pharmacology, University of Nebraska Medical Center, Omaha, NE 68198

The goal of this study was to determine if calcium-induced calcium release (CICR) from intracellular stores contributes to synaptic transmitter release in photoreceptors. Retinal slices were extracted from Tiger Salamanders (Ambystoma tigrinum) and loaded with the calcium-sensitive dye Fluo4-AM. Confocal imaging studies were performed and results suggest that high levels of potassium depolarize the rod cell membrane,

opening calcium channels and stimulating a large calcium influx which causes further calcium release via CICR. Low levels of ryanodine were found to stimulate calcium release, but continued application of ryanodine blocked CICR. Patch clamp studies indicated that ryanodine inhibits light-evoked responses of second order cells yet fails to inhibit rod light responses. In addition, ramp depolarization studies indicate that ryanodine does not affect inward calcium currents. These results support the role of CICR in synaptic transmission in rod photoreceptors. This research was supported by NIH grant # 1 P20 RR 16469 from the BRIN Program of the National Center for Research Resources.

EFFECTIVNESS OF NP COAT FOR PREVENTION OF BOVINE RESPIRATORY DISEASE IN HIGH RISK CALVES

Merle Bierman and C.J. Bicak, Department of Biology, University of Nebraska at Kearney, NE 68849

Bovine respiratory disease (BRD) is an extremely costly disease for the cattle industry. It is the reported to cause up to one third of cattle deaths, having an economic impact of hundreds of millions. This in turn hinders production performance and increases medical and labor costs. Numerous viral and bacterial pathogens are the cause of BRD, and many of these can be isolated from the nasal cavities of healthy cattle. NP Coat® is a new product developed by CAMAS Inc. and is administered intranasally, which coats the nasopharyngeal passages of healthy cattle. This product contains pre-formed antibodies for several pathogens; including infectious bovine rhinotracheitis, bovine viral diarrhea, bovine respiratory syncytial virus, Parainfluenza 3 virus, *Pasteurella multocida, Mannheimia haemolytica, Haemophilus somnus*, and 14 strains of *Mycoplasma bovis*. It is intended to interfere with the adherence and colonization of these pathogens. For this study, 231 calves weighing between 600 and 800 pounds are being tested. Half of the calves were randomly selected to receive NP Coat®, and the other half received a placebo. For the initial treatment, each calf received 1.5cc of either the NP Coat® or the placebo in each nostril. A booster of the same treatment was given ten days later. The calves were monitored and cared for by the Platte Valley Feeders staff who were "blinded" as to the calves that received NP Coat® and those that received placebo. At the end of a 30-day period, the medical records provided by the feedlot will be used to evaluate the calves and a Chi Square test was used to test the significance of the data. The results and data will be discussed. This research was supported by the University of Nebraska at Kearney (UNK) College of Natural and Social Sciences and the UNK Biology Department.

FUNCTIONAL ANNOTATION OF HYPOTHETICAL PROTEINS BY NMR

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From the Human Genomic Project and similar studies, more than 45,000 novel proteins have been identified that need to be characterized structurally and functionally. Accomplishing this daunting goal promises to provide an unprecedented wealth of information on cell biology, development, evolution and physiology. Since sequence homology may only identify function for approximately half of the proteome, new methodologies are necessary to elucidate functions for the vast number of novel proteins being revealed by genomics. The three-dimensional structure of a novel protein provides a general means to assign function by structural similarity to proteins of known function, the approach is comparable to sequence homology methods. The function of protein AF2095 from *Archaeglobus fulgidis* has been assigned as a peptidyl-tRNA hydrolase (Pth2) based on our NMR structure of the protein. Similarly, the biological function of a protein may be inferred from the structural details of its active site and the identity of its natural ligand(s). We are developing a method using multi-step NMR high-throughput screening combined with rapid determination of protein-ligand co-structures to annotate the function of proteins. FAST-NMR (Functional Annotation Screening Technology by NMR) will assign biological function by comparing both active site structures and bound ligands between known and unknown proteins. By using a tiered multi-step NMR protocol, both protein material and instrumentation time can be considerably minimized. A database has been developed that links known protein-ligand structures in the PDB to our functional compound library. We are also developing software to automatically identify binding events and compare protein active-sites based on ligand interactions. We are also developing a protein-ligand binding screen by combining affinity chromatography, mass spectrometry and NMR to augment the FAST-NMR effort by expediting throughput and as a general drug discovery tool. The FAST-NMR procedure has been employed to determine the function of a Northeast Genomics Consortium hypothetical protein, SAV1430 from *Staphylococcus aureus*. The functional annotation of novel proteins and the *in vivo* activity of drug leads are also being evaluated by the application NMR in the analysis of the metabolome. NMR can follow relative changes in the concentration of metabolites from whole cell extracts to follow changes in the activity of proteins as a result of drug activity or mutation.

APPLYING MULTIVARIATE AND PATTERN RECOGNITION METHODS TO EVALUATE THE MOLECULAR PROPERTIES OF A HOMOLOGOUS SERIES OF NITROGEN MUSTARD AGENTS

Ronald Bartzatt and Laura Donigan, Department of Chemistry, Medicinal Chemistry Laboratory, University of Nebraska at Omaha, NE 68182

A homologous series of nitrogen mustard (N-mustard) agents was formed by inserting one to nine methylene groups (-CH2-) between two N-mustard groups. The parent compound being tetrakis(2-chloroethyl)hydrazine undergoes substantial changes in pharmacological properties upon the addition of an aliphatic carbon chain dividing the two N-mustard groups. The addition of an aliphatic chain of methylene groups forms a homologous series of similar alkylating agents. Molecular properties of the series were calculated and shown to have significant correlations and associations. Multivariate and pattern recognition techniques were utilized to analyze molecular properties, including hierarchical classification, cluster analysis, nonmetricmultidimensional scaling, detrended correspondence analysis, K-means cluster analysis, discriminant analysis, multiple regression, and self-organizing tree algorithm (SOTA) analysis. Detrended correspondence analysis showed a linear-like association of the nine homologs having from one to nine methylene groups within an aliphatic carbon chain. Hierarchical classification showed that individual homologs have great similarity to at least one other member of the series, as did cluster analysis utilizing paired-group distance measure.

Nonmetricmultidimensional scaling was able to identify associations that showed homologs 2 and 3 (by number of methylene groups) grouped, homologs 4, 5, and 6 into the identical group, and homologs 7, 8, and 9 into an identical group. Discriminant analysis, K-means cluster analysis, and hierarchical classification distinguished the high molecular weight homologs from low molecular weight series members. As the number of methylene groups increased the aqueous solubility decreased, dermal permeation coefficient increased, Log P increased, molar volume increased, parachor increased, and index of refraction decreased. Multiple regression analysis was performed to develop three regression equations to predict similar drugs utilizing properties such as molar volume, parachor, and molar refractivity

STRUCTURAL STUDIES OF CPRK FROM DESULFITOBACTERIUM DEHALOGENANS

Jodi M. Ryter and A. Krueger, Department of Chemistry, Nebraska Wesleyan University, Lincoln, NE 68504; and B. Biehl, S. Pop, and S. W. Ragsdale, Department of Biochemistry, University of Nebraska–Lincoln, NE 68588

Desulfitobacterium dehalogenans is an anaerobic microbe that can harvest energy by coupling reductive dehalogenation of chloroaromatic substrates to an electron transport chain in a process called dehalorespiration. The cpr gene cluster is an eight-gene cluster that is induced when anaerobes sense chlorinated aromatic compounds in their environment, many of which are environmental pollutants. Transcriptional regulation of the *cpr* gene cluster is controlled by CprK, a member of the CRP-FNR superfamily of transcriptional regulators. It has been shown this protein only binds DNA under anaerobic conditions and is redox regulated, active only when reduced. CprK utilizes the unique effector 3-chloro-4-hydroxyphenyacetate (CHPA). A structural study of the effector-mediated allosteric control of the conformation and activity of CprK has been undertaken utilizing X-ray crystallography, and the structural basis of the unique effector-effector domain interaction, as well as the CprK-*cpr* promoter region will be examined. This work was supported by NIH grant number P20 RR 16469.

STRUCTURAL CHARACTERIZATION OF A METABOLITE-RESPONSIVE RIBOZYME

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

Cellular metabolism typically involves protein-mediated regulation of gene expression either through transcriptional or translational control. Recent studies, however, have identified a class of messenger RNA (mRNA) catalysts called riboswitches that exhibit activity only in the presence of a specific metabolite. Increased cellular concentration of the metabolite initiates internal structural changes in riboswitch domains that function to down-regulate genes responsible for the production of the metabolite. Most structural changes in riboswitch domains result in transcriptional termination or translational repression. A novel catalytic riboswitch has been identified in the 5'-untranslated region of the *glmS* mRNA of numerous Gram-positive bacteria. The *glmS* riboswitch selectively recognizes and is 1000-fold activated by glucosamine-6-phosphate, the metabolic product of the GlmS enzyme. The binding of glucosamine-6-phosphate to the ribozyme initiates an internal phosphoester transfer reaction that results in self-cleavage and inactivation of the mRNA. Biochemical analysis of the structure of this molecule will provide better understanding of its function in the process of gene expression. Using Nucleotide Analog Interference Mapping (NAIM) we have identified important metal binding sites and essential functional groups in the catalytic riboswitch. In our studies of a *glmS* riboswitch from *Bacillus cereus* our data indicate that the natural, full-length ribozyme is stabilized by peripherally folded domains within the RNA. Whereas a minimal ribozyme core has an increased need for metal ions as well as a differing group of essential nucleotide functional groups.

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.

STRUCTURAL CHARACTERIZATION OF LIGAND RECOGNITION AND ACTIVATION OF A METABOLITE-RESPONSIVE RIBOZYME

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

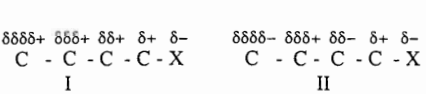
The metabolic state of a cell typically affects gene expression through protein-mediated mechanisms of transcriptional or translational control. Yet recent studies have shown that messenger RNAs (mRNAs) can directly sense and respond to specific metabolites through intrinsic domains termed riboswitches. In the presence of metabolites, structural changes in riboswitch domains can result in either transcriptional termination or translational repression. Recently a novel catalytic riboswitch has been discovered that exerts genetic control through self-cleavage of the nascent RNA in response to cellular metabolite concentration. The metabolite-dependent ribozyme resides in the 5'-untranslated region of the *glmS* mRNA of numerous Gram-positive bacteria and it catalyzes an internal phosphoester transfer reaction that results in cleavage and inactivation of the mRNA. The ribozyme selectively recognizes and is 1000-fold activated by glucosamine-6-phosphate, the metabolic product of the GlmS enzyme, and an important component of bacterial cell walls. We are interested in understanding the molecular basis of ligand recognition and catalysis by the *glmS* riboswitch. To address this we measured the rate of self-cleavage of the ribozyme/riboswitch in response to a panel of related but distinct ligands, serinol, glucose and glucosamine, to name a few. We have determined that the ribozyme makes important contacts to the amine and phosphate in the natural ligand. We are interested in determining how these two functional groups are interacting with the full-length *glmS* ribozyme in order to fully understand its role in 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.

THE INDUCTIVE EFFECT IN ORGANIC CHEMISTRY, PART II

C. A. Kingsbury, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

The basic problem is the validity of the classic Lewis-Ingold model for the inductive effect (I) vs. the more recent Pople-Gordon model (II). A previous lecture gave evidence for some tendency toward alternation of induced charge, but neither model seemed completely consistent with the data.



I II

The present work concerns one line of evidence for the classic model, the decreasing acidity of halocarboxylic acids, as fluorine becomes more distant from the carboxylic acid group, i.e. 2F > 3F > 4F. However, the acidity is entropy dominated. Calculations were done at the B3LYP/6-311+G(2d,p) level and lower levels. The emphasis is on conformational effects and on solvation models. In the ipcm aqueous solution model at DK = 78, the effect of fluorine in the 2,3, and 4 positions of butanoic acid showed results resembling the classical model. However, the gas phase model showed conformational effects that were consistent with a dominant ion-dipole interaction. The effect of fluorine substitution on other "acids" such as butyl boranes and ammonium salts is reported.

A NEW MECHANISM FOR NUCLEOPHILIC AROMATIC PHOTOSUBSTITUTIONS PARA-TO-NITRO IN NITROPHENYL ETHERS

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

The large class of nucleophilic aromatic photosubstitutions; typified by reactions of nitrophenyl ethers are well understood for displacements meta to the nitro group. They are best interpreted by the energy gap law for radiationless transitions. The photodisplacements para-to-nitro have been enigmatic, most often being interpreted by a single electron transfer from nucleophile to excited nitroaromatic followed by radical coupling to form the para-to-nitro sigma complex. We present evidence from direct NMR detection of predictable side products and intermediates that casts doubt on the radical mechanism. We propose an alternative, namely, meta attack by the nucleophile and fast [1,6] sigmatropic rearrangement to form the para sigma complex.

FURTHER ZINC METAL REDUCTIONS OF ALKYNES

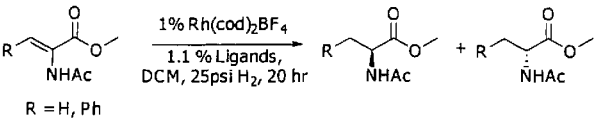
Erin Johnson and Don Kaufman, Department of Chemistry, University of Nebraska at Kearney, NE 68849-1150

We have continued to explore alkyne reductions with powdered zinc in the presence of various proton donors. Alkynes of current interest are those which are reduced to the corresponding alkene. It has been found that the stereochemistry of the alkene depends upon the acidity of the reaction medium. For example, the trans alkene predominates in hydrochloric acid solutions while the cis isomer predominates when acetic acid is used. Additional results will be reported along with possible mechanistic implications.

RHODIUM-CATALYZED ASYMMETRIC HYDROGENATION USING MONODENTATE AND SELF-ASSEMBLED LIGANDS

Kittichai Chaiseeda, Shin A. Moteki, Di Wu, Kusum L. Chandra, D. Sahadeva Reddy, and James M. Takacs, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Combinations of chiral and achiral monodentate ligands with Rh(cod)2BF4 have been used in the rhodium-catalyzed asymmetric hydrogenation of methyl 2-acetamidoacrylate and methyl 2-acetamidocinnamate providing products with up to 94% enantiomeric excess. Self-assembled ligands (SAL), constructed based on the results obtained with the corresponding monodentate ligands, are being investigated in an effort to further improve the level of enantioselectivity. The results obtained thus far demonstrate that the nature of the SAL scaffold significantly impacts the yield and enantiomeric excess of the reaction.



XPS AND AES OF $Ni_{1-x}Zn_xO$ SOLID SOLUTIONS

Anne Starace, Sarah Petitto, Harry Garcia-Flores, and Dr. Marjorie Langell, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

$Ni_{1-x}Zn_xO$ forms a solid solution for approximately $0 \leq x \leq 0.4$. The rocksalt oxide contains octahedrally coordinated Zn^{2+} and presents an unusual chemical environment for the zinc ion. $Ni_{1-x}Zn_xO$ solid solutions were prepared over the range of concentrations and X-ray diffraction (XRD) was used to confirm the single-phase nature of the bulk. Auger electron spectroscopy (AES) and X-ray photoelectron spectroscopy (XPS) were then employed to study the surface composition and chemical environment. Over the range where solutions are formed, the zinc environment is significantly different than that found for ZnO as determined by XPS, and the environment is analyzed by Auger parameter calculations. The interactions of methanol with the $Ni_{1-x}Zn_xO$ surface were also examined using AES and XPS.

SURFACE CHARACTERIZATION OF SINGLE CRYSTAL COBALT OXIDE SPINEL SURFACES

E. M. Marsh, S. C. Petitto, M. A. Langell, College of Arts and Sciences, University of Nebraska–Lincoln, NE 68588-0304

The surface properties of Co_3O_4 spinel are of interest because of its use as a partial oxidation catalyst. The bulk Co_3O_4 structure can be written stoichiometrically as $[Co^{2+}][Co^{3+}]_2[O^{2-}]_4$, with cobalt 2+ cations occupying tetrahedral sites and the cobalt 3+ cations occupying octahedral sites within a face-centered cubic oxygen lattice. The faces of the Co_3O_4 single crystal naturally terminate with well-ordered (110) and (111) planes. Single crystal Co_3O_4 spinel surface characterization is reported here using complimentary surface sensitive techniques, which provide a more complete picture of the surface integrity. Auger electron spectroscopy (AES) is used to determine the cleanliness of the sample and its stoichiometry, X-ray photoelectron spectroscopy (XPS) provides information about the composition of the sample and the chemical environment of the lattice ions, and low energy electron diffraction (LEED) establishes the order of the surface and its two-dimensional surface structure.

AB INITIO COMPUTATIONAL STUDIES OF STRUCTURE AND ENERGETICS OF SINGLE WALLED ARMCHAIR AND ZIGZAG CARBON NANOTUBES

Kristy L. Kounovsky, P. A. Karr, and A. Krause, Wayne State College, Wayne, NE 68787; and F. D'Souza and M.E. Zandler, Wichita State University, Wichita, KS 67260-0051

Utilizing the commonly used exchange-correlation functional B3LYP coupled with the 3-21G basis set as implemented in the Gaussian 03 software suite, we have investigated the frontier molecular orbitals and energies of armchair and zigzag nanotubes. The frontier molecular orbitals, visualized by Gaussview, were compared to the semiconductor/metallic characteristics of carbon nanotubes as described by Charlier[1]. By varying the carbon nanotube structure, the following effects were investigated: (1) the comparison of the HOMO-LUMO gap and the semiconductor/metal characteristics from the equation (n-m)/3, (2) the relationship between the number of atoms and the energies of the carbon nanotubes, (3) the fixed diameter energies of the SWNT compared to the length, and (4) the energies versus the length to diameter ratio.

(1) Charlier, J. C., *Defects in Carbon Nanotubes*; Acc. Chem. Res., **2002**, 35, 1063-1069.

AB INITIO COMPUTATIONAL STUDIES OF STRUCTURE AND ENERGETICS OF QUINONE/ HYDROQUINONE HYDROGEN BONDED SYSTEMS

Paul. A. Karr and M. D. Beck, Wayne State College, Wayne, NE 68787; and F. D'Souza and M.E. Zandler, Wichita State University, Wichita, KS 67260-0051

Quinone/hydroquine hydrogen bonded systems form an important bio-mimicry model and may also be used as quinone or hydroquinone chemical sensors. Insight into the nature of the bonding in these self assembled systems can provide valuable insights into biological systems as well as computational model chemistry/basis set combinations. HF and DFT model chemistries coupled with basis sets varying from minimal to diffuse polarized were used to analyze the self assembled quinhydrone systems. Selected frontier molecular orbitals were visualized with the Gaussview software, HOMO-LUMO gap energies were compared to oxidation-reduction potentials, and counterpoise calculations run for analysis of the Basis Set Superposition Error (BSSE).

SYNTHETIC PEROXIDES AS ANTIMALARIALS: PROGRESS SINCE THE DISCOVERY OF ARTEMISININ

Jonathon L. Vennerstrom, College of Pharmacy, University of Nebraska Medical Center, Omaha, NE 68198-6025

The discovery of artemisinin in 1971 initiated a new era in malaria chemotherapy. Although the clinically useful semisynthetic artemisinin derivatives are rapid acting and potent antimalarial drugs, they have short half-lives and must be administered over a period of 5-7 days, leading to noncompliance and recrudescence. With this in view, many synthetic antimalarial peroxides have been prepared. Yet, identification of synthetic peroxides that are easily synthesized, inexpensive, and that have good biopharmaceutical properties has been surprisingly difficult. In this talk, we document the pitfalls and progress made in this endeavor and highlight the discovery of a novel secondary ozonide (1,2,4-trioxolane) drug development candidate.

EFFECTS OF VARYING SALT CONCENTRATIONS ON APTAMER BINDING IN SOLUTION

Annette C. Moser and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Clinical immunoassays often incorporate affinity ligands for the extraction and detection of target compounds. Currently, antibodies are used for this purpose due to their specificity and high affinity. Aptamers are another group of ligands which could be used in clinical assays since they also exhibit good specificity and affinity towards their target compounds. In addition, aptamers can be synthesized *in vitro* without the use of animals and have greater stability than antibodies. Aptamers consist of single-stranded DNA or RNA with tertiary structures capable of recognizing and binding particular analytes. Before aptamers can be used in clinical studies, their association rate constant (k_a), dissociation rate constant (k_d), and equilibrium constant (K) must first be compared with antibodies. Since aptamers can be developed in a variety of buffers, the ionic strength of the binding buffer can be very important. Furthermore, the phosphate backbone is highly charged, making its tertiary structure somewhat dependent upon the salt concentration. In this study, the k_a, k_d, and K of a thyroxine aptamer were determined under a variety of salt concentrations (10 mM Tris-HCl, pH 7.6, 1 mM MgCl2, with 0.1 - 1.0 M NaCl or LiCl) and compared with those of an anti-thyroxine antibody.

DEVELOPMENT OF AFFINITY MONOLITHS FOR ULTRA-FAST IMMUNOEXTRACTION

Tao Jiang, Rangan Mallik, David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Affinity monoliths based on a copolymer of glycidyl methacrylate and ethylene dimethacrylate were developed for ultrafast immunoextractions. Rabbit immunoglobulin G (IgG) and anti-FITC antibodies were used as model ligands for this work. The antibody content of the monoliths was optimized by varying both the polymerization and immobilization conditions for preparing such supports. The temperature and porogen composition used during polymerization showed significant effects on monolith morphology and on the amount of antibodies that could be coupled to these materials. The effects of various immobilization procedures and coupling conditions were also evaluated, including the coupling temperature, pH, protein concentration and use of high buffer concentrations. The maximum ligand density obtained for rabbit IgG was approximately 60 mg/g. When using a 1 mm x 4.5 mm I.D. monolith containing anti-FITC antibodies, 95% extraction of fluorescein was achieved in 100 ms. These properties make such monoliths attractive for work in the rapid isolation of analytes from biological samples.

ANALYSIS OF FREE HORMONE FRACTIONS BY AN ULTRAFAST IMMUNOEXTRACTION/ DISPLACEMENT IMMUNOASSAY: STUDIES USING FREE THYROXINE AS A MODEL SYSTEM

John E. Schiel, William Clarke, Annette Moser, and David S. Hage, Chemistry Department, University of Nebraska–Lincoln, NE 68588

A system was developed for measuring the noncomplexed or free fraction of a hormone in serum based on the combined use of ultrafast immunoextraction with a chromatographic displacement immunoassay. This approach was tested using L-thyroxine as a model analyte. Items considered in the development of this technique included the choice of immunoassay format and the selection of conditions for the removal of thyroxine's free fraction from samples without significant interference from its protein bound fraction. The final method had an effective extraction time of 90 ms and allowed the amount of free thyroxine to be determined within 30 s after sample injections. The limit of detection was 6 pM (S/N = 3) for a 100-uL sample, and the linear response extended up to at least 100 pM. This technique gave good correlation versus reference methods when used for the determination of free thyroxine in serum samples. Advantages of this method included its speed and its ability to analyze a sample with no pretreatment other than standard filtration. The same approach could be adapted for other hormones or drugs by using appropriate antibodies and labeled analogues for such agents.

CHARACTERIZATION OF GLYCATION SITES ON HSA BY MALDI-TOF MS USING MULTIPLE ENZYMATIC DIGESTION AND ZIPTIP FRACTIONATION

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

A protocol for identification of glycation sites on proteins by matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) is described. In this method, proteins are digested by three kinds of enzymes (trypsin, endoproteinase Lys-C and endoproteinase Glu-C). Each enzymatic digest was then fractionated by using a ZipTip, followed by analysis with MALDI-TOF MS. It was found that the combination use of multiple enzymatic digestion and ZipTip fractionation increases the sequence coverage greatly. The general value of this strategy is illustrated by the analysis of non-glycated human serum albumin (HSA) and the identification of glycation sites on HSA. The sequence coverage of HSA was 94.5% with this approach. For glycated HSA, new glycation sites were found using this protocol.

AN AUTOMATED METHOD FOR THE DIRECT DETERMINATION OF FREE DRUG FRACTIONS USING AFFINITY CHROMATOGRAPHY AND MASS SPECTROMETRY

Corey M. Ohnmacht, Chad Briscoe, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

The free fraction of a drug is the portion of the drug not bound to proteins. It is believed to be the fraction that can elicit a therapeutic effect. This ratio of free to bound fraction can change due to illness, trauma, and age leading to the possibility of overdose. Recently a novel means to directly measure free drugs has been developed incorporating on-line affinity chromatography and mass spectrometry for detection. This method provides fast, accurate and precise data when compared to current methods like equilibrium dialysis and ultrafiltration. Briefly, the free drug fraction is extracted from the sample in the millisecond time scale and detected using electrospray mass spectrometry. The measurement of dissociation rate constants is needed in order to determine the time required to extract the free drug in solution before its protein complexes begin to dissociate. Chromatographic peak profiling has been successfully used to determine the dissociation rate constant for carbamazepine with the protein human serum albumin as being 1.13 s^{-1}. Column residence times of less than 180 milliseconds have resulted in greater than 80% extraction efficiency of the free fraction for carbamazepine. Detection limits well below the therapeutic range for the steady-state plasma concentration of 13 to 32 nM for carbamazepine have been observed using an API 4000 triple quadrupule mass spectrometer utilizing electrospray ionization. The use of an internal surface reversed phase trapping column to remove phosphate prior to entering the mass spectrometer resulted in no loss of signal. Automation has been successfully accomplished using a Cohesive HTLC System interfaced to the mass spectrometer with a total analysis time of less than 20 minutes per sample.

INFRARED MICROSCOPY OF EXPLOSIVE RESIDUES

Lancia N.F. Darville and David Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Infrared (IR) microscopy has grown in popularity over the past few years due to its versatility and ease of use. It has been widely accepted in the analytical area as a qualitative and quantitative research tool that provides direct molecular information on the materials being studied. It has also found promising applications in forensics and homeland security. The advantages gained by this method include its need for only limited sample preparation, its non-destructive nature, its short analysis times and its ability to do morphological characterization, such as size and shape analysis.

Analyses of explosive compounds such as diphenylamine, 2,4-dinitrotoluene and nitrobenzene using infrared microscopy have shown similar spectral results to those obtained by a conventional FT-IR instrument. The IR microscope, like the conventional FT-IR, has the capability to differentiate between isomers such as 2,4-dinitrotoluene and 2,6-dinitrotoluene. Unlike conventional FT-IR, the IR microscope can also give information on the specific sizes and shapes of each explosive compound, which provides more specific characterization. The IR microscope is also capable of recognizing mixtures. A mixture of diphenylamine and 2,4-dinitrotoluene exhibited characteristic peaks of each compound. Due to the specificity of the IR microscope a library of explosive compounds and smokeless powders has been created.

IMMOBILIZATION OF α_1-ACID GLYCOPROTEIN FOR CHROMATOGRAPHIC STUDIES OF DRUG-PROTEIN BINDING

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

α_1-Acid glycoprotein (also known as AGP or orosomucoid) is a serum protein that is known to bind many basic and neutral substances in blood. Many techniques have been used to examine the binding of drugs to AGP, such as ultrafiltration, ultracentrifugation and equilibrium dialysis. In this report a new method is described for the preparation of immobilized AGP support for use in chromatographic studies of drug-protein binding. In this approach, periodate is used under mild conditions to oxidize the carbohydrate chains in AGP for attachment to a hydrazide-activated support. This method is evaluated by using it to attach AGP to HPLC-grade silica for use in high performance affinity chromatography and self-competition zonal elution studies. In work with R- and S-propranolol, only one type of binding site for both enantiomers was observed on the immobilized AGP, in agreement with previous observations made with soluble AGP. The association equilibrium constants measured for the immobilized AGP with R- and S-propranolol at pH 7.4 and 37°C were $2.7 \times 10^6\ M^{-1}$ and $4.2 \times 10^6\ M^{-1}$, respectively. Studies performed at 5 to 37°C gave linear van't Hoff plots for R- and S-propranolol, also indicating that only one site on the immobilized AGP was binding to these agents. Work performed with other drugs gave similar agreement between the behavior seen for immobilized AGP and soluble AGP.

CHEMISTRY AND PHYSICS

PHYSICS

1905: EINSTEIN'S *ANNUS MIRABILIS*

Robert E. Kennedy, Department Of Physics, Creighton University, Omaha, NE 68178

1666 is noted as Isaac Newton's "annus mirabilis" (miracle year) for his three major works: laying the foundation for calculus, the theory of colors, and his theory of gravitation (including mechanics). Similarly, 1905 is noted as Albert Einstein's *annus mirabilis* for his three major works: establishing the reality of atoms, establishing the quanta of radiation, and the special theory of relativity. Contrary to popular lore, the focus of the paper on atoms was not to explain Brownian motion, the focus of the paper on the quanta was not to explain the photoelectric effect, and the focus of the paper on the special theory of relativity was not to explain the Michelson-Morley experiment. This talk will discuss Einstein's focus in these papers and their significance to the physics community.

DID A UNIVERSITY OF NEBRASKA EXPERIMENT INFLUENCE EINSTEIN'S THEORY OF RELATIVITY?

M. Eugene Rudd and Roger D. Kirby, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68588-0111

In 1887 DeWitt Bristol Brace, with a Ph.D. in physics from the University of Berlin, came to the University of Nebraska where he founded the Physics Department and carried out a program of research that took him to the forefront of the world of physics by the time of his untimely death in 1905. His experimental work on the effect of ether drift on double refraction, published in 1904, was the most sensitive experiment ever done at the time and its result, quite likely known by Einstein, may well have been an influence on his development of the Theory of Relativity published the following year.

THE HAFELE-KEATING EXERIMENT: FIRST DIRECT CONFIRMATION OF TIME DILATION, PERFORMED ON COMMERCIAL JET FLIGHTS BY A CREIGHTON UNIVERSITY GRADUATE

Thomas H. Zepf, Department of Physics, Creighton University, Omaha, NE 68178

During October 1971, Astronomer Richard E. Keating, then in the Time Service Division of the U.S. Naval Observatory in Washington, D.C., and Physicist Joseph C. Hafele, then an assistant professor at Washington University in St. Louis, flew four cesium beam atomic clocks around the world on commercial jet flights to check the validity of the time dilation prediction of Einstein's relativity theory. The clocks, flown once eastward and once westward, recorded directionally dependent time differences relative to the atomic time scale of the U.S. Naval Observatory. Their results, in good agreement with theory, provided an empirical resolution of the famous clock "paradox" using macroscopic clocks. A brief overview of the experiment and its results will be presented. Of particular local interest is that Richard Keating grew up in St. Paul, NE, and graduated in 1963 with a major in physics from Creighton University. Reminiscences of him at Creighton and local news coverage of the experiment will be presented.

TESTING EINSTEIN'S TWIST: THE RELATIVITY GYROSCOPE EXPERIMENT

Dan Wilkins, Department of Physics, University of Nebraska at Omaha, NE 68182-0266

Gravity Probe-B, the long-awaited test of Einstein's General Relativity, has finally gotten off the launch pad. After 40 years of development and delays, and $700 million in funding, the probe blasted off from Vandenberg Air Force Base onboard a Delta II rocket on April 20, 2004. The entire mission is planned to last 16-18 months. The probe carries 4 ultra precise gyroscopes, and a telescope that can fix on a guide star. It is able to test to unprecedented accuracy two miniscule swiveling motions predicted for the gyroscopes: the geodetic effect (6.6 arcsec/yr), and frame dragging (0.042 arcsec/yr). The geodetic effect reflects warping of spacetime by the mass of the Earth. The frame-dragging effect reflects the twisting of spacetime near the Earth induced by the planet's spin. I will review the design of the probe, tell what it can reveal about the nature of gravity, and report on the current progress of the mission. (Gravity Probe-B is a joint project of Stanford University, the Lockheed Martin Company, and NASA.)

THE 2004 TRANSIT OF VENUS - THE ROMANCE AND THE SCIENCE

Kenneth E. Kissell, Astro-Metrology Group, Department of Physics, University of Maryland, College Park, MD 20742

A rare astronomical event occurred in early June of last year, a transit of Venus (passage of Venus between the Earth and the Sun) seen only for the sixth time since Kepler predicted its occurrences prior to his death in 1630. Only 5 people saw it in 1639, while perhaps 5 billions may have seen TV broadcasts of it in 2004. It will occur again in 2012, and then not again for 120 years. During the early development of the mechanics and modeling of the solar system, transits of Venus played a key motivating role in planetary astronomy, and in the geographical exploration of the Earth leading to voyages by Capt. Cook in the 1760s and to attempts by the US Naval Observatory to organize field surveyors, laying out early railroads across the Western States, to measure the contact times of the 1882 transit so as to aid in the calculation of the Astronomical Unit (Earth-to-Sun distance) to an accuracy of better than a few percent. This 19th- century opportunity to observe a Venus transit occurred before the invention of most tools of astronomy and astrophysics, including astrophotography. Some of this history will be reviewed and images obtained in 2004 across Asia and Europe will be summarized, pointing toward its exploitation in future transits of extra-solar planets.

ZENITH ANGLE DEPENDENCE OF PROMPT MUON AND NEUTRINO FLUXES IN HIGH ENERGY COSMIC RAY SHOWERS

Louis A. Licate and Gintaras K. Duda, Department of Physics, Creighton University, Omaha, NE 68178

Upon entering Earth's atmosphere, high energy cosmic rays generate a shower of particles in which high energy muons and neutrinos are created. These high energy ($> 10^6$ TeV) particles can mimic signals coming from astrophysical sources currently hunted for by neutrino telescopes. In particular, the prompt component of such showers is important as prompt muons and neutrinos dominate over conventional particles at higher energies. We simulate the flux of prompt muons and neutrinos using pQCD calculations with NLO corrections to charm production cross sections. Prompt muon and neutrino fluxes for UHECR with non-zero zenith angles will be presented. Implications for backgrounds at neutrino telescopes will also be discussed.

LASER INDUCED HEATING IN THE OPTICAL STRETCHER

Joseph M. Huff and Michael G. Nichols, Department of Physics, Creighton University, Omaha, NE 68178

It is well known that light can be used to trap and stretch biological cells as a means of studying intracellular activities that are not well understood. The use of optical trapping systems is growing and the environmental changes, specifically temperature increase, occurring inside the trapping region are poorly understood. Heat generation inside the focused beam trap has been modeled but a diverging beam trap has not. The purpose of this paper is to investigate the difference in heat generation of a focused beam trap and a diverging beam trap with particular boundary conditions implemented.

Support for this work is provided by N.I.H.-Inbre.

COHERENT ρ^0 PRODUCTION IN ULTRA-PERIPHERAL HEAVY ION COLLISIONS

Michael G. Swanger and Janet E. Seger, Department of Physics, Creighton University, Omaha, NE 68178

The STAR (Solenoidal Tracker at RHIC) detector is located at the Relativistic Heavy-Ion Collider (RHIC) at Brookhaven National Laboratory. STAR has collected data for gold-gold ion collisions with a center of mass energy of 130 and 200 GeV per nucleon. When these gold ions pass close to each other, but do not overlap, it is referred to as an ultra-peripheral collision (UPC). In UPC's, intense electromagnetic fields created between the two ions can produce various particles. The most frequently observed is the rho-meson. A cross section for rho production at 130 GeV per nucleon has been published. A similar analysis of the 200 GeV per nucleon data taken in 2001 has begun. I will discuss the ongoing analysis and compare it with previous data.

Support for this work is provided by the Office of Science, U.S. Department of Energy.

JET TRIGGER STUDIES FOR ALICE

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

An overview of jet trigger studies for the proposed electromagnetic calorimeter for the ALICE detector at CERN will be presented. Simulations of particle jets, collimated groups of particles, are used to study possible triggers to select relevant ultra-relativistic heavy ion collisions for use in later analyses. In particular, the efficiency of various selection criteria and the biases that these criteria may impose on the data will be discussed.

Support for this work is provided by the Office of Science, U.S. Department of Energy.

COMPARING INTENSITY RATIOS OF L-SHELL X-RAYS TO THEORY VALUES FOR ELEMENTS RANGING FROM Z=39 TO Z=50

Jacob S. Hervert and Sam J. Cipolla, Department of Physics, Creighton University, Omaha, NE 68178

When atoms in an element are bombarded by x-rays, it is possible for orbiting electrons to be freed, causing a need for the resulting vacancies to be filled. As other electrons make transitions to fill those vacancies, photons of a specific energy are created as a result. The energy spectra that result are specific to that atom. The measured x-ray spectra are then used to calculate the theoretical intensity ratios for the range of elements of Z=39 to Z=50. The goal of this research is to measure the L sub-shell transitions for L_l, L_α, and $L_{\alpha 2,15}$ using Fe^{55} as an x-ray source. The measured intensity ratios will be compared to theoretical predictions.

EARTH SCIENCE

HYDROLOGICAL PROCESSES OF THE SAND HILLS OF NEBRASKA-A VIEWPOINT

Venkataramana Sridhar, School of Natural Resources, University of Nebraska–Lincoln, NE 68588

The Sand Hills of Nebraska, covering an area of about 58,000 km^2, is the largest grass-stabilized sand dune area in the Northern Hemisphere. Knowledge about evapotranspiration (ET) not only aids our understanding on the linkages between soil water characteristics and the water budget but also benefits our long-term plan of studying the vulnerability of the Sand Hills to extreme conditions. Using the high-resolution land cover dataset from Landsat Thematic Mapper (TM) and grass-based reference ET computation of Penman-Monteith scheme, ET was estimated at 30 m resolution for the Sand Hills. The results showed that daily estimated values of ET of approximately 2 mm/day, 6 mm/day and 3 mm/day for the initial, mid and end of the crop growing season. However, the aggregated results at coarser resolutions using common geospatial methods indicated that, the aggregation technique to get the regional estimates is quite important.

In order to evaluate the Sand Hills hydrology, a modified scheme of the Thornthwaite and Mather model was employed to estimate the water balance components and to characterize the water status over the Sand Hills region. Based on observed precipitation and estimated reference ET, additional water balance components were derived including accumulated potential water loss, soil moisture storage, actual ET, deficit, surplus and available runoff. The magnitude of estimated reference ET showed drastic increase between Feb-Jul, followed by a sharp decline between Aug- Nov. The accumulation of potential water loss started in April-May and thus, showing negative values for the remaining period of the year. Given the higher demand of water by the plants in the early and mid-growing season, higher utilization of soil moisture during this time is reasonable, as reflected in high values of actual ET for the same period. By combining the land cover types with site-wise water balance estimates, area-weighted water balance was computed for the Sand Hills. The results suggested that soil moisture deficit existed for all months except April and May as well as there were periods of soil moisture recharge between March-April, which is normally pre-growing and or greening-up period. Furthermore, when the annual precipitation was only 380 mm for this region, the question of sub-surface and surface water interaction can be potential. An overview of the methodology, analysis and results will be presented.

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

Brandi B. Bracht, Sheri C. Fritz, and Lora R. Stevens, Department of Geosciences, University of Nebraska–Lincoln, NE 68588

Long-term limnological and ecological changes in the Rocky Mountain region can be caused by changing climate. Here we use changes in the diatom species composition of a sediment core from Crevice Lake, Yellowstone National Park to infer changes in limnological conditions driven by climate change. Sediment samples from long cores, spanning the past 2000 years, were analyzed for diatom assemblage changes. Throughout this period, 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.

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. Prior to 800 yrs B.P., *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. The most dramatic change in species assemblage occurs just prior to the onset of the Little Ice Age, as shown by the sudden shift in species dominance.

COMPARISON OF THE TRACE FOSSIL DAIMONELIX WITH MODERN BURROWS OF THE BLACK-TAILED PRAIRIE DOG

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The trace Fossil "*Daimonelix*" was first noted by E.H. Barbour around Harrison, Nebraska, in 1891. Since then there have been numerous interpretations of their nature and origin, spiraling direction, mode of excavation and the animal responsible for their excavation. This study is a comparison of burrow features in size, nature, and spacing between the trace fossil *Daimonelix* and the burrows of the black-tailed prairie dog *Cynomys ludovicianus*. *Daimonelix* may have been the result of colonial dwelling of its maker, *Palaeocastor*, similar to that of modern *Cynomys*. Results of this study show that burrows of both *Palaeocastor* and *Cynomys* were spaced out at around 3-4 meters. Daimonelix averages 11.7 cm in diameter with an opening of 14.2 cm, while *Cynomys* burrows average 10.4 cm in diameter with an opening of 13.7 cm.

THE LAGOMORPH PALAEOLAGUS FROM THE ORELLAN MEMBER OF THE BRULE FORMATION, TOADSTOOL PARK, NEBRASKA

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Two genera of lagomorphs have long been recognized as Orellan inhabitants of the Nebraska panhandle: *Palaeolagus* and *Megalagus* of the subfamily Palaeolaginae. However, species have not been recognized up to this point. Specimens collected from Toadstool Park near Crawford, Nebraska, were studied to find species. The dominant species in the Toadstool Orellan collection appears to be *Palaeolagus temnodon*. The Toadstool population is very similar to the P. temnodon population at Flagstaff Rim, Wyoming, described by Emry and Gawne (1986) and those at Pipestone Springs and Three Forks, Montana Dawson (1958). This species' geologic age ranges from Chadronian to early Oligocene. Distinguishing characteristics include lower crowned cheek-teeth and lower maxillary tuberosities. This project is still ongoing as not all species of Palaeolagus have been compared to the Toadstool collection and no species has been suggested for the *Megalagus* population up to this point.

VISIBLE LIGHT SPECTROMETRY AS AN AID TO ROCK COLOR IN THE FIELD

Michelle Long, Department of Geosciences, Chadron State College, Chadron NE 69337

Rock color is used as a distinctive characteristic in identifying and describing individual rocks and rock units. However, rock color is highly subjective and many variables may lead to incorrect rock color analysis. Primarily, rock color has been compared to the Munsell Color Chart in the field. This study was conducted to find out if a portable spectrometer could reduce the amount of uncertainty and human error related to rock color analysis in the field, and if this method would be useful in correlating rock units. An ALTA Reflectance Spectrometer was used in acquiring the color analysis data. The results of this study show that in many cases, spectrometry can increase the repeatability of rock color measurements.

HISTORY AND PHILOSOPHY OF SCIECE

NEW AND EMERGING INFECTIONS: THE CREATION OF GENETIC VARIATIONS IN VIRULENCE OF *STREPTOCOCCAL A* AND *ESCHERICHIA COLI* O157:H7

Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha, NE 68124-2377

Many years ago it would have been common practice to suggest to students studying medicine that mutation in bacteria was not very common. A popular medical school textbook, by Topley and Wilson, published in 1946 said: "The application to bacteria of terms that have been coined to express changes in form or function occurring in higher plants or animals is not without its dangers, and it is possible that there is little real justification for the use of such a term as mutation, in connection with the variations which bacteria may undergo". Such caution is not surprising for medical science in 1946. The mutational origin of bacterial variations had been demonstrated only a few years earlier, in 1943.

This presentation will deal with the revival of Group A *streptococcal* (GAS) diseases and pathogenic *Escherichia coli* O157:H7.

MULTIPLE PATHS TO CRITICAL REFLECTION: A FLEXIBLE MODEL OF TEACHER LEARNING AND ITS IMPACT ON 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, Omaha, NE 68131

Traditional evaluations of professional development programs focus on teacher perceptions of the experiences. 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 study was to evaluate the impact of a flexible but intensive teacher development program on teacher change and on student achievement in mathematics and science. 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 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.

At the time of this writing the project is in the fifth year of the award. To date, 60 of the 83 Omaha Public Schools and a total of 427 teachers have actively engaged in the USP initiative. This research is based on the first three cohorts of schools (34) and teachers (166), from which full sets of data were collected. 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. To date, 10 of these schools have been named Exemplary, based on consistent improvement of student understanding across grade levels as demonstrated on Criterion Referenced Tests. 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.

A BRIEF HISTORY OF THE DEVELOPMENTS IN THE FIELD OF MORPHOLOGY AND HUMAN DEVELOPMENT

Claire M. Oswald, Biology Department, College of Saint Mary, Omaha, NE 68124-2377

The year 2000 celebrated not only a Jubilee year, but also the centenary of quantum physics, of Mendelian genetics, and the bicentenary of morphology. During the amazing scientific period of the 1800's, significant ideas entered the Western contemplation of Nature, one historical, the other developmental. The ideas provided a modern aspect to the Aristotelian, or more importantly, neo-Platonic views of nature which dominated the field of biology until the beginning of the nineteenth century. A brief overview of the developments that have taken place in morphology will be presented.

COLLEGIATE ACADEMY

BIOLOGY

SESSION A

CRYSTALLIZATION OF A TETRANUCLEOTIDE REPEAT RNA: IMPLICATIONS TO MYOTONIC DYSTROPHY TYPE 2 (DM2)

Matthew D. Shortridge, Nebraska Wesleyan University, Lincoln, NE 68504; and J. Lounge and J.A. Berglund, Institute of Molecular Biology University of Oregon, Eugene, OR 97403

Myotonic dystrophy is a dominantly inherited multisystemic disorder and is the most prevalent form of muscular dystrophy in adults. The disorder affects 1/8000 people with clinical features including: myotonia, cardiac arrhythmias, cataracts, and insulin insensitivity leading to type 2 diabetes. The unique combination of clinical features is an expression of the unique pathological mechanism of the disorder. Both forms of myotonic dystrophy (DM1 and DM2) are caused by a gain-of-function RNA mechanism, in which CUG (DM1) and CCUG (DM2) repeat expansions, within respected genes, effect cellular functions such as alternative splicing. To understand what this RNA gain-of-function mechanism looks like, we attempt to crystallize a CCUG repeat expansion for structural studies using X-ray crystallography.

PC12 CELLS AS A MODEL FOR THE STUDY OF CATHECHOLAMINE SECRETION

Heather A. Hergott, Nebraska Wesleyan University, Lincoln, NE 68504; and T. Luke and T. Hexum, University of Nebraska Medical Center, Omaha, NE 68198-6545

PC12 cells can be used to study the mechanism of secretion of catecholamines. This study examines the ability of a nicotine derivative, DMPP, to enhance secretion of [^{3}H]norepinephrine on both chromaffin cells and PC12 cells. A dependent relationship was found to exist between the increase secretion of [^{3}H]norepinephrine and the increase in DMPP concentration with a greater DMPP concentration leading to more [^{3}H]norepinephrine secreted from both the chromaffin and PC12 cells. Although it was found that both chromaffin and PC12 cells respond to an increase in DMPP concentration by increasing their secretion of [^{3}H]norepinephrine, chromaffin cells were found to be more affected by the increase in DMPP concentration.

ANALYSIS OF P16 AS A CANDIDATE GENE FOR EMCA1, A GENETIC MODIFIER OF ESTROGEN-INDUCED MAMMARY CANCER IN THE ACI RAT

Erin M. Hughes, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504; and Beverly Shaffer and James Shull, Department of Genetics, Cell Biology, and Anatomy, University of Nebraska Medical Center, Omaha, NE 68198

Estrogens have been hypothesized to contribute to breast cancer etiology by increasing the rate of mammary cell proliferation, thereby promoting the accumulation of somatic mutations. Dr. Jim Shull's lab at UNMC has demonstrated that the female ACI rat strain exhibits a unique propensity to develop mammary cancers when treated continuously with physiological levels of 17B-estradiol (E2). In contrast, the Brown Norway rat is highly resistant to developing E2-induced mammary cancer when subjected to the same physiological levels of E2. Linkage analysis of progeny from mating the two rat strains identified a region on chromosome 5 (named *Emca1*) that modifies susceptibility to E2-induced mammary cancer and harbors the p16 gene. Previous human studies suggested that p16 was decreased in breast tumors compared to normal breast tissue. Based on these findings, our hypothesis is that p16 mRNA expression will be decreased in the ACI rat strain mammary tumor tissue compared to non-tumor tissue. Quantitative Reverse Transcription Real Time PCR (Q-RT-PCR) analysis showed increased expression of p16 mRNA in tumor tissue compared to non-tumor tissue. Microarray analysis was done to determine gene differences associated with the p16-estrogen pathway between E2 treated ACI, BN, and genetically developed *Emca1* rat strain, which has the BN allele of *Emca1* introgressed onto an ACI background. Preliminary analysis of micrarray results shows differential expression in many genes between each of the three strains. Of particular interest are the increased mRNA expressions of cyclin D1 and CDK4 genes when comparing ACI and *Emca1* strains to the BN. Both genes are associated with the p16-Estrogen pathway. P16 mRNA expression levels were too low to detect with microarray analysis. This work was supported by the NIH grant number 2P20RR016469-04.

DIFFERENTIAL GENE EXPRESSION IN B-CELL LYMPHOMA

Jamie Gilmore, J.S. Joshi, Doug Christensen, and Shawn Pearcy, Wayne State College, Wayne, NE 68787 and University of Nebraska Medical Center, Omaha, NE 68198

Studying the difference between cancerous and non-cancerous cells could be instrumental in finding a cure to B-cell Chronic Lymphocytic Leukemia (B-CLL), or other cancers. In this study, various genes were examined in order to find the differential expression between cancer cells and a normal Universal Reference (Stratogene) sample. These samples were compared using Clontech microarrays, and each gene was examined to determine if it was differentially expressed. From these results, genes that were differentially expressed in cancer cells were chosen to do further research on their possible contribution to B-cell Lymphoma. To do this,

iRNA for the various genes found was obtained. Then, a highly metastatic murine cell line, RAW117-H10, was grown in culture. The iRNA was then added to the cells, and its affects on the growth of the cells was recorded. This research was funded by the Nebraska IN-BRE Grant Number: 2 P20 RR016469-04.

GENETIC EFFECT OF EXPRESSION OF HUMAN DEAMINASES AID AND APOBEC3G IN YEAST

Elizabeth R. Worrall, College of Saint Mary, Omaha, NE 68124

Cytidine deamination is the alteration of genetic information by the conversion of cytidine to uridine. A recent study showed that both innate immunity to retroviruses and humoral immunity require cytidine deaminases. APOBEC3G deaminates cytidine in retroviral cDNA to stop retrociruses from infecting further. Activation-induced deaminase (AID) is involved in antibody gene diversification. AID deaminates cytosine in DNA in immunoglobulin gene regions in B-cells, which is required for somatic hypermutation (SHM), gene conversion (GC), and class switch recombination (CSR). Using the expression vector pESC-Leu we explored the genetic effects of expression of human deaminases AID and APOBEC3G in yeast. We constructed yeast strains expressing AID and APOBEC3G and verified protein production by Western Blot. Expression of both deaminases cause uracil DNA glycosylase (Ung enzyme)-dependent induction of mutations: the mutagenic effect is much stronger in the *ung 1*⁻ strain. We also found that specificity of mutator effects is different between AID and APOBEC3G.

TRANSCRIPTIONAL REGULATION OF THE HUMAN N-CADHERIN GENE

Josh Smith and Kate Marley, Biology Department, Doane College, Crete, NE 68333

Cadherins are single chain transmembrane glycoproteins that mediate calcium-dependant cell-cell adhesion. Early cancer research revealed that underexpression of E-cadherin caused increased motility in breast cancer cells. Research done by Nieman (1999) showed that the upregulation of N-cadherin promoted increased motility and invasiveness regardless of E-cadherin expression in some breast cancer cell lines. The aim of our research is to map the DNase I hypersensitive sites of the N-cadherin gene, to determine likely sites where regulatory proteins are binding to the DNA promoter. In order to do the DNase I hypersensitive site studies our lab has done some preliminary cloning of the probe fragment of the N-cadherin gene from a bacterial artificial chromosome (BAC). This has been harder than expected due to the low yield of the large size BAC from bacterial cultures. This low yield gets to be an even larger problem as only 4 kb of the promoter region is cut from the BAC for use in cloning the fragment into a reporter plasmid. Difficulties with this cloning procedure as well as preliminary DNase I hypersensitive site data will be presented. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

INCIDENCE OF ANESTHESIA RELATED DENTAL INJURY AND THE IDENTIFICATION OF FACTORS THAT INCREASE THE LIKELIHOOD OF INJURY

Jill R. Russell, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504; and Myrna C. Newland, Sheila J. Ellis, K. Reed Peters, Jean Simonson, Tim Durham, and John H. Tinker, Department of Anesthesiology, University of Nebraska Medical Center, Omaha, NE 68198

Anesthesia related dental injury is one of the most common complaints against anesthesia providers. Previous studies have noted several characteristics that increase the likelihood of injury, including pre-existing dental conditions, obesity, diabetes, rheumatoid arthritis, previous difficulty of tracheal intubation and limited cervical range of motion. Studies have also estimated the frequency with which dental injury occurs, reporting incidence values ranging from 3.4 in 10,000 to 111 in 10,000. In the present study, cases of dental injury were

identified by anesthesia providers at the time of injury and recorded in an anesthesia database. Each incidence of injury was matched with two patients who underwent anesthesia on the same date without dental injury. Data collection forms were completed for all cases and controls detailing information regarding patient demographics, ASA physical status, operation, type of airway management, degree of difficulty of intubation and other airway devices utilized. Cases were further reviewed for information regarding the discovery, classification and follow-up of the injury. Based on this analysis, 78 cases of dental injury were identified in the 14 year period between August 14, 1989, and December 31, 2003, for an incidence of approximately one injury in 2,000 cases of general anesthesia. Factors that appeared to be predictive of dental injury included the degree of difficulty of intubation, the existence of dental problems prior to surgery, upper caps and use of an oral airway.

VIRUS-INDUCED GENE SILENCING USED TO IDENTIFY PLANT GENES THAT FUNCTION IN DISEASE RESISTANCE

Jessica R. Betten, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504

Pathogen attack can have a negative impact on plants. To better understand plant-pathogen interactions, work is being done to identify genes that may play a role in plant disease resistance. One method of approaching this subject is to use a technique known as virus-induced gene silencing (VIGS). This technique allows one to silence specific genes so that the function of each gene may be studied in a reverse genetics approach. I determined that VIGS is an effective technique to use for *N. benthamiana*, and I established two control groups using VIGS. The phytoene desaturase (PDS) gene and the N gene were successfully silenced in *N.benthamiana* plants. Plants with a silenced PDS gene established a time-line for gene silencing, while the plants with a silenced N gene served as a positive control. In the future, additional genes will be silenced in an attempt to discover a gene or group of genes that may grant disease resistance to an individual plant.

EFFECTS OF THE GLUCOCORTICOID ASTHMA DRUG ON EPIDERMAL GROWTH FACTOR RECEPTORS IN THE AIRWAY CELLS

Jennifer A. Mihaljevic, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504; and M.L. Toews and N.A. Schulte, University of Nebraska Medical Center, Omaha, NE 68198

Previous studies have shown that excessive binding of the epidermal growth factor to the epidermal growth factor receptor causes an increase in the proliferation of the human airway smooth muscle cells. The proliferation of the human airway smooth muscle cells is a characteristic feature of asthma. Currently, glucocorticoids and beta-agonists are the most effective means in treating asthma. The effects of glucocorticoids on the epidermal growth factor receptor are currently unknown. In this study, we examined the effects of two glucocorticoids on the epidermal growth factor receptor in various cell lines. Dexamethasone caused an increase in the ^{125}I-EGF binding in human airway smooth muscle cells, bronchial epithelial cells and A549 lung cancer cells. Fluticasone caused an increase in bronchial epithelial cells and A549 lung cancer cells, but did not increase ^{125}I-EGF binding in human airway smooth muscle cells. In conclusion, more studies need to be done to determine the severity of the effects of dexamethasone on the increase in ^{125}I-EGF binding in human airways smooth muscle cells.

CRYOPRESERVATION IN BOVINE OVIDUCT EPITHELIAL CELLS BY VITRIFICATION USING THE OPEN-PULL STRAW METHOD

Ann Janesch, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504

Cryopreservation of sperm and embryos is important to the conservation and reproduction of many domestic animals as well as endangered animals especially those present in zoos around the world. Cryopreservation is especially important in the preservation of sperm and embryos during transportation. It is

thought that oviduct epithelial cells possess certain nutrients that are important for embryo development especially during transportation. As of yet a protocol for the cryopreservation of these cells has not been developed. In this experiment vitrification using the OPS method that is employed for embryo cryopreservation was used for the freezing of bovine epithelial cells to address this issue. After thawing of the cells the survival rate was observed. Three trials were run using the same method to determine if the cells were viable post freezing and thawing. In all three trials the survival rate for the bovine epithelial cells was zero. Thus, another method must be employed to successfully cryopreserve epithelial cells to benefit from their use in embryo transfer.

COMPARATIVE IRRIGATION OF *ZEA MAIZE*

Ella Ruf, Biology Department, Doane College, Crete, NE 68333

A comparative study was conducted to analyze irrigation methods based on their water use efficiency and crop production for corn, *Zea maize*. The study was conducted in southwest Nebraska comparing flood (gravitational), center pivot (with drop nozzles), and subsurface drip irrigation methods. The results presented that drip irrigation used between 30% and 60% less water while still producing a comparable yield to that of both center pivot and flood irrigation methods.

ALLOCHTHONOUS INPUT EFFECTS ON THE BACTERIAL COMMUNITY OF AN AQUATIC MESOCOSM

Lynette A. Pauly, College of Saint Mary, Omaha, NE 68124

The emergence of periodical cicadas constitutes a substantial and rare allochthonous nutrient and energy input into small ponds and streams. To our knowledge, fluxes of nutrients by means of dead cicada bodies have not been quantified, nor have their effects on recipient aquatic ecosystems. We examined the relationship between sudden allochthonous input (i.e. dead cicada bodies) and bacterial richness in aquatic mesocosms to mimic small ponds. Our hypothesis was that sudden input of dead cicada bodies will have an effect on the bacterial community of aquatic mesocosms. If there is an input of dead cicada bodies into an aquatic ecosystem, the nutrients, i.e. phosphorus and nitrogen, will increase in that system. The increase in nutrients will allow the bacterial community in the system to proliferate. A high treatment ($300g/m^2$) of dead cicada bodies will have a greater bacterial number than the medium ($150g/m^2$) or low ($75g/m^2$) treatments. After a certain time period, the nutrients will become exhausted and the bacterial numbers in each treatment will start to decrease. We observed that sudden allochthonous input could influence the bacterial community richness. As we predicted, the higher the treatment the greater the bacterial numbers in the mesocosm. This study is important because it shows the effects sudden allochthonous inputs have on the bacterial community of aquatic ecosystems and thus takes an important step towards understanding aquatic ecosystem food webs.

THE EFFECTIVENESS OF FORAMINIFERA AS ABIOTIC INDICATORS: THE ROLE OF FORAMINIFERAL PRESERVATION

Elizabeth G. McKee, College of Saint Mary, Omaha, NE 68124

Foraminifera (forams) are single celled protists with shells. Forams have inhabited all types of marine environments for eons and are sensitive to environmental changes. Their fossils allow forams to be used as indicators of turbidity, temperature, salinity, and oxygen levels in the fields of paleoecology and paleogeography. The hypothesis is one can effectively depict past aquatic environments by using forams as abiotic indicators.

Sediment cores samples from Great South Bay, a shallow estuary, were studied by qualitatively analyzing organic material and fossils, quantifying forams, and determining sediment analyses based upon grain size and type for each discreet sample depth. Water content was used to normalize foram counts and sediment analyses to gram dry weight of sediment. As a result, a larger number of forams were collected in marsh-like or muddy

regions (high clay/silt), than in quartz-like regions (low clay/silt). In 78% of the samples, forams were greater in abundance and diversity when clay/silt percentages were above 24%, while regions with a lower percentage contained fewer forams with less diversity.

In conclusion, the use of forams as abiotic indicators is not effective for all aquatic environments. In regions of high (24% or greater) clay/silt percentages, which have a high rate of foram preservation, forams abundance and diversity will effectively predict the abiotic conditions. However, regions such as shallow estuaries, a type of environment with clay/silt percentages below 24%, forams will not provide an effective description of past aquatic environments. This is due to the low rate of foraminiferal preservation.

PROVING TO MYSELF WHY RHESUS MONKEYS ARE USED IN DRUG TRIALS: CLADOGRAMS AS METHOD OF INQUIRY

Adeline L. Denniston, Chadron State College, Chadron, NE 69337

Cladistics is a form of classification utilizing genetic materials to establish genetic relatedness between extant species. I have constructed cladogram models between old world monkeys, new world monkeys and *Homo sapiens* to examine why specific species are more relevant to human drug trials.

FOOD PREFERENCE AND FOOD CONSUMPTION RATES OF THE RED FLOUR BEETLE (TRIBOLIUM CASTANEUM)

Chantelle M. Bicket, K.M. Gaspers, and W. R. Wolesensky, Department of Mathematics; and M. A. Schlueter, Department of Biology, College of Saint Mary, Omaha, NE 68124

Red Flour Beetles (*Tribolium castaneum*) are important pest species. *Tribolium castaneum* 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. Females are capable of laying eggs and larvae successfully develop in a wide temperature range of 22°C to 40°C. Adults are highly adaptable, feeding 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.

The main purpose of this study was to investigate food preference and consumption rates of red flour beetles (*T. castaneum*). In the first experiment, we introduced 40 beetles into experimental chambers containing 6 different types of food or substrates (white flour, wheat flour, a wheat-white flour mixture with yeast, whole wheat grains, cornmeal, and sand) randomly deposited into 20 different depressions. Our results indicate that these *Tribolium* prefer white flour and cornmeal. In addition, the beetles were rarely seen in the sand or in the whole-wheat grains, which indicates that they disliked these food resources. Our daily observations also indicated that the beetles did not remain in one food source or location. Beetles were observed to move to different food resources and to different locations of the same food resource.

The next experiment involves examining beetle food consumption rates at different temperatures. The consumption rate of cornmeal, white flour, wheat flour, and a wheat-white flour mixture with yeast by *Tribolium castaneum* was measured over a two-week period at various temperatures. The following temperatures were examined: 15°C, 20°C, 25°C, 30°C, 35°C, 40°C, and 45°C. We hypothesize based on mathematical models that food consumption will increase as temperature increases.

These raw data gathered in these experiments will be used to test various predictive mathematical models designed to predict food consumption rates. In addition, these real life parameter values will be incorporated into new mathematical models, which may more accurately predict food consumption rates and feeding preferences.

MORPHOMETERIC DATA ON THE EASTERN MASSASAUGA (*SISTRURUS CATENATUS CATENATUS*) IN SOUTHEAST NEBRASKA

Stephanie A. Hinman, College of Saint Mary, Omaha, NE 68124

The eastern massasauga (*Sistrurus catenatus*) is a diminutive rattlesnake that resides primarily in mesic to hydric grassland ecosystems in the North-Central United States. Extensive losses of wetland habitat have caused the massasauga to become a state threatened wildlife species in Nebraska. A thorough understanding of the massasauga is necessary in order to begin a successful conservation plan. This research provides a baseline population survey for massasaugas in eastern Nebraska, as well as documenting certain physical characteristics. Each time a snake is successfully captured, it is coaxed into a clear plastic tube in order to safely handle the snake. Once it is secured, the following data is recorded: snout-to-vent length, tail length, number and completeness of rattle segments, and weight. The information collected is then compiled into a series of statistical analyses. The data collected from these analyses provides important information that will help to provide a formal conservation plan for Nebraska's massasaugas. The information obtained will be made available to state wildlife agencies in order to help contribute to the conservation of this species.

THE EFFECT OF TRAP HEIGHT ON MOSQUITO COLLECTION OF *CULEX* SPECIES COMPARED TO ALL OTHER MOSQUITOES COLLECTED VIA CDC LIGHT TRAPS AT 0.61, 1.52, 3.05, AND 4.57 METERS ABOVE GROUND

Aaron Morse, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504

The density of mosquitoes as well as the species diversity at 0.61, 1.52, 3.05, and 4.57meters above ground was investigated throughout the months of July and August of 2004 in Scotts Bluff County Nebraska. This was done randomizing the placement of Center for Disease Control (CDC) light traps at each of the four heights at each of four locations. Mosquitoes in the genus *Culex* were shown to be captured in much higher numbers compared to all other mosquitoes throughout the summer. *Culex* species captured are known to be excellent vectors of the emerging West Nile virus. No mosquitoes captured were found to have the virus. It was thought that *Culex* species would be captured at higher levels in the atmosphere because of their preference to feed on birds however this was not the case. The majority of all the mosquitoes were found to be at the 1.52 meter above ground level.

DETECTION OF ASH YELLOWS PHYTOPLASMA IN ASH (*FRAXINUS* SP.) TREES IN COMANCHE COUNTY, OKLAHOMA

Erin M. Divine and Jerald S. Bricker, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504

Ash Yellows is a progressive disease affecting multiple species in the genus *Fraxinus* (Olaeceae). The causal agent of Ash Yellows has been determined to be phytoplasmas. Phytoplasmas are prokaryotic organisms that live exclusively in plant tissues. Ash Yellows has been known to occur in the northeastern, midwestern, Great Plains and Rocky Mountain regions of the US and eastern Canada. The purpose of this study was to determine if the Ash Yellows phytoplasma was present in western Oklahoma, in particular Comanche county. Ash trees used in the study were screened for symptoms of Ash Yellows by visual inspection. Symptoms include; branch dieback, yellowing, witches brooms, as well as the presence of opportunistic fungi. Tissues were collected from the surveyed trees. DNA was isolated from the tissue and probing for phytoplasma was done using polymerase chain reaction (PCR). No evidence of the Ash Yellows phytoplasma was found in any of the 54 samples examined in this study. Although no evidence of the phytoplasma was found, it is possible that Ash Yellows is present in western Oklahoma but was not found in the samples due to low titers of the phytoplasma and the fact that most of the trees sampled appeared healthy after visual inspection.

SCREENING OF DISEASE CAUSING ORGANISMS FROM ROTTING GLOXINIA (*SINNINGIA SPECIOSA*) TUBERS

Jennifer Peek, Doug Christensen, and Marian Borgmann-Ingwersen, Wayne State College, Wayne, NE 68787

A problematic organism is affecting the health of greenhouse Gloxinia (*Sinningia speciosa*) and the economic status of a greenhouse owner in Wayne, NE. PCR based screening was conducted on several bacteria, fungi and viruses in an effort to detect a potential cause. Results were positive for Tobacco Mosaic Virus but it is believed that additional pathogens may need to be present to justify the level of wasting seen in the tubers. Further biochemical and PCR based testing was performed providing insight as to the causative agent of the plant disease aiding in treatment recommendations. This research was funded by the Nebraska IN-BRE Grant Number: 2 P20 RR016469-04.

FUMONISIN AND ITS ABILITY TO INDUCE NEURAL TUBE DEFECTS IN THE SWV STRAIN OF MICE COMPARED WITH ITS EFFECTIVENESS ON LMBC MICE

Katie L. Deminski, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504; and J. van Waes, Center for Human Molecular Genetics, University of Nebraska Medical Center, Omaha, NE 68198

Fumonisin (FB1) is a mycotoxin known to contaminate corn and corn products. Because of its similarity in structure to sphinganine, FB1 inhibits the enzyme ceramide synthase leading to an accumulation of sphinganine and depletion in sphingolipids. An important receptor in development is the folate receptor which has sphingolipids incorporated in the structure. If folate is inhibited from being taken into the cell by the folate receptor during development, a neural tube defect (NTD) may occur. NTDs occur from the failure of the neural tube to close properly and are one the most common congenital defects in the world. It has been shown that FB1 can induce NTDs in LMBC mice. In this experiment SWV mice were treated with 20mg/kg FB1 and 15mg/kg FB1 on GD (gestation day) 7.5 and 8.5. Only 0.8% of the SWV pups had an NTD compared with 79% in LMBC. These results indicate a possible genetic cause of fumonisin resistance or susceptibility. This work was supported by NIH grant number 2P20RR016469-04.

THE AL TRANSCRIPT ANTISENSE TO THE LAT REGION IN HEPRS SIMPLEX VIRUS TYPE 1 GENOME INHIBITS ACTIVITY OF THE INTERFERON BETA PROMOTER

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Subsequent to ocular infection, herpes simplex virus type 1 (HSV-1) travels up sensory neurons of the trigeminal ganglia and establishes latent infection. While in the latent state, the LAT gene is the primary gene transcribed and it is believed that this section maintains the virulence of the virus during the latent period. In recent studies, experimental evidence suggests that a particular gene, AL-RNA, which lies at the 5' end of the LAT gene, is responsible for the virulence of the virus. It is believed that the AL gene affects the innate immune system by altering the ability of the cell to produce interferon-signaling molecules. Consequently, in our study we hypothesized that mouse 2A neuroblastoma cells transfected with the AL transcript would inhibit activity of the interferon beta promoter. These results supplied the hypothesis as the 2A neuroblastoma cells transfected with AL transcript did suppress interferon beta cat activity in a chloramphenicol actyltransferase assay. This result suggests that the AL transcript plays a role in the virulence of the virus.

THE ROLE OF NK CELLS IN THE CLEARING OF A FACULTATIVE INTRACELLULAR PATHOGEN, *FRANCISELLA TULARENSIS*

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NK cells are a specific, but relatively small, population in the white blood cell community. The purpose of this study was to determine the importance of NK cells during a bacterial challenge, specifically a *Francisella tularensis* infection. Three groups of mice were established in which two were infected with the bacteria *Francisella tularensis* and one group was not infected for control purposes. One of the infected groups was treated with ASGM, which is responsible for depleting NK cells, while the other infected group did not receive the ASGM treatment. The thinking is that mice which had their NK cells depleted would be voided of an important source of INF-γ. INF-γ is believed to activate a specific lymphocyte, the macrophage, to clear the infection from the body. To determine whether NK cell numbers increased during infection flow cytometry analysis was conducted using the specific cell marker NK-1.1. The findings showed that NK cell numbers were significantly higher in *F. tularensis* infected mice. To determine whether this increase in cell number makes a significant difference in the clearing of the infection bacterial counts were performed on mouse livers of ASGM treated and non-ASGM treated mice. The results of these counts showed that NK cells do not play a vital role in immunity until 10 days after the infection.

CHARACTERIZATION OF OPTIMAL ACTIVITY OF THE PUTATIVE PHOSPHOINOSITOL KINASE OPEN READING FRAMES A278L AND A282L IN PBCV-1 USING RADIOACTIVE δ-^{32}P ATP *IN VITRO* METHODS

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Phosphoinositol kinases have many important roles in signaling transduction mechanisms. *Paramecium bursaria* chlorella virus type 1 (PBCV-1) has two putative phosphoinositol kinase encoding genes (open reading frames A278L and A282L) including 60% amino acid homology to each other. Different optimum conditions, such as pH, temp, and cation cofactor, of these two kinases could have a significant impact on the *in vitro* or *in vivo* function. Radio-labeled δ-^{32}P ATP was used to detect the presence of these kinases under different environmental conditions. Both kinases preferred MnCl2 over any other cofactor in 1 mM concentrations and phosphorylated myelin basic protein more effectively than other substrates. A278L autophosphorylated significantly better than A282L at 50°C, while the opposite was shown at 25°C. Also, the two kinases preferred relatively the same buffer pH at 7.5. An inhibitor assay further differentiated the two kinases. This research is a starting point for future investigations of the role of PBCV-1's putative phosphoinositol kinases in regards to understanding cell signaling mechanisms.

CHARACTERIZATION OF SET DOMAIN PROTEINS FROM AN ALGAE AND A BACTERIUM

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Epigenetic processes can heritably modify gene expression without any change in DNA sequence. They play an important role in eukaryotic development as well as in protecting the genome from molecular parasites such as transposons and viruses. Epigenetic gene silencing can occur at either the transcriptional level, transcriptional gene silencing (TGS), or at the posttranscriptional level, posttranscriptional gene silencing (PTGS).

Previous research using mutagenesis screens have identified several components of the molecular machinery involved in TGS, in *Chlamydomonas reinhardtii*, a single-celled green alga. One of these mutants, Mut-11, also showed reactivation of a transcriptionally silenced trasngene, and defects in transposon mobilization, cellular growth, and sensitivity to DNA damaging agents. Sequence analyses revealed that the interrupted gene *Mut11* encodes a 370 amino acid long polypeptide containing 7 WD40 repeats. Mut11p is part of a protein complex, including two SET domain-containing polypeptides that are required for transcriptional silencing. The *Set3* gene was cloned using RT-PCR and then expressed into protein. When tested in methyltransferase assays the SET3 protein was shown to methylate histone H3. SET domain proteins have also been identified in bacteria. This includes the plant pathogen *Xanthomonas campestris* that possesses genes that may encode SET domain proteins. This raises an interesting question of function since there are no histone proteins in bacteria. A gene encoding a SET domain protein and a gene encoding a histone-like protein (HUP) from the bacterium *Xanthamonas campestris* were cloned and expressed. The bacterial SET protein had little to no methyltransferase activity on HUP or eukaryotic histones. Future research could explore the possibility that this protein methylates a different protein in the bacterium. This work was supported by NIH grant number 2P20RR016469-04.

THE EFFECT OF AZT AND INTERFERON ON CELLS

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Epstein-Barr virus (EBV), a member of the herpesvirus family, may contribute to the development of malignant diseases such as Hodgkin's disease, Burkitt's lymphoma, and lymphomas found in patients that are severely immunocompromised. Lymphomas occur when some of the cells in the lymph system multiply uncontrollably. Treatments for lymphomas have steadily improved; in addition, new endeavors to explore the effects of tumor suppressing agents such as interferon and azidothymidine have shed optimism on the subject Interferons, which are naturally occurring proteins secreted by cells in response to infection, serve multiple roles as antitumor, antiviral, and immune stimulating agents. Researchers at the NIAID have found that IFN can prevent assembly and release of new viruses from cells chronically or latently infected with diseases that cause a system to become immunocompromised. AZT, an antiretroviral agent, also works to combat viral production; however, it acts in earlier stages by inhibiting viral replication. A combination of both AZT and IFN has the advantage of confronting viruses at two different steps in their replication. Previous data shows that AZT and IFN induce apoptosis in herpesvirus-associated tumors. Furthermore, when combined, it seems that IFNs and AZT may help to enhance, not just duplicate, their antiviral potential. A current challenge lies in deriving mechanisms to show how IFNs interact with AZT to produce enhanced effects. Here we show how specific antibodies can be used to determine the protein expression enhanced by IFN and AZT together. Research has shown that interferons can activate signal transducers and transcription factors that are responsible in turning on genes that include antitumor genes. Specifically, we have examined if IFN and AZT together could enhance the signalling pathway of IFN. This work was supported by NIH grant number 2P20RR016469-04.

COMPARISON OF UNKNOWN SAMPLES OF *HELICOBACTER* TO *HELICOBACTER FENNELLIAE* AND OTHER KNOWN *HELICOBACTER* STRAINS

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An association between the spiral-shaped bacterium, *Helicobacter fennelliae*, and colitis of research macaques has been found in previous studies. *H. fennelliae* is also associated with the most severe and common form of human inflammatory bowel disease called ulcerative colitis. The purpose of this project was to characterize *H. fennelliae* isolated from humans and macaques with colitis. To accomplish this, reference strains and field isolates of *Helicobacter* were compared with closely related reference strains of *Campylobacter* and *Arcobacter* using phenotypic and genotypic methods. For phenotypic studies, pure cultures of each microbe

were examined for growth at 25°C, 37°C and 42°C, oxidase and catalase activity, production of urease, reduction of nitrate to nitrite, hydrolysis of hippurate, and susceptibility to nalidixic acid (30 g) and cephalothin (30 g) by disk diffusion using standard laboratory methods. For genotypic analysis, a highly variable 212 nucleotide region of *Helicobacter* 16S rRNA gene of selected isolates was amplified by PCR and the products was sequenced after cloning into pCR®4-TOPO®. The nucleotide sequences were compared with available enterohepatic *Helicobacter 16S rRNA gene sequences deposited in the GenBank.* Similarity values for all sequence pairs were computed using the Align X module in Vector NTI Advance (VNTI 8.0). For phylogeny estimate, partial 16S rRNA gene sequences were aligned with Clustal W (version 1.7; Higgins et al., 1994) and phylogenetic trees were constructed with the DNAML program within the PHYLIP 3.5c. Bootrap values were estimated based on 100 bootstrapping data sets, generated by the SEQBOOT program of PHYLIP.

IDENTIFICATION OF PATHOGENIC ENTERIC SPIROCHETE BACTERIA IN TURKEYS (*MELEAGRIS GALLOPAVO*) USING LASER CAPTURE MICROSCOPY AND 16S rDNA PCR

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This study was to identify disease causing intestinal bacteria in four turkeys and develop the laser capture extraction technique for more precisely isolating bacteria embedded in paraffin wax. The samples were positive in the immunohistochemistry for *Brachyspira*. The 16S rDNA PCR for *Helicobacter* was the only positive result out of the four PCR products (*Campylobacter* 16S rRNA, *Brachyspira aalborgi* 16S rRNA, *Brachyspira pilosicoli* 16 S rRNA, and *Helicobacter* 16S rDNA) studied. Three were sequenced and identified as *Helicobacter fennelliae* and Helct 97-6194-5. The result of this study was expected to be *Brachyspira*.

ESTABLISHMENT OF A COTRANSFECTED 2T3 MURINE CELL LINE

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Low density related (LDL) receptor related protein 5 (Lrp5) is known to be important in the bone formation pathway as well as the Wnt signaling pathway. Establishment of a cell line expressing a large quantity of Lrp5 protein would make it more readily and easily studied. Recent studies have shown that a chaperone protein, MESD, facilitates the movement of Lrp5 to the cell membrane where it can function as a cell surface protein in the Wnt signaling pathway. We have attempted to develop a procedure for cotransfecting Lrp5 (and its mutant HBM) and MESD into 2T3 murine osteocytes. Lrp5 DNA fragments were amplified using PCR, cloned into plasmids and grown in bacteria. Pure plasmid vectors were extracted using electrophoresis, by isolating and purifying the desired bands. MESD-flag vectors were obtained and cotransfected with Lrp5 as well as with HBM into several sets of 2T3 cells. A few positive MESD/Lrp5 and MESD/HBM cotransfected cell lines were found using electrophoresis. Western blot analysis was used to support the results. Further testing will be needed to show improvement in Lrp5 expression in the presence of MESD. The cotransfected cell lines may be useful for studying the role of Lrp5 in Wnt signaling and bone formation. Manipulation of MESD and Lrp5 genes and their actions may prove to be useful in treatment of bone disorders.

THE EFFECTS OF CULTURE CONDITIONS ON THREE DIMENSIONAL COLLAGEN GEL CONTRACTION MEDIATED BY HUMAN FETAL LUNG FIBROBLASTS

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Studies were carried out to determine the affects of culture conditions on three dimensional type-1 collagen gel contraction mediated by human fetal lung fibroblasts (HFL-1 cells) for both slow and rapid gel

contraction assays. Previous studies have shown that the only culture condition to affect gel contraction is varied dish diameter of tissue culture dishes. In order to determine the reason for this, further experimentation was performed including testing the number of gels released into the tissue culture dishes. The number of gels released was varied from the standard of releasing three gels into a 100 mm tissue culture dish by releasing one and two gels into the 100 mm dish. This variation was performed to determine if the concentration of the fibronectin near the gels containing fibroblasts was the cause of previous findings. In this study the only culture conditions that inhibited gel contraction in the slow gel contraction assay were increased dish diameter and decreased media volume. For the rapid gel contraction assay, all culture conditions affected gel contraction via inhibition. This concludes that the standard culture conditions and methodology of the assays is correct and does not influence the gel contraction results.

EFFECT OF DIABETES ON THE INTRACELLULAR LEVELS OF GLUTATHIONE IN RAT OCULAR TISSUES

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The decrease in glutathione, an intracellular antioxidant, is an important signal for the increase in oxidative stress occurring in the ocular tissue of diabetic rats. This increase in oxidative stress is caused by free radical production which can be linked to the formation of retinopathy and other visual problems. Varying results have been found in previous experiments measuring the glutathione levels in ocular tissues. It has been found that glutathione levels were reduced by 40% in the diabetic rats as compared to the control group. No difference in the glutathione levels of diabetic and control rats were discovered by other researchers. In this experiment, the glutathione levels were measured in the retina, cornea, ciliary body, and lens of four control rats and four diabetic (hyperglycemic) rats. Although a trend of increased glutathione levels was present in this study, the results concurred with the findings of Obrosova and colleagues. The glutathione levels were found to not be significantly different in any of the four tissues when a two-tailed t-test was conducted. The trend that was present, if shown to be significantly different in the future, would show that diabetic rats do have a decreased amount of antioxidants present, and therefore an increased amount of oxidative stress.

THE INDUCTION OF DIFFERENTATION IN TRANSITIONAL CELL CARCINOMA CELL LINE RT112 THROUGH THE ACTIVATION OF THE PEROXISOME PROLIFERATOR ACTIVATE RECEPTOR

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In normal urothelium, differentiation can be induced by the activation of PPAR-γ pathway, through the ligand troglitazone, and the inhibition of the EGFR pathway, through inhibitor PD153035. However, the effects of troglitazone (TZ) and inhibitor PD153035 are unknown for Transitional Cell Carcinomas. Using the expression of Uroplakin II (UPII), and cytokeratins as markers for differentiation, this experiment investigated the effects of the activation of PPAR-γ on differentiation. An increase in the expression of UPII was found in the cell line RT112, when PPAR-γ was activated, seen in the results from RT-PCR, and an increase in the expression level of CK20 a marker of terminal differentiation. Differentiation was induced in cell line of transitional cell carcinomas, RT112 or a medium grade carcinoma.

COLLEGIATE ACADEMY
BIOLOGY
SESSION B

INFLUENCE OF N-GLYCANS OF THE ATTACHMENT (G) GLYCOPROTEIN OF BOVINE RESPIRATORY SYNCYTIAL VIRUS ON EXPRESSION

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Bovine respiratory syncytial virus (BRSV), genus *Pneumovirus*, family *Paramyxoviridae*, order *Mononegavirales*, infects the lower respiratory tract of calves and is a component of the bovine respiratory disease complex, which significantly reduces profitability in the cattle industry. There are several modified-live and inactivated virus vaccines on the market for BRSV, but they are not very effective in the field as re-infection can occur following administration of the vaccines or after natural infection. The attachment (G) glycoprotein facilitates the attachment of the virus to the host cell membrane. It has a high content of carbohydrate, mostly O-linked sugars, with seven N-linked glycosylation sites. Glycosylation is similar to the mucins produced by the host and it has been suggested that this may hinder host recognition of BRSV antigens. The objectives of this study were to use site-directed mutagenesis of G glycoprotein cDNA to delete specific N-linked glycosylation sites, to clone and express these mutants in mammalian cells, and to evaluate host cell expression. Four N-glycan deletion mutant constructs were created by deleting the first, second, third, and fourth glycosylation sites of the G protein sequence, respectively. The first site is an internal site while the other three sites are external. Expression of these recombinant mutants was analyzed using immunoperoxidase staining of cells transfected with plasmid DNA encoding individual deletion mutants, authentic G protein, or cells infected with virulent BRSV. Expression comparable to that of viral infection and cells transfected with the complete G protein was observed in cells transfected with each of these N-glycan deletion mutant constructs.

UBC9 ROLE IN THE BETARETROVIRUS LIFE CYCLE STUDIES USING SMALL INTERFERRING RNA

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The E_2 Sumo conjugating protein, Ubc9, has been found to interact with the major retroviral assembly protein, Gag, near the nuclear membrane. Upon overpression of Ubc9, the proteins were found to colocalize within the nucleus (Weldon et al 2003). To further the study of the role of Ubc9 within the retrovirus life cycle, the optimization of using gene silencing for the down regulation of Ubc9 was established. The technique of small-interfering RNA (siRNA) was used in experiments to aid in determining the possible role of Ubc9 in late retrovirus assembly and/or early infectivity. Research was made possible by NIH Grant Number P20 RR 16469 from the INBRE Program of the National Center for Research Resources.

DISTRIBUTION OF ß-TUBULIN IN THE DEVELOPING AND ADULT RAT ORGAN OF CORTI

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Microtubules composed of α and ß-tubulins control cell functions such as structural integrity, transport of organelles, and cilia movement. There are seven isotypes of ß-tubulin, each encoded by different genes. These sequences are very similar and highly conserved in evolution. Changes in the carboxy terminus of the amino acid sequence define the isotype. Observations of cells selectively expressing different combinations of

the seven isotypes suggest that there are functional differences within the isotypes. The significance of the functional differences in ß-tubulin is not yet clear or understood. The multiple functions may require different forms of tubulin. The organ of Corti within the mammalian ear is a novel place to study microtubules. The cells within the organ of Corti, Outer Hair Cells (OHC), Inner Hair Cells (IHC), Outer Pillars (OP), Inner Pillars (IP), and Dieters, contain a variety of specialized microtubule structures. In this experiment, whole mounts of embryonic day 17 to adult aged rat organ of Corti were fixed and the cochlea dissected. The different forms of ß-tubulin were labeled using indirect immunohistochemistry and viewed using fluorescence microscopy and confocal microscopy. The images captured from these specimens were used to answer the following questions: What is the isotype distribution in the cells of the organ of Corti in rat? And, does the distribution change during development? The results show that at the embryonic stage of development, the primary cilia contain only $ß_I$. At the developing stage, primary cilia begin to disappear, and then asters form in the IHC and OHC, which contain $ß_I$, $ß_{II}$ and $ß_{IV}$. And finally, at the adult stage of development, the ß-tubulins in the microtubules become specific to the cell type in which they exist. No precise conclusions can be drawn from this data, because it is not yet clear the exact function of the ß-tubulin isotypes. This research was funded by NIH grant number 2P20RR016469-04.

HUMAN HERPESVIRUS TYPE-8/KAPOSI'S SARCOMA-ASSOCIATED HERPESVIRUS SEROLOGY IN ZAMBIAN MOTHER/INFANT PAIRS

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Human Herpesvirus 8 (HHV-8) is causally associated with Kaposi's Sarcoma, primary effusion lymphoma and multicentric Castleman's disease. The specific route and timing of human herpesvirus 8 infection in regions where Kaposi's Sarcoma is endemic are not known. The present study indicates that transmission of HHV-8 to infants can occur early and is likely via multiple routes. Serological and molecular biology assays are used to investigate the biology of this virus in different populations and diseases. Serological assays are mainly used to study the prevalence of the viral infection and to predict the diagnosis of Kaposi's Sarcoma and other HHV-8 associated cancers. The appearance of antibodies against lytic antigens precedes the appearance of antibodies against latent antigens, probably explaining the lower sensitivity of assays based on latent HHV-8 infection. More research is needed to define the most useful laboratory tests for the diagnosis of HHV-8 infection. This work was funded by NIH Grant Number 2P20RR016469-04.

EA SURVEY OF WILD RING-NECKED PHEASANTS IN NEBRASKA FOR INTERNAL HELMINTH PARASITES

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Parasites are common in all forms of wild mammals and birds, and can have a great impact on the animals' ability to survive and reproduce. As a part of background research being conducted by Dave Oates of the Nebraska Game and Parks commission on all forms of gallinaceous birds in Nebraska (wild turkeys, grouse, and ring-necked pheasants, among others), samples of the ring-necked pheasant (*Phasianus colchicus*) were collected by hunters and sent to Game and Parks in Lincoln. In 238 bird samples, 150 were infected with some form of helminth parasite, and of those infected with some form of parasite, ranging from having a single worm to 48 worms of various types. If any of the aforementioned birds' populations start to decline rapidly, this type of research is designed to give wildlife biologists a starting point to examine causation.

EXCEPTIONS TO THE 12/23 RULE: THE EFFECTS OF USING MODIFIED 12/12 AND 23/23 RSS CONSTRUCTS ON V(D)J RECOMBINATION

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B and T cells gain their immune diversity through a process called V(D)J recombination. The first step in V(D)J recombination is to introduce a double stranded break in the DNA at a restriction signal sequence (RSS). The RSS flanks the V, D, and J (variable, diversity, and joining) gene segments. Spacers of 12 or 23 base pairs (bp) exist between the RSS heptamer and nonamer. Recombination generally occurs between a 12 and a 23 bp fragment, otherwise known as the 12/23 rule. Two recombinant plasmids were successfully created. One contains a 12-12 RSS construct and the other contains a 23-23 RSS construct. These plasmids are to be used in order to investigate the outcome of V(D)J recombination due to variations of the 12/23 rule.

CONFORMATIONALY ALTERED RIBOSOMAL RNA REVERTS BACK TO THE WILD TYPE

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Translation is the process that uses the coded information in RNA to assemble a protein in the cytoplasm. The ribosome is a complex molecular machine of extraordinary precision that participates in the synthesis of polypeptides of all organisms with the ribosomal RNA playing a central catalytic role. Recent studies used ribosomal mutations at several nucleotide base pairings to inhibit bacterial cell growth as a means of disease prevention. The present study determined the stage of translation in the logarithmic growth phase of uninhibited mutants based on free ribosomes. Cells that are in the logarithmic growth phase have free ribosomal subunits that are in the process of initiation, 70S ribosomes and polyribosomes that are in the process of elongation, and 70S vacant couples that are neither initiating nor elongating. In a wild type cell growing under optimal conditions elongating ribosomes will predominate, with vacant couples and free subunits present in very low quantities. Ribosomes were separated from the rest of the cell, based on size and weight, using a sucrose gradient centrifugation. The data was then compared to that of the wild type strain providing a detailed view of the cell's ability to function. It was discovered that three different strains of the uninhibited conformationaly altered ribosomal RNA reverted back to what is believed to be the wild type.

THE INFLUENCE OF SHIGA-LIKE TOXIN ON INFLAMMATORY CYTOKINE PRODUCTION IN MACROPHAGE CELLS

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Infections with Pathogenic *Escherichia coli* cause multiple symptoms including bloody diarrhea, renal failure, and damage to capillaries supplying central nervous tissue. A key virulence factor in pathogenic *E. coli* infections is the production of Shiga like toxins. These toxins target globotriaocylceramide receptors of the various cell types of tissues described above, and eventually leads to termination of protein synthesis, consequently resulting in apoptosis. Pathogenesis of this infection is also linked to a host inflammatory response that increases toxin receptor concentration on target cells, increasing the amount of toxin entering the cell. The current study examines the effect of shiga like toxin-1 (SLT-1) in eliciting pro-inflammatory cytokines from macrophage cells (Phorbol 12-myristate 13-acetate treated THP-1 cells). This research was funded by the Nebraska IN-BRE Grant Number: 2 P20 RR016469-04.

THE EFFECTS OF BRADYKININ ON THE INSULIN DEGRADING ENZYME OF RAT LIVER AND MUSCLE ENZYME PREPS.

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Bradykinin (BK) is a hormone that has an "insulin-like" activity. It appears to function by stimulating insulin secretion from the beta cells in the pancreas and possibly altering the insulin signaling pathway at different levels. The insulin- degrading enzyme (IDE) is the major enzyme responsible for insulin degradation in vitro. The goal of our study was to 1) To determine if BK is degraded by IDE and 2) Study the degradation and effect on the proteasome. IDE was prepared from rat skeletal muscle. BK degradation was analyzed by mass spectrometry. Insulin degradation was measured by TCA precipitation of 125I insulin. The trypsin-like activity of the proteasome was measured with the fluorogenic peptide t-Boc-Leu-Ser-Thr-Arg-7-amido-methyl coumarin (LSTR). Cellular proteasome activity was measured using HepG2 hepatoma cells and the membrane permeable substrate methoxysuccinyl-Phe-Leu-Phe-7-amido-4-trifluoromethyl coumarin (FLF). At the conclusion of our study, we were able to determine that BK does interact with IDE, having a similar effect as insulin on the proteasome. We also found that BK is cleaved by IDE at two sites on the amino acid chain. It was concluded that the effect of BK on IDE may contribute to its beneficial effects on diabetes.

PRION STRAIN TARGETTING IN THE CENTRAL NERVOUS SYSTEM

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Prion diseases are neurodegenerative, transmissible spongiform encephalopathies that affect humans and other animals. It is thought that prions (PrPsc) spread via targeted populations of neurons. Prions are thought to ascend three descending motor neuron tracts originating in the brain, the Vestibulospinal, Rubrospinal, and Corticospinal tracts. All of these tracts have axons that terminate in the lumbar spinal cord region on interneuron cell bodies, which synapse on Ventral Motor Neurons (VMN) in the lumbar spinal cord region. Using an *in vivo* sciatic nerve model, we were able to track the spread of transmissible mink encephalopathy to the brain and brain stem using immunohistochemistry, in which depositional staining (PrPd) indicates the presence of prion particles. After sciatic nerve inoculation, one would expect to see PrPd in the VMNs and interneuron cell bodies of the lumbar spinal cord region if infection is present. PrPd was seen at two, three, four, and five weeks post infection in VMNs in laminas 7 and 9; in the anterior gray horn ipsilateral to the inoculation site, in lamina 7 and 9; in laminas 5 and 10; and on the contralateral and ipsilateral sides of inoculation, in laminas 1-10 and around the VMNs respectively, all in the lumbar spinal cord. To ascertain that the cell bodies exhibiting PrPd were VMNs, fluorescently tagged retrograde tracers were injected into the right hind sciatic nerve to highlight the VMNs in the lumbar spinal cord region. The results were consistent with PrPd patterns at two weeks post infection. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

COMPARISON OF *ESCHERICHIA COLI* AND *PSEUDOMONAS AERUGINOSA* MEMBRANE LIPIDS GROWN UNDER INDUCED STRESS BY VARYING PH LEVELS

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Prokaryotic cells grown under extreme environmental conditions exhibit a limited ability to alter membrane lipid composition in an effort to maintain homeostasis under those conditions. Stress induced changes in membrane lipid profiles of *Escherichia coli* and *Pseudomonas aeruginosa* were examined in cultures grown under varying pH levels. Membrane lipids were extracted from cells grown in tryptic soy broth (TSB). Stan-

dard growth condition was considered to be TSB at pH 7.11, the pH of TSB with no amendment. TSB was amended with 0.1M HCl or 0.1M NaOH to produce growth media of pH levels ranging from 5.78 to 8.62. Growth of the cultures was monitored using a Spec 20 and cells were harvested at 20%T, when the cells had reached log phase and the concentration was approximately $2x10^9$ cells/ml. The membrane phospholipids were extracted and esterified to produce fatty acid methyl esters (FAMES). The lipid profiles were obtained using GC-MS to analyze the FAMES. From the lipid profiles, eight lipids were determined to be common to both organisms. Comparative analyses of these eight lipids were performed at each pH level as well as over the pH range. *E. coli* and *P. aeruginosa* were determined to exhibit differing membrane lipid responses to the pH of their growth environment. The results indicate that while each of these two organisms can live and survive under the same environmental conditions and changes, their mechanisms of membrane adaptation to stressful conditions are different.

STUDIES OF THE MUC1-DERIVED PEPTIDES BINDING TO CLASS I MAJOR HISTOCOMPATABILIGY COMPLEX (MHC)

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Major Histocompatibilty Complex (MHC) is a protein which presents antigens to a cells surface to be recognized by T-cells. Glycosylated epitopes bind to the MHC groove and "label" tumor cells for killing by epitope-specific T cells. MUC1 glycopeptide has been shown to be overexpressed in 85% of carcinomas and several other cancers. The purpose of the research was to understand how the glycosylation of the peptide affects binding to the MHC groove. Our objective was to analyze binding of the MUC1 derived peptides, SAPDTRPAPG, SAPDT(GalNac)RPAPG and SAPDT(Gal-GalNac)RPAPG, to class I MHC molecules by experimental methods and molecular modeling methods. An MHC stabilization assay was performed using antibodies labeled with fluorescent markers and flow cytometry was used to identify which glycosylated peptides would bind best to the MHC molecule. Molecular modeling was used to understand how these glycosylated peptides bind to the MHC groove, with the sugar outside or inside the groove. The flow cytometry results illustrate that the 10mer peptide with a double glycosylation SAPD(Gal-GalNAc)TRPAP binds to the MHC groove with the best affinity. The molecular modeling suggests that the double glycosylation at the fifth residue of the peptide binds outside of the MHC groove. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

CENTRAL PACEMAKER-REGULATED GENE NETWORK IN THE HYPOTHALAMUS OF FEMALE MOUSE

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In mammals, the essential component of the central pacemaker, which drives the rhythmic transcription of clock-regulated genes, is the heterodimer of MOP3 (bMAL1) and CLOCK genes. Loss of MOP3 results in estrus acyclicity and leads to abnormal release of luteinizing hormone (LH), which is required for follicle maturation and ovulation. The aim was to compare wildtype and knockout mice in order to identify signaling components and biological pathways regulated by MOP3 using microarray technology. The expressed genes from the microarrays were then analyzed by performing a comparison analysis. From this analysis, we identified genes that were differentially expressed in the hypothalamus of MOP3 knockout mice. Some of these genes may also belong to the CLOCK pathway, indicating the pathway is perturbed. In addition, other downstream genes possibly regulated by the pacemaker were also identified. This analysis supports that the central pacemaker plays an essential role in synchronizing a diverse array of regulatory signals into a concerted action that impacts female reproduction. This work was supported by NIH grant number 2P20RR016469-04.

COLLEGIATE ACADEMY
BIOLOGY
SESSION C

ROLE OF THIOL PEROXIDASES INVOLVED IN THE YEAST OXIDATIVE STRESS RESPONSE

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In the past few years, there has been a substantial interest in characterizing the Oxidative Stress Response (OSR) in yeast, *Saccharomyces cerevisiae*. This interest has resulted from realization of a very specific and complex signaling system -much in contrast to a *non-specific* OSR. Recent studies have collectively pointed to interactions between the Yeast AP-1 (Yap1) transcription factor and thiol peroxidases in the glutathione and thioredoxin redox systems as elements of the OSR. In the current study, single, triplicate, quintuplicate, and octuplicate mutants for eight thiol peroxidases were characterized. Growth curves and spot assays were generated for wild type and 11 mutant strains. These 12 strains were also screened for mutations, and four errors were uncovered. Northern blot analyses of thioredoxin 2, the gene regulated by Yap1, were performed. Finally, we cloned all 8 thiol peroxidases and prepared expression constructs, which will be used to assess interactions between thiol peroxidases and Yap1. This research was funded by the University of Nebraska–Lincoln REDOX Center and by the Nebraska IN-BRE Grant Number: 2 P20 RR016469-04.

EFFECTS OF *PUERARIAE RADIX* ON PUPS OF ALCOHOL-TREATED FEMALE MICE

Kerry Brader, Kathleen Tallman, and Kate Marley, Department of Biology, Doane College, Crete, NE 68333

Alcohol is a well known teratogen known to cause craniofacial deformities. The type of damage and the severity depends upon the gestational timing as well as the dosage and route of exposure. C57Bl/6 mice were kept in a 12-hour light/dark cycle, with food and water available at all times. Female C57Bl/6 (20g+) and male C57Bl/6 mice of similar age groups were housed together for varying periods of time. Females were checked daily at 7am for vaginal plugs. The presence of a plug was considered to be gestational day 0 of pregnancy. Fetuses were photographed using an Olympus digital camera mounted on a dissecting microscope to observe any outward birth defects as well as any differences in size. It was determined with an initial dose response curve that injections of alcohol on gestational day (G.D.) 7 and 8 induced the most physical deformities on developing fetuses. Next female mice (20g+) were bred and separated into four experimental groups: 1) the 0.9% saline (control) group (0.030ml/g) 2) the alcohol (25% ethyl alcohol) injected group (0.030ml/g) 3) the *Puerariae radix* treated group (30mg/kg) 4) the alcohol and *Puerariae radix* treated group. Embryos were initially harvested and photographed at G.D. 18. Next embryos were harvested on G.D. 9.5 and embryos from the same litter were separated into two groups: ethanol affected and ethanol non-affected. After harvesting, embryos were prepped for RNA extraction. Gene microarray studies underway comparing gene expression patterns from alcohol affected and alcohol non-affected G.D. 9.5 pups. This publication was made possible by NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

THE USE OF RECOMBINANT HEP G2 CELLS IN THE STUDY OF ETHANOL METABOLISM BY ALCOHOL DEHYDROGENASE AND CYTOCHROME P450 2E1

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In order to investigate the mechanisms by which ethanol metabolism causes alcoholic liver disease recombinant Hep G2 cell lines have been created that metabolize ethanol. These cell lines express the primary ethanol metabolizing enzymes alcohol dehydrogenase and cytochrome P450 2E1. The metabolism of ethanol by these cells resulted in cell death and a decrease in cell accumulation in culture. This decrease in accumulation was more severe in cells metabolizing ethanol via CYP 2E1. Cell accumulation was further decreased when ethanol was metabolized in the presence of buthionine-sulfoximine, which inhibits the synthesis of the major cellular antioxidant glutathione. CYP 2E1 mediated ethanol metabolism results in the formation of free radicals including reactive oxygen species that cause lipid peroxidation and oxidative stress. It is suggested that ethanol metabolism via CYP 2E1 resulting in oxidative stress is responsible for the increased reduction in cell accumulation.

THE IMMUNOLOGICAL EFFECTS OF ALCOHOL ON THE CELL MEDIATED IMMUNE RESPONSE IN MICE INFECTED WITH GROUP B COXSACKIEVIRUS

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One of the key effects of chronic alcohol consumption is immunosuppression. This increases the susceptibility of viral infections, such as the group B coxsackievirus, as well as the severity of damage due to infections because of the inability of the suppressed immune system to clear the viral infection. Current investigations are being conducted to determine the specific role alcohol plays in an autoimmunity response, which is also responsible for the exaggerated organ and tissue damage. Our examination led us to comparing chronic ethanol fed mice and their cell-mediated T-cell immune responses to control mice that were not fed ethanol. We analyzed the specific complications, i.e. immunosuppression, that the alcohol had on the immune response when infected with group B coxsackievirus. Although T-cell production was comparable between both ethanol-fed and control groups, the activation and cytokine production of the ethanol-fed mice was lagging, which agrees with previous findings of immunosuppression. We observed that IFN-γ appeared to be the primary cytokine Th-1 response to the viral infection. However the Th-1 response was noticeably lagging in the ethanol-fed animal models.

THE EFFECTS OF CHRONIC ALCOHOL ABUSE IN A MOUSE MODEL ON THE IMMUNE SYSTEM'S ABILITY TO PRODUCE SPECIFIC ANTIBODIES

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Alcohol abuse causes immunosuppression, and alcohol abuse coupled with Coxsackie B virus leads to a more severe case of pancreatitis. These findings have resulted in curiosity about the effects of alcohol abuse on the body's ability to fight infection, specifically with respect to humoral immunity. This study was done to determine if alcohol abuse causes a decline in antibody production. Neutralization assays were performed on samples from ethanol fed and control fed mice on Hela cells infected with Coxsackie B virus. Results showed that antibody production was significantly lower in the ethanol fed samples compared to the control fed samples. the optical density measured in the neutralization assay 12 days after infection at the 1:1600 dilution of the samples were ~0.5 in the ethanol fed samples and ~0.8 in the control fed samples. Western Blots showed that the antibodies produced in the neutralization assays were, in fact, antibodies against the virus. These data support the idea that chronic alcohol abuse inhibits the body's antibody production.

CONSTRUCTION AND QUANTIFICATION OF HINGE REGION DELETION MUTANTS OF VSV P-PROTEIN UNDER VARYING POLYMERASE CHAIN REACTION CYCLING CONDITIONS

Laura C. Pickering, Biology Department, Nebraska Wesleyan University, Lincoln, NE 68504; and Asit K. Pattnaik and Subash C. Das, Nebraska Center for Virology, University of Nebraska–Lincoln, NE 68588

The role of phosphorylation in transcription of the phosphoprotein (P) of vesicular stomatitis virus (VSV), Indiana serotype, has recently been under much investigation. The P protein is composed of three domains, as well as a hinge region positioned between domains one and two. Studies have been conducted to determine the significance of domains one, two, and three of this protein. However, little work has been done to investigate the significance of the hinge region in accordance with in vitro transcription of the P protein. In this study, construction of four hinge region deletion mutants of twenty amino acids each and one deletion mutant of 10 amino acids was attempted. The deletions were to occur at: 1) amino acid 130-150, 2) 150-170, 3) 170-190, 4) 190-210, and 5) 210-220. Using variations in extension time and annealing temperature of the polymerase chain reactions, DNA containing deletions 3 and 4 were obtained and quantified. Three samples from deletion number 3 were quantifiable, as well as one sample from deletion number 4. In this study, we obtained the largest quantity of DNA from deletions number 3 and number four with an extension time and temperature of one minute for 72 degrees and an annealing temperature of 50 degrees. Further work will be done in order to obtain a quantifiable amount of mutant DNA for deletions numbers 1, 2, and 5. Creation of these deletion mutants in the hinge region of the VSV P protein will ultimately allow for a better understanding of viral transcription and efficiency.

KINASE SUPRESSOR OF RAS AS A POTENTIAL REGULATOR OF GLUCOSE UPTAKE IN CELLS

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

KSR (Kinase Suppressor of Ras) is a molecular scaffold protein for 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. What isn't known about KSR is how it affects glucose uptake, or if it has any role in that pathway. Another unknown is how KSR is related to the glucose pathway, whether it is an indirect or direct association. When cells are put under stress 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 at one point, whether KSR is active or inactive when CTAK-1 is bound is not known. Starving KSR 1.1, LKB1 knockouts, and LKB1 heterozygous MEF's (Mouse Embryonic Fibroblasts) for glucose will help determine the relationship of KSR and the glucose pathway. Also it will help establish an indirect or direct relationship between the glucose pathway and KSR. This research was funded by the Nebraska IN-BRE Grant Number: 2 P20 RR016469-04.

EVALUATING A CANDIDATE REGION INFLUENCING DYSLEXIA

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Dyslexia, or reading disability (RD) is the most common learning disability in school-age children, with a prevalence rate of ~5%-10%. It can not be explained by deficits in intelligence, learning opportunity, motivation or sensory acuity. It is well established that RD is a significantly heritable trait with a neurobiological basis. Linkage studies have identified several quantitative trait loci (QTLs) for RD. The QTL on chromosome 18p11.2 has been independently replicated by several groups and spans an interval between D18S464 and D18S53. In this study, we performed pedigree linkage analyses to define more accurately the QTL interval. Using single-point analysis, no significant linkage was shown.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

CALCULATED SURFACE ELECTROSTATIC POTENTIAL MAXIMA AS MEASURES OF THE STABILITIES OF CARBOCATIONS

Adele M. Robbins, University of Nebraska–Lincoln, NE 68508; and Ping Jin, Jane S. Murray, and Peter Politzer, Department of Chemistry, University of New Orleans, New Orleans, LA 70148

When a hydrocarbon or substituted hydrocarbon loses a hydride ion, it becomes positively charged and is referred to as a carbocation. Carbocations are important in organic chemistry, both as intermediates in reactions, such as nucleophilic substitution reactions, and as components of compounds containing highly polar C^+C^- linkages. The stability of any particular carbocation is viewed as being determined by how well its molecular framework can delocalize the positive charge on the system; that stability decreases in the order $3° > 2° > 1° >$ methyl is a general rule of thumb learned by every student in the first semester of organic chemistry. The purpose of this work has been to investigate whether the computed electrostatic potential V(r) might prove to be an indicator of how well the positive charge in a carbocation is delocalized. We demonstrate for a series of carbocations that the computed surface electrostatic potential maxima, $V_{S,max}$, associated with the carbons that have lost the hydride ions correlate with their relative stabilities, with stability increasing as $V_{S,max}$ decreases. We have computed optimized geometries and electrostatic potentials at the HF/6-31G* level. Our surfaces are defined as the 0.001 electrons/bohr^3 contour of the electronic density.

HARDWARE CONROL SYSTEM FOR THE STAR EXPERIMENT USING EPICS

Andrew Trapp, Department of Physics, Creighton University, Omaha, NE 68178-0114

The Experimental Physics and Industrial Control System (EPICS) has been implemented for controlling and monitoring the STAR (Solenoidal Tracker at RHIC) experiment at Brookhaven National Laboratory. The system provides a common interface to all hardware subsystems. It regulates and measures approximately 10,000 parameters, such as temperatures and voltages. Much of the software has been produced by Creighton students. A summary of the project and recent upgrades will be presented.

IDENTIFICATION OF CHARMED MESON CANDIDATES USING DISTANCE OF CLOSEST APPROACH

Peter Dudley, Department of Physics, Creighton University, Omaha, NE 68178

Studies of charmed hadrons (a particle containing a charm quark) production at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory and future work at the Large Hadron Collider at the European Center for Nuclear Research (CERN) will examine nucleon-nucleon collisions in energy regimes which have not previously been studied. This research looks specifically at the production of the D* meson. The D* is reconstructed in the decay channel in which it decays to a charged pion and a neutral D^0 meson, where the D^0 subsequently decays to a charged pion and a charged kaon. Due to the large combinatorial background, the analysis requires additional constraints in the identification of potential D* candidates.

The measurement of the distance of closest approach (DCA) provides such a constraint. We find the DCA of the D^0 candidates by reconstructing the vertex of its possible decay products and tracing the D^0's path back toward the interaction region. Because the average lifetime of the D* is very short, its decay takes place very near its point of production. Reconstructed D^0 candidates that trace back to the interaction region are

significantly less likely to be from the combinatorial background. The ability to correctly identify D^0's enhance the filtering of genuine D* candidates from potential D^0-pion combinations with the expected invariant mass. Simulations demonstrating the effectiveness of the technique are presented.

NEUTRALINO-NUCLEON SCATTERING RATES WITH REALISITIC FORM FACTORS FROM ELECTRON SCATTERING DATA

Ann Kemper and Gintaras 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 rates 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, Xe, 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.

MAGNETIC BIREFRINGENCE IN A LIQUID CRYSTAL

Tyler Doane, Physics Department, Hastings College, Hastings NE 68902

Magnetic field induced birefringence in liquid crystals was investigated. The response of molecules in the disordered phase of a liquid crystal to an applied magnetic field was examined. Experiments were conducted in which the birefringent properties were measured as a function of magnetic field strength and temperature.

A MEASUREMENT OF THE WAVELENGTH DEPENDENCE OF RALEIGH AND MIE SCATTERING IN LIQUID SUSPENSIONS

Michael Mahoney, Physics Department, Hastings College, Hastings, NE 68902

An experiment was conducted in which Rayleigh and Mie scattering cross-sections were measured for small dielectric spheres suspended in a liquid. Utilizing an absorption spectrophotometer, wavelengths in the visible region were analyzed. The experimental cross-sections were then compared to the theoretical values predicted by Rayleigh and Mie scattering theories.

AN INVESTIGATION INTO THE PROPERTIES OF VARIABLE MASS OSCILLATORS

Heidi Miller, Physics Department, Hastings College, Hastings, NE 68902

The study of variable mass systems dates to the 16th century and the ingenious work of Galileo. An adaptation of this type of investigation was done in which variable mass oscillators were examined. A mass-spring system was allowed to lose mass as sand drained from a container. Flow rate characteristics and general oscillator properties were measured and compared to theory. This experiment was then extended to modified pendulum systems.

AN EXAMINATION OF PERFORMANCE CHARACTERISTICS OF BASEBALL BATS

Kyle Oakeson, Physics Department, Hastings College, Hastings, NE 68902

The use of advanced technology and materials has provided the sports industry with superior equipment in all areas. The introduction of high performance aluminum alloy bats into college baseball is an example of this technology. Though the advances have undoubtedly helped the player's performance, questions have arisen as to the effect this is having on the sport. To explore this concern and to quantify the differences between the old and new technologies, the exit velocity, coefficient of restitution and other parameters were measured for four bat compositions, two aluminum alloy and two wooden.

CONSTRUCTION AND TESTING OF AN ELECTRIC GUITAR PICKUP

Michael Rust, Physics Department, Hastings College, Hastings, NE 68902

The advent of the electric guitar has elicited great changes in the sound and direction of popular music. An electric guitar pickup was constructed and measurements made to define its performance parameters. Measurements of inductance, resistance and frequency response were done. The performance characteristics were then compared to those of a typical commercially available unit.

A MEASUREMENT OF SUPERNOVA MAGNITUDE AND TYPE CLASSIFICATION

Jill Schmitz, Physics Department, Hastings College, Hastings, NE 68902

There are five different types of supernovae. Each type is determined by the star's emission characteristics during its supernova transition. Measurements of the change in brightness of a supernova throughout its life span were done using a CCD based telescopic system. An analysis of the change in brightness with time was utilized to classify the supernova type.

HALL EFFECT MEASUREMENTS IN LOW DENSITY PLASMAS

Jeff Tonniges, Physics Department, Hastings College, Hastings, NE 68902

In low-density plasmas, like the positive columns of glow discharges, the Hall Effect is large and easily observable. The Hall voltage across a gas discharge column was determined as a function of magnetic field strength, discharge current and gas pressure. Electron drift velocities and densities were inferred from measurements of electrical parameters. A measurement of the resistance allowed an evaluation of the collision frequency of the electrons from which the electron temperature was determined.

EXTRACTION OF THE PAIR POTENTIAL FROM THE STRUCTURAL DATA OF LIQUIDS.

Jessica Changstrom, Midland Lutheran College, Fremont NE 68025; and Vadim Warshavsky and Xueyu Song, Iowa State University, Ames, IA 50011

In this work, an iterative predictor-corrector method is used to obtain a two body interaction potential v(r) from a pair correlation function g(r). Calculations were performed for a Lennard-Jones test system. Ultimately, a reliable way to find an effective pair potential from state dependent g(r) of a many-body potential will be developed.

THE PURPLE GENIE-THE REACTION OF TURPENTINE AND IODINE

Amanda Lytle, Department of Chemistry, Doane College, Crete, NE 68333

The reaction of turpentine and iodine is a spectacular reaction, producing a large cloud of purple smoke. The reaction is very exothermic due to the relief of ring strain associated with opening of the four-membered ring in α- and ß-pinene. By using GC/Mass Spec, GC, and HPLC, it was found that the products formed are not those proposed in the literature.

STUDIES IN THE SYNTHESIS OF A NEUROPEPTIDE Y Y2 RECEPTOR-SELECTIVE ANTAGONIST

Dustin L. Simpson and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178-0104

A method for the triply convergent synthesis of neuropeptide $Y Y_2$ receptor antagonist BIIE0246 will be discussed. The first stage of this synthesis used nucleophilic substitution to make Boc-Arg(Mts) from Boc-Arg. Separately, preparation and purification of 11-chloro-5,6-dihydro-6-oxomorphanthridine obtained in 3 steps from anthraquinone was accomplished. The purified 11-chloro-5,6-dihydro-6-oxomorphanthridine underwent nucleophilic substitution with piperazine to give a product which reacted with 8-oxaspiro[4.5]decane-7,9-dione, completing the second stage of the synthesis.

GREEN AMIDATION: THE OPTIMIZATION OF AN ENVIRONMENTALLY FRIENDLY, HIGH-YIELDING AMIDE SYNTHESIS

Michael T. Wentzel and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178-0104

N-alkyl and *N,N*-dialkyl amides are prepared directly from corresponding amines and carboxylic acids in one pot using stoichiometric amounts of amine, acid, BOP-Cl, and TEA. When these reactions are performed in nonvolatile, nontoxic ionic liquid 1-butyl-3-methylimidazolium salts [(BMIM)X, X=BF_4, PF_6], the amides are produced in high yields. Optimization of preparation of model amide *N,N*-diethyl *m*-toluamide (DEET) monitored by HPLC provides a method by which DEET can be isolated in a chemically pure form by extraction.

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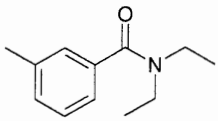


DEET

PRODUCING ASPIRIN FROM WILLOW BARK

Michael Stutzman, Department of Chemistry, Doane College, Crete, NE 68333

The goal of this study is to develop a laboratory project for a sophomore organic chemistry class. In this experiment, it is the students' objective to produce aspirin from the bark of a willow tree by a series of "sophomore organic" level reactions. This includes extracting salicin from the bark, hydrolyzing the salicin to salicyl alcohol, oxidizing the alcohol to salicylaldehyde, and then to salicylic acid. Finally, the salicylic acid is acetylated into acetylsalicylic acid or "aspirin".

ELECTROGENERATED CHEMILUMINESCENT INVESTIGATION OF ENROFLOXACIN AND TRIS (2, 2'-BIPYRIDYL) DICHLORORUTHENIUM (II) HEXAHYDRATE COMPLEX USING CYCLIC VOLTAMMETRY

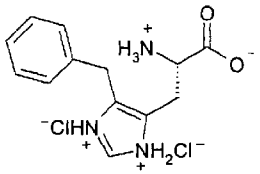
Evan K. Kimura and E.M. Gross, Department of Chemistry, Creighton University, Omaha, NE 68178

Electrogenerated chemiluminescence (ECL) involves chemical reactions that produce light via electrolytically stimulating species with an applied potential. Light can be emitted in the ultraviolet, visible or infrared regions, with light emitted in the visible region being the most common. A rapid detection scheme of the fluoroquinolone antibiotic of interest occurs at the microelectrode surface. ECL reactions, depending on the molecules and/or compounds involved, produce light at select pH buffered regions. ECL can be applied to detect fluoroquinolone levels in blood, fecal samples, and food and water samples; therefore, one can determine the fate of antibiotics given to people and animals. Recently, we have found that a chemiluminescent reaction occurs between the enrofloxacin and tris (2, 2'-bipyridyl) dichlororuthenium (II) hexahydrate complex near the physiological pH, tested at pH = 7.0, when they are oxidized. This provides insight on a detection scheme that can be directly applied to humans and animals. A potential of 1.10 V was applied to produce light based upon running a cyclic voltammetric (CV) scan to determine the oxidation potentials. We are currently using CV to determine the reaction mechanism(s) that are taking place during the ECL reaction.

A SYNTHESIS OF 4-BENZYL-L-HISTIDINE

Michael Mao and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178-0104

In order to confirm the spectroscopically assigned structure of the potent calcitonin gene-related peptide (CGRP) antagonist N_{α}-benzyl-(4-benzyl)His^{10}-CGRP(8-37), a synthesis of 4-benzyl-L-histidine was undertaken. A mixture of diastereomeric 4-phenylspinacines was formed by Pictet-Spengler reaction of benzaldehyde with L-histidine. Either diastereomer or their mixture can be hydrogenated to provide 4-benzyl-L-histidine as a diacetate syrup. Lyophilization twice from 1 molar hydrochloric acid resulted in the solid 4-benzyl-L-histidine dihydrochloride. This rapid approach to the synthesis of 4-substituted histidines has implications for the preparation of conformationally restricted histidine analogues.



14-Bn-L-His · 2 HCl

INTERACTION BETWEEN HUMAN ADENOSYL TRANSFERASE AND METHIONINE SYNTHASE REDUCTASE

Kassandra Douglas, Midland Lutheran College, Fremont, NE 68025; and Carmen Gherasim and Ruma Banerjee, Redox Biology Center, University of Nebraska–Lincoln, NE 68588-0664

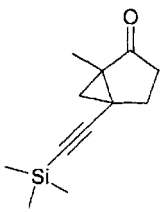
The two biologically active forms of vitamin B_{12}, adenosyl cobalamin (AdoCbl) and methyl cobalamin (MeCbl), are required in two essential enzymatic reactions catalyzed by methionine synthase (MS), involved in one carbon metabolism and methylmalonyl-CoA mutase (MCM), involved in the degradation of branched chain amino acids. AdoCbl synthesis required the reduction of cob(II)alamin to cob(I)alamin which is then adenosylated in an ATP-dependent reaction catalyzed by human adenosyl transferase (hATR). Recent data (Leal et al.) revealed that MSR is not only involved in the NADPH-dependent reduction of cob(II)alamin for MS activation but also in the reduction of cob(II)alamin to cob(I)alamin used in AdoCbl synthesis. Interesting, cob(I)alamin formation is enhanced by the presence of hATR consistent with an interaction between MSR and hATR. The aim of this study was to map the interaction surfaces between MSR and hATR.

Reference: Leal, N., Olteanu, H., Banerjee, R., Bobik, T. (2004) Journal of Biological Chemistry, Accepted for Publication.

STUDIES IN EXTENDED CONJUGATE ADDITION: 1-METHYL-5-(TRIMETHYLSILYLETHYNYL)BICYCLO[3.1.0]-2-HEXANONE

David Moody and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178-0104

A strategy for the synthesis of the title compound , useful for the preparation of ring-enlarged exocyclic allenylketones, was developed. Protection of 2-methyl-1,3-cyclopentanedione as its isobutyl monoenol ether was followed by reaction with trimethylsilylethynylmagnesium bromide to provide an intermediate propargylic alcohol. Acid-catalyzed dehydration with concommittant deprotection of the enol ether provided the desired 3-trimethylsilylethynyl substituted conjugated ketone. Reduction using lithium aluminum hydride gave the corresponding allyl alcohol, which was cyclopropanated. Reoxidation leads to the desired bicyclo[3.1.0]-2-hexanone.



SYNTHESIS OF A LESS TOXIC COPPER-CONTAINING CERAMIC GLAZE

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A high percent of metal content in glazes poses a threat to the health of those who manufacture ceramics and to those individuals who use the end products. Copper(II) carbonate ($CuCO_3$) is a common glaze colorant that produces a wide variety of greens, blues, and reds depending on the glaze formula, atmosphere, and temperature of firing. Substitution of the copper(II) carbonate with a copper(II) coordination complex, $[Cu(NH_3)_4]\ SO_4 \cdot H2O$, as means to reduce the copper content and thereby decrease the toxicity of the glaze was studied. Colorant properties of two glazes containing reagent grade copper(II) carbonate and pentaamminecopper(II) sulfate monohydrate respectively were noted and compared in this preliminary study. A high temperature muffle furnace was used to simulate a kiln to fire the clay A-frame supports and glazes that were used in the study.

STRUCTURAL CHARACTERIZATION OF AN ALLOSTERIC RNA CATALYST

Shennen Floy, T. McCarthy, J. Jansen, J. Greimann, A. Kertsberg, G. Soukup, and J. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha, NE 68178

In nature, catalysts are used to expedite biochemical reactions and achieve specificity. Initially proteins were thought to be the only molecules that could act as biocatalysts and nucleic acids were thought to serve merely as information storage and transfer molecules in cells. This rationale has changed with the discovery of catalytic nucleic acids capable of folding to form active sites which promote chemical reactions. The structural conformation of catalytic nucleic acids has been shown to have a direct effect on the molecules in order to determine how they work. While there is a growing database of structures for naturally occurring catalytic RNA structures (ribozymes), very little structural data exists for many other nucleic acids. Crystal structures of ribozymes provide a glimpse of how functional groups arrange for catalysis, however, structure can be directly connected to catalytic function by using the biochemical approach, Nucleotide Analogue Interference Mapping (NAIM). Of particular interest is the investigation of catalytically active structures of nucleic acid molecules in order to explore and predict structural motifs in these biomolecules, to understand how the the molecules structure affects function, and to elucidate mechanisms of certain chemical reactions. Many protein catalysts are subject to the binding of small molecules, which results in stimulating or inhibiting catalytic activity of the protein. Similarly, tailor-made allosteric ribozymes can be used in a variety of applications including molecular detection and artificial control of cellular processes. In order to better understand RNA structure and conformational transitions which empower allosteric control of RNA catalysts, NAIM has been used to investigate the active structure of one such allosteric ribozyme. Results from NAIM will enable generation of a detailed structural model for the allosteric catalyst, providing a mechanistic view of the allosteric transition brought about by effector binding, and contribute general knowledge that will be applicable to further RNA design and engineering strategies.

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STRUCTURAL CHARACTERIZATION OF A GUANINE RIBOSWITCH THAT EXHIBITS METABOLIC CONTROL

Carolyn Green, J. Jansen and J. Soukup, Department of Chemistry, 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 a cell to genetic machinery. While it has been shown that engineered RNAs can similarly respond to affector molecules and function as allosteric enzymes, it has recently been shown that certain naturally-occurring RNA structures termed riboswitches can directly affect gene expression. These highly structured domains reside in noncoding regions of certain prokaryotic and eukaryotic mRNAs and serve as metabolite-sensitive switches. To date, riboswitches have been identified for the following metabolites: SAM, cobalamin, thiamine, FMN, lysine, guanine, adenine, glucosamine-6-phosphate and glycine. Since riboswitches are essential to the regulated expression of genes important to normal cellular metabolism, they are targets for new antibiotic development. It is therefore important to investigate the structural characteristics of riboswitches in the absence and presence of metabolite. A molecular level understanding of these genetic units will aid in further development of genetic regulatory tools. Mutational analysis of a guanine riboswitch has been performed as well as preliminary Nucleotide Analog Interference Mapping (NAIM). These techniques are utilized in order to investigate important functional groups in this one family of riboswitches involved in purine metabolism. Examination of the guanine riboswitch aims to reveal how metabolite interacts with the riboswitch and what structural changes ensue.

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COMPARING THE PRODUCTS OF THE ULTRASONIC INITIATION OF GRIGNARD REACTONS WITH CONVENTIONAL GRIGNARD REACTIONS

Abby Fenner, Department of Chemistry, Doane College, Crete, NE 68333

Grignard reactions are a common part of student laboratory work. Traditionally, these reactions are very difficult to initiate because they must take place in extremely dry conditions. The ultrasonic method of making Grignard reagents allows reaction initiation to occur under average laboratory conditions. This study compares the product mixtures resulting from the ultrasonic and the conventional methods and focuses on the mixtures caused by common student mistakes.

INVESTIGATING THE ACTIVATION OF $ClONO_2$ ON THE SURFACE OF ICE USING QM/MM AND *AB INITIO* METHODS

Trenton L. Pruden and Mark A. Freitag, Department of Chemistry, Creighton University, Omaha NE 68178

The reaction of HCl with a chlorinated nitrate produces photochemically liable chlorine gas at a very slow rate. Hillier, *et. al.* have determined that this process is readily catalyzed in the gas phase when in the presence of at least two water molecules. Our research has expanded Hillier's conclusions by examining the possible catalytic activity of solid ice in this reaction. To investigate this, the solid ice lattice has been modeled using the QM/MM Effective Fragment Potential EFP) method. Our work involves constructing a large, experimentally determined structure of ice using EFPs and removing a small number of water molecules on the surface to allow for the reaction of the chlorinated nitrate molecule. We will use standard computational methods to

determine the transition state of the reaction of HCl with the chlorinated nitrate, and then track the reaction coordinate backwards to reactants and forwards to products using the IRC method. By comparing these results with those in the gas phase, the catalytic effects of block ice may be determined.

UNDERSTANDING THE PHOTOCHEMISTRY OF ATMOSPHERIC HALOGEN SOURCES, INTERMEDIATES, AND RESERVOIRS: EXCITED STATE DYNAMICS AND ENERGY PARTITIONING

Tracy Niday, Midland Lutheran College, Fremont, NE 68025; and Hahkjoon Kim and Simon W. North, Texas A&M University, College Station, TX 77841

Our group has have focused on the visible-ultraviolet photolysis of halogenated source and reservoir species, in particular, chlorine-containing compounds. We seek to establish quantitative trends in the wavelength dependent photochemistry of these molecules to aid in assessing their atmospheric significance. Our approach utilizes molecular beam velocity-map ion imaging of state-selected photofragments. The technique permits correlated scalar distributions and angular distributions to be measured. The poster will highlight recent results on several chemical species including ClONO2 and ClO.

WEAKLY POLAR INTERACTIONS IN MODEL HELICAL PEPTIDES

Nicholas Palermo, Department of Computer Science, College of Information Science and Technology, University of Nebraska at Omaha, NE 68182; and Michael C. Owen, Richard F. Murphy, and Sándor Lovas, Department of Biomedical Sciences, School of Medicine, Creighton University, Omaha, NE 68178

Weakly polar interactions between aromatic rings of amino acid residues and hydrogens of backbone amides (Ar-HN) support local structures in proteins [1]. In Ala-based model α-helical peptides with Tyr replacement in the N-terminal and inner helical positions [2], it was shown using ^{1}H NMR and molecular dynamics (MD) simulations that aromatic-backbone interactions are the result of the Ar-HN, π-HC, and Ar-CO interactions. These interactions are weak separately but, in combination, they can have strong influence on the stability of polypeptide structure.

In the present study, *ab-initio* and DFT calculations were used to further characterize the aromatic-backbone interactions in hexaalanyl α-helical model peptides with sequential Tyr replacement (Ac-YAAAAA-NHMe, Ac-AYAAAA-NHM, Ac-AAYAAA-NHMe, etc.) to study the positional dependence of the interactions. Geometry optimizations were completed with the Jaguar 5.1 program package. $E=f(\chi_i^{n,m})$ hypersurfaces were generated with $\omega_i\Phi_i/\Psi_i$ dihedral angles constrained with ideal α-helical values and a Poisson-Boltzmann solver was used to simulate an aqueous environment. Conformers were initially constructed at the RHF/3-21G level of theory and then brought up to the RHF/6-31G(p) level. Further investigations were performed through the induction of electron correlation, using the B3LYP/6-31G(p) level.

The study showed that Ar-HN interactions occur in solution phase and have the form of an *i, i*-4 interaction. Furthermore, the aromatic ring was able to interact with multiple backbone entities, and whole peptide bond interaction was observed.

This work was supported by NIH-BRIN grant (1 P20 RR16469) and the Carpenter Endowed Chair in Biochemistry, Creighton University.

[1] Tóth G., Watts C.R., Murphy R.F., Lovas S., Proteins: Struct. Funct. Genet. 2001, 43, 373-81.
[2] Tóth G., Kövér K.E., Murphy R.F., Lovas S., J. Phys.Chem. B 2004, 108, 9287-9296.

STUDIES OF THE EFFECTS OF SILICON ON ARENE-CHROMIUM BONDS

Phil Krzycki and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

The stabilizing effects of silicon on arene-chromium bonds were studied by comparing the physical properties of three trimethylsilyl (TMS) benzene chromium tricarbonyl complexes (1-, 1,4-di- and 1,3,5-tri-TMSbenzene chromium tricarbonyl) to benzene chromium tricarbonyl. IR results show a decrease in the carbonyl frequencies of 2-6 cm^{-1} per TMS as expected, while UV shows an increase of 2-4 nm per TMS, not expected. For a better understanding of the of the bonding and structural effects, the system was modeled using Gaussian '03W with DFT method B3LYP/6-31+G(d). The calculated energies show an increase in the Cr-arene bond strength of about 8 kJ/mol per TMS, but that is competing against a general increase in rotational barriers, 4-5 kJ per TMS.

EXPERIMENTAL AND THEORETICAL STUDIES OF THE UV/VIS AND FLUORESCENCE SPECTRA OF ACID-BASE INDICATORS

Erin Koch, Ryan Becker, Dan Froistad, Paul Karr, and David Peitz, Wayne State College, Wayne NE, 68787

The UV/Vis and fluorescence spectra of 20 ppm protonated/deprotonated indicators were determined on PerkinElmer Lambda 25 UV/Vis Spectrometer and LS 55 Luminescence Spectrometer. For a better understanding of the electronic structure of indicators and to develop a method for predicting fluorescence spectra, TD-DFT using the B3PW91 model chemistry coupled with the 6-31G(d,p) basis utilizing the Gaussian 03W (G03W) software package was used to predict the UV/Vis and fluorescence spectra of the indicators. The G03W calculated singlet-singlet excitation energies and intensities were shown to be a good approximation of the experimental spectra. Fluorescence spectra were generated by calculating the B3PW91/6-31G(d,p) ground state vibrational energies and coupling the IR bands with the UV/Vis bands. A C++ program was written and then used to generate fluorescence spectra which were graphed to demonstrate the expected wavelength red shift.

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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 CHARLES LANG

Charles Lang grew up on a typical Eastern Nebraska farm, attending a one-room elementary school and a small secondary school. Early on science was important in the family. Apparently his father, Richard Lang, was George Beadle's chemistry laboratory instructor at the University of Nebraska Agriculture campus. Chuck received his undergraduate degree from Nebraska Wesleyan and his graduate degrees from Minnesota and Kansas State.

His first teaching assignment was in the Stromsburg, Nebraska public school. From there Chuck went to Omaha Westside High School for the majority of his teaching career. He enjoyed his work there, a district that fostered creativity through extended contracts and professional leave.

Beginning with his dissertation on computer graphics for the classroom, Chuck has been very involved with programs and products that utilize visualization for learning science. Among these are Mechanical Universe, Project Physics, and Physics: Cinema Classics. Chuck has recently helped to move Frames of Reference, Project Physics and Physics: Cinema Classics to DVD.

In addition to teaching high school physics, Chuck has worked on physics textbook development in this country, Canada, The Netherlands and Jordan, been a science consultant to Don Herbert's Mr. Wizard television program, and done many teacher in-service workshops in eighteen states and Canada. Some of his best efforts occurred in the twenty, week-long summer workshops for teachers in Nebraska.

Chuck's past work has not gone unnoticed by others. Among his many awards are the Presidential Science Award, the Distinguished Service Award from the American Association of Physics Teachers, and the Nebraska Teachers of Science Catalyst Award.

Currently Chuck is working with Carnegie Mellon and Kansas State on the development of the synthetic interview. A pilot website, physicspathway.org, allows a physics teacher to log-on and ask Chuck Lang, Paul Hewitt, or Roberta Lang questions about teaching mechanics. A high-speed connection and a PC are needed at this time. The pilot will be expanded in the next five years to include most physics topics and many more "bells and whistles". Charles Lang is still devoted to bringing the best means possible to help teachers teach and students learn physics.

FRIEND OF SCIENCE AWARD TO KATHLEEN JACOBITZ

Kathleen Kae Jacobitz has worked in the field of education for 29 years, teaching, creating curriculum, helping to develop state science standards and evaluating science curriculum. She has been both a secondary school teacher and a University of Nebraska Science instructor.

A Howard Hughes Grant allowed Kathleen to help create new courses at the University of Nebraska in Biology, Earth Science, Chemistry and Physics for pre-service teachers of grades 4-8. Another grant, through the Howard Hughes Medical Institute, provided funding for Kathleen's development of student research curricula to allow high school students to receive college credit while in high school. In 1993-1995, Kathleen wrote Wetlands and Biological Region Units for the Nebraska Department of Education and took part in pilots of Wetlands, Amphibians, and Radon units for distance learning. Kathleen also created a cross-curriculum unit for the internet about farming in Nebraska in the 1930's.

Kathleen has been involved with teacher education and science associations holding various state offices. She has been closely tied the Nebraska Junior Academy of Sciences (NJAS) as co-chair from 1980 - 2000 and has been a member of the Academy since 1975. Kathleen's mentoring of her students has led them to participate in competitions at the NJAS state science fair, and the Westinghouse Talent Search. In addition to numerous regional and state winners, Kathleen's students were recognized nationally by Westinghouse in 1985, 1986, and 1988. Her students competed in the International Science and Engineering Fair and won 4th in Engineering, 1975, 1981 and 1982; 4th in Medicine and Health in 1981 and 1982, 1st in Botany in 1984 and 1985, and 1st in Environmental as well as the top award at the fair in 1988.

Numerous awards have been presented to Kathleen throughout her career including Nebraska Science Teacher of the Year in 1984, 1987 and 1990; Presidential Award of Excellence in Science Education 1986-1988 and 1990; the Christa McAuliffe Award in 1989, and the Nebraska Association of Teachers of Science Catalyst Award in 1998.

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