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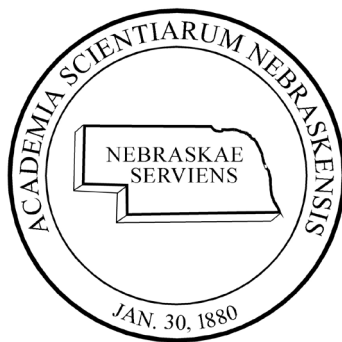
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**PROGRAM
and
PROCEEDINGS**

**THE NEBRASKA ACADEMY
OF
SCIENCES
1880-2009**

including the

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



129th Anniversary Year

One Hundred-Nineteenth Annual Meeting

April 17, 2009

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

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The 2009 Fall Retreat of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, October 8 - 10 (Thursday, Friday, and Saturday).

President: Dan Sitzman, Omaha North High School, Omaha, NE

President-Elect: Joan Christen, Beatrice High School, Beatrice, NE

AFFILIATED SOCIETIES OF THE NEBRASKA ACADEMY OF SCIENCES, INC.

1. American Association of Physics Teachers, Nebraska Section

Web site: <http://www.cune.edu/facweb/brent.royuk/naapt/officers.htm>

2. Friends of Loren Eiseley

Web site: <http://www.eiseley.org>

3. Lincoln Gem & Mineral Club

Web site: <http://www.lincolngemmineralclub.org>

4. Nebraska Chapter, National Council for Geographic Education

5. Nebraska Geological Society

Web site: <http://maps.unomaha.edu/ngs/>

Sponsors of a \$50 award to the outstanding student paper presented at the Nebraska Academy of Sciences Annual Meeting, Earth Science Section

NGS Annual Meeting, April 16, 2009

6. Nebraska Graduate Women in Science

7. Nebraska Ornithologists' Union

Web site: <http://rip.physics.unk.edu/NOU/>

Publishers of the quarterly, *The Nebraska Bird Review*

Spring Meeting, May 15 - 17, 2009, York, NE

8. Nebraska Psychological Society

<http://www.nebpsych.org/>

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

10. Nebraska Space Grant Consortium

Web site: <http://www.unomaha.edu/nasa/>

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

THE NEBRASKA ACADEMY OF SCIENCES, INC.

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

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

GENERAL INFORMATION

Members and visitors will be registered at Olin Hall of Science, Nebraska Wesleyan University, 50th & St. Paul, Lincoln, Nebraska. The registration fee is \$20.00 for General Registrants and \$10.00 for students with a VALID student ID. Registrants are entitled to the PROGRAM/PROCEEDINGS and to attend any of the section meetings. Junior and senior high school students will register at a separate area, FREE.

Additional copies of the PROGRAM/PROCEEDINGS may be obtained at the Registration Desk or, after the meeting, at the Academy Office, for \$3.00/copy.

The Nebraska Academy of Sciences was organized on January 30, 1880 with monthly scheduled meetings in Omaha, Nebraska. The Academy was reorganized on January 1, 1891 and annual meetings have been held thereafter.

AUTHORS ARE INVITED TO SUBMIT MANUSCRIPTS OF THEIR WORK FOR PUBLICATION IN THE TRANSACTIONS OF THE NEBRASKA ACADEMY OF SCIENCES a technical journal published annually by the Academy for 33 years.

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

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

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

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

PROGRAM

FRIDAY, APRIL 17, 2009

- 7:30 a.m. REGISTRATION FOR ACADEMY, Lobby of Lecture wing, Olin Hall
- 8:00 Aeronautics and Space Science, Olin 249
Collegiate Academy, Biology Session A, Olin B
Earth Science, Olin 224
- 8:10 Collegiate Academy, Chemistry and Physics, Session A, Olin 324
- 8:30 Biological and Medical Sciences, Session A, Olin 112
Biological and Medical Sciences, Session B, Smith Callen Conference Center
Junior Academy, Senior High REGISTRATION, Olin Hall Lobby
NWU Health and Sciences Graduate School Fair, Olin and Smith Curtiss Halls
- 9:00 Junior Academy, Senior High Competition, Olin 124, Olin 131
- 9:10 Aeronautics and Space Science, Poster Session, Olin 249
- 9:15 History and Philosophy of Science, Olin 325, combined section
Teaching of Science and Math, Olin 325, combined section
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN B
Dr. Donald Frey, Chair, Department of Family Practice, Creighton University Medical Center
- 12:00 LUNCH, PATIO ROOM, STORY STUDENT CENTER
(pay and carry tray through cafeteria line, or pay at NAS registration desk)
Policy and Program Committee Luncheon, Roundup Room
Emeriti Luncheon, Presidents Room
Aeronautics Group, Conestoga Room
- 1:00 p.m. Anthropology, Olin 111
Biological and Medical Sciences, Session C, Olin 112
Biological and Medical Sciences, Session D, Smith Callen Conference Center
Chemistry and Physics, Section A, Chemistry, Olin A
Chemistry and Physics, Section B, Physics, Planetarium
Collegiate Academy, Biology Session A, Olin B
Collegiate Academy, Biology Session B, Olin 249
Collegiate Academy, Chemistry and Physics, Session A, Olin 324
Junior Academy, Junior High REGISTRATION, Olin Hall Lobby
Junior Academy, Senior High Competition, (Final), Olin 110
- 1:30 Junior Academy, Junior High Competition, Olin 124, Olin 131
- 2:00 NJAS Board/Teacher Meeting, Olin 219
- 5:00 Junior Academy, General Awards Presentations, Smith Callen Conference Center
- 5:00-5:45 BUSINESS MEETING, OLIN B
- 5:45-6:30 SOCIAL HOUR for Members, Spouses, and Guests
First United Methodist Church, 2723 N 50th Street, Lincoln, NE
- 6:30-8:30 ANNUAL BANQUET and Presentation of Awards and Scholarships
First United Methodist Church, 2723 N 50th Street, Lincoln, NE

*For papers with more than one author, an asterisk follows the name of the author(s) who plans to present the paper at the meeting.

AERONAUTICS AND SPACE SCIENCE

Chairperson: Scott E. Tarry

NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha
Olin 249

- 8:00a.m. 1. CATIA V5 SIMULATION IN SUPPORT OF CONSTELLATION GROUND OPERATIONS. Andrew Kelley*, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 8:10 2. THE ABORT FLIGHT TEST – FLIGHT TEST ARTICLES TESTING TEAM. Justin Green*, Department of Mechanical Engineering, University of Nebraska–Lincoln; and Michael Titus, Department of Engineering Science and Mechanics, Virginia Tech; and Caroline Gorham, Kings College London, London, England.
- 8:20 3. DEVELOPMENT OF INTEGRATED LOW TEMPERATURE MECHANISMS FOR NEXT GENERATION ROBOTICS MISSIONS. Evan Luxon, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 8:30 4. A SWARM-BASED MULTI-ROBOT SYSTEM FOR LUNAR AND MARS SURFACE MAPPING. Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 8:40 5. MINIATURE ROBOTS FOR MINIMALLY INVASIVE SURGERY. Amy C. Lehman* and Shane M. Farritor, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 8:50 6. PRINCIPAL COMPONENT ANALYSES OF ANTHROPOMETRIC DATA: A REVISIT OF A DIFFERENT APPROACH. M. Chandrasekaran and Ram Bishu*, Department of Mechanical Engineering, University of Nebraska–Lincoln; and Sudhakar Rajulu, ABF Laboratory, Johnson Space Center, Houston, TX.
- 9:00 7. FLUID STRUCTURE INTERACTIONS FOR BLAST WAVE MITIGATION. Wen Peng, Christopher Bruening, Zhaoyan Zhang*, and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln.
- 9:10 BREAK/POSTER PRESENTATIONS
- 9:30 8. LYOTROPIC LIQUID CRYSTALS AND THEIR POLARIZING EFFICIENCY UNDER DIFFERENT TEMPERATURE AND CONCENTRATION CONDITIONS. Jeremy Stromer* and Josh Beck*, Department of Physics, University of Nebraska at Kearney.

- 9:40 9. EFFECTS OF PLACEMENT OF CROP COSMIC RAYS DETECTORS. Alejandro Echeverri*, Thomas S. McShane, and Lyle S. Sass, Department of Physics, Creighton University, Omaha.
- 9:50 10. DESIGN AND CONSTRUCTION OF A PROTOTYPE LIDAR ENHANCEMENT DETECTOR FOR THE PIERRE AUGER COSMIC RAY OBSERVATORY. Emily Petermann*, Gregory R. Snow, and Maria Becker, Department of Physics and Astronomy, Creighton University, Omaha.
- 10:00 11. DARK MATTER IN NON-STANDARD COSMOLOGIES. Gintaras Duda, Department of Physics, Creighton University, Omaha.
- 10:10 12. A NASA SPITZER SPACE TELESCOPE INFRARED STUDY OF QUASAR OUTFLOWS. Allison Showalter*, Sandra Behncke, and Jack Gabel, Department of Physics, Creighton University, Omaha.
- 10:20 13. RETRIEVAL AND PROCESSING OF LUNAR SOIL FOR ³He, OXYGEN AND BUILDING MATERIALS. Juana Acosta* and Cheslee Cornell*, Department of Chemistry, College of Saint Mary, Omaha.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. USING A GEOGRAPHIC INFORMATION SYSTEM TO DEVELOP A VINEYARD SUITABILITY MODEL FOR SELECTED WINE GRAPE CULTIVARS IN SOUTHWESTERN NEBRASKA. Ellen Mickle*, Donald Rundquist, and Ting Chen, School of Natural Resources and CALMIT; and Paul Read, Department of Agronomy and Horticulture, University of Nebraska–Lincoln.
- 11:00 15. ENHANCING TRIBAL ECONOMICS, CULTURE, AND ENVIRONMENTAL BENEFITS WITH CONSERVATION PLANTINGS. Hank Miller*, Department of Natural Resources, Nebraska Indian Community College, Niobrara; and David Shelton, Northeast Research and Extension Center, University of Nebraska–Lincoln.
- 11:10 16. COASTAL WETLAND MAPPING AND AQUATIC CHLOROPHYLL PREDICTION USING HYPERSPECTRAL AIRCRAFT IMAGERY IN REDFISH BAY, TEXAS. Adam E. Altrichter*, John Schalles, Tyler Craven, and Tyler Monahan, Department of Biology, Creighton University, Omaha.
- 11:20 17. AIR POLLUTION FROM CHINA: GROUND TRUTH AND SATELLITE VIEW. Catherine May* and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln.
- 11:30 18. COMPARATIVE ANALYSIS OF FOSSIL TRACK MORPHOLOGY AS A FUNCTION OF SUBSTRATE CONDITIONS. J. Zwiebel* and M.B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron; and H.E. LaGarry, Department of Math and Science, Oglala Lakota College, Kyle, SD; and B.H. Breithaupt, Geological Museum, University of Wyoming, Laramie, WY; and N.A. Matthews, National Science and Technology Center, Bureau of Land Management, Denver, CO.

11:40 19. WEIGHTED RANKING SYSTEM FOR IDENTIFICATION OF GEOLOGICAL STRUCTURES FROM LINEAMENTS ON REMOTELY-SENSED IMAGES OF THE PINE RIDGE – BLACK HILLS REGION, USA. Jennifer L. Balmat* and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.

12:00 ADJOURN

AERONAUTICS AND SPACE SCIENCE

Poster Session 9:10 - 9:30 a.m. & 10:30 – 10:50 a.m.
Olin Hall Room 249

AVIATION AND SPACE EXPLORATION CLUBS. Diane Bartels, STARBASE Nebraska Inc., Lincoln.

A SPITZER SPACE TELESCOPE INFRARED SPECTRAL STUDY OF QUASAR OUTFLOWS. Sandra Behncke and Jack Gabel, Department of Physics, Creighton University, Omaha.

DETECTING CORN-PLANTING FOR NEBRASKA USING LANDSAT DATA. Vijendra K. Boken and Kelsey A. Bard, Department of Geography and Earth Science, University of Nebraska at Kearney.

UNO'S ONLINE EARTH SYSTEM SCIENCE COURSES USING NASA RESOURCES. Neal Grandgenett, Department of Teacher Education and Robert Shuster, Department of Geology, University of Nebraska at Omaha.

USE OF THE GENERALIZED EIKONAL APPROXIMATION METHOD TO TEST LIGHT SCATTERING BY A LEVITATED LARGE SPHERICAL DIELECTRIC. Jason Gerritsen, Department of Physics, Hastings College, Hastings.

SINGLE BUBBLE SONOLUMINESCENCE (SBSL) PRODUCTION IN A SPHERICAL RESONANT FIELD. Joe Jeanjaquet, Department of Physics, Hastings College, Hastings.

INVESTIGATION OF THE SAFETY AND EFFICIENCY OF WIRELESS POWER TRANSFER USING COUPLED MAGNETIC RESONANCES. Jordan Neuhart, Department of Physics, Hastings College, Hastings.

THE DESIGN, CONSTRUCTION AND TESTING OF A THERMOACOUSTIC REFRIGERATOR. Brian Steinert, Department of Physics, Hastings College, Hastings.

IN-SITU ELLIPSOMETRIC ANALYSIS OF CONDENSED RTV EFFLUENTS ON MgF₂ COATED GLASS SUBSTRATES. N.J. Ianno and Jinya Pu, Department of Electrical Engineering, University of Nebraska–Lincoln.

THE LUMINOSITY MEASUREMENT OF THE DZERO EXPERIMENT AT FERMILAB'S TEVATRON COLLIDER. Ioannis Katsanos and Gregory R. Snow, Department of Physics, University of Nebraska–Lincoln.

AMERICAN INDIAN SCIENCE AND ENGINEERING SOCIETY CONFERENCE. Victor M. Leading Horse, Department of Psychology, University of Nebraska at Omaha.

USING GEOSPATIAL INFORMATION TECHNOLOGIES TO ESTIMATE CORN PRODUCTION FOR ETHANOL. Andy McDowell, Department of Geography, University of Nebraska–Lincoln.

INNOVATIVE CHANGES AND PROCEDURES TO REDUCE FUEL CONSUMPTION. Joseph Rotterdam and Michael Cameron, Aviation Institute, University of Nebraska at Omaha.

ENHANCEMENT OF ONLINE PHYSICS COURSES, GENERAL PHYSICS I & II, WITH NASA EDUCATIONAL MATERIALS. Maria Becker and Gregory R. Snow, Department of Physics, University of Nebraska–Lincoln.

THE EFFECTS OF A LATE DECAYING SCALAR FIELD ON DARK MATTER DENSITY. Katherine Garrett and Stephanie Schuk, Department of Physics, Creighton University, Omaha.

OPTICAL SINGULARITIES. Carl Corder, Department of Physics, University of Nebraska at Kearney.

ANTHROPOLOGY AND GEOGRAPHY

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

1:00 p.m. WELCOME

- 1:10 1. A PRELIMINARY SURVEY OF LESSER KNOWN POLYANDROUS SOCIETIES. Kathrine E. Starkweather, Department of Anthropology, University of Nebraska–Lincoln.
- 1:30 2. IN THE WAITING ROOM: USE AND PERCEPTIONS OF REPRODUCTIVE HEALTHCARE IN QUITO, ECUADOR. Emily R. Smith, Department of Anthropology, University of Nebraska–Lincoln.
- 1:50 3. INTERNATIONAL POLITICAL ECONOMY EXPLANATIONS TO GUATEMALA'S ECONOMIC OPENNESS AND ITS IMPACT ON RURAL COMMUNITIES. José Nicolás Cabrera-Schneider, Department of Anthropology, University of Nebraska–Lincoln.
- 2:10 4. UTOPIAN AND COMMUNAL SOCIETIES: THE IMPORTANCE OF INSTITUTIONALIZED AWE THROUGH IDEOLOGY. Matthew H. Brittingham, Department of Religious Studies, University of Nebraska–Lincoln.
- 2:30 5. ARCHAEOLOGICAL RECONASSAINCE OF THE ROYAL BUFFALO HUNT OF 1872. Stephen Damm, Department of Anthropology, University of Nebraska–Lincoln.
- 2:50 6. A LOOK AT A COLLECTION OF OIL LAMPS AND THEIR COLLECTORS. Geri J. Knight, Department of Anthropology, University of Nebraska–Lincoln.

BIOLOGICAL AND MEDICAL SCIENCES

Chairperson: Theodore Burk
Department of Biology, Creighton University

SESSION A

Session Chairperson: Theodore Burk, Creighton University
Olin 112

- 8:30 a.m. 1. QUANTIFICATION AND ISOLATION OF BACTERIOPHAGE IN HYPERALKALINE-SALINE LAKES IN WESTERN NEBRASKA. Andrew A. Block* and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney.
- 8:42 2. ANALYSIS OF SEX CHROMOSOMAL DNA AND MORPHOLOGY IN CHIMERIC MARMOSETS. Andrew Z. Lescelius* and Jeffrey A. French, Biology and Psychology Departments, University of Nebraska at Omaha.
- 8:54 3. BUTTERFLY POPULATION TRANSECT STUDIES AT TWO EASTERN NEBRASKA TALLGRASS PRAIRIES. Collin J. Brennan* and Theodore Burk, Environmental Sciences Program, Creighton University, Omaha.
- 9:06 4. BUTTERFLY NECTAR PLANT VISITS AT TWO EASTERN NEBRASKA TALLGRASS PRAIRIES. Katherine A. Cusack* and Theodore Burk, Department of Biology, Creighton University, Omaha.
- 9:18 5. RE-EXAMINATION OF DIET FOR THE COMMON BARN OWL (*TYTO ALBA*) AND GREAT HORNED OWL (*BUBO VIRGINIANUS*) AT CRESCENT LAKE NATIONAL WILDLIFE REFUGE. Stacey L. Bonner* and K. Geluso, Department of Biology, University of Nebraska at Kearney.
- 9:30 BREAK
- 9:45 6. DOES ENVIRONMENTAL ENRICHMENT ALTER THE LOCOMOTOR STIMULANT EFFECTS OF CAFFEINE IN RATS? Jamie Fosdick* and D. J. Stairs, Department of Biology, Creighton University, Omaha.
- 9:57 7. ENVIRONMENTAL ENRICHMENT AND THE SUBJECTIVE EFFECTS OF CAFFEINE IN RATS. Beth Mittelstet* and D. J. Stairs, Department of Biology, Creighton University, Omaha.
- 10:09 8. DOES ENVIRONMENTAL ENRICHMENT ALTER DRINKING BEHAVIOR IN RATS? Elizabeth Schwarzkopf* and D. J. Stairs, Department of Biology, Creighton University, Omaha.
- 10:21 9. A FLORISTIC STUDY OF BROWN COUNTY, NEBRASKA. Megan Killion and Steven J. Rothenberger*, Department of Biology, University of Nebraska at Kearney.

10:33 10. RECENT FLORISTIC DISCOVERIES IN THE NEBRASKA PINE RIDGE AND A COMPARISON TO THE FLORA OF THE BLACK HILLS. Steven B. Rolfsmeier*, Kansas State University Herbarium, Manhattan, KS; and Ronald R. Weedon, High Plains Herbarium, Chadron State College, Chadron.

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

Session Chairperson: Karin van Dijk, Creighton University
Smith Callen Conference Center

8:30 a.m. 1. CHARACTERIZATION OF PUTATIVE REGULATORY ELEMENTS 5' AND 3' OF EXON 1 OF THE HUMAN N-CADHERIN. Kate Marley*, C. Flitcroft, K. Bryant, M. Wilson, B. Barelmann, and H. Kroese, Department of Biology, Doane College, Crete.

8:42 2. A DIFFERENT VIRULENCE STRATEGY USED BY THE PLANT PATHOGEN *PSEUDOMONAS SYRINGAE*: MODIFYING HOST CHROMATIN. McKenzie Jarecki* and Karin van Dijk, Department of Biology, Creighton University, Omaha.

8:54 3. STRUCTURE AND FUNCTION OF A POTENTIAL MAMMALIAN RIBOSWITCH. Kelley Wanzeck*, Department of Chemistry, and Juliane K. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

9:06 4. ANTIBIOTIC DEVELOPMENT BY INVESTIGATION OF THE *GLMS* RIBOSWITCH. Danielle N. Renner*, Department of Chemistry, and Juliane K. Soukup, Departments of Chemistry and Biomedical Sciences, Creighton University, Omaha.

9:18 5. ANALYZING PAIRING INTERACTIONS IN THE 5' NONTRANSLATED REGION OF THE COXSACKIEVIRUS B3 GENOME. Alisha A. Anderson* and William E. Tapprich, Department of Biology, University of Nebraska at Omaha.

9:30 BREAK

9:45 6. INVESTIGATION OF OTK18 BINDING TO VARIOUS PROMOTER ELEMENTS. Becky A. Fusby*, D. J. Carlson, B. L. Ericson, F. Kovacs, and K. A. Carlson, Department of Biology, University of Nebraska at Kearney.

9:57 7. STUDY OF CNBD DOMAIN IN EPAC PROTEINS. Stephanie Brady* and Dhundy Bastola, Department of Computer Science, University of Nebraska at Omaha.

- 10:09 8. EFFECT OF NICOTINE ON AVIAN EMBRYO DEVELOPMENT. John T. Olley*, P. R. Brauer, and M. V. Reedy, Department of Biomedical Sciences, Creighton University, Omaha.
- 10:21 9. UNDERSTANDING THE ROLE OF TIMP-2 IN CARDIAC NEURAL CREST CELL MIGRATION. Megan Ruhland*, A. Jizba, and M. Reedy, Department of Biology, and P. Brauer, Department of Biomedical Sciences, Creighton University, Omaha.
- 10:33 10. TIMP-2/ $\alpha_3\beta_1$ INTEGRIN INTERACTION MEDIATES CARDIAC NEURAL CREST CELLS MIGRATION. Lan Uyen B. Tran* and M. V. Reedy, Department of Biology, and P. R. Brauer, Department of Biomedical Sciences, Creighton University, Omaha.
- 11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

Session Chairperson: Theodore Burk, Creighton University
Olin 112

- 1:00 p.m. 1. DIFFERENTIAL GENE EXPRESSION IN BUFFALOGRASS CULTIVARS INFESTED WITH CHINCH BUGS. Austin S. Nuxoll*, K. Langenfeld, A. Barber, and P. Twigg, Department of Biology, University of Nebraska at Kearney.
- 1:12 2. SOYBEAN RESPONSES TO SOYBEAN APHIDS ASSESSED USING SUBTRACTIVE HYBRIDIZATION. Anna Barber* and P. Twigg, Department of Biology, University of Nebraska at Kearney, and T. Heng-Moss, Department of Entomology, University of Nebraska–Lincoln.
- 1:24 3. EXERCISE TRAINING NORMALIZES ACE AND ACE2 IN THE BRAIN OF RABBITS WITH PACING INDUCED CHRONIC HEART FAILURE. Sumit Kar*, Department of Biology, Creighton University, Omaha; and L. Gao and I. H. Zucker, Department of Cellular and Integrative Physiology, University of Nebraska Medical Center, Omaha.
- 1:36 4. CONSEQUENCES OF TOILET LID USE ON TOOTHBRUSH CONTAMINATION BY AEROSOLIZED COLIFORM BACTERIA. James D. Hadden* and Julie Shaffer, Department of Biology, University of Nebraska at Kearney.
- 1:48 5. INCIDENCE, RADIOGRAPHICAL FEATURES, AND PROPOSED MECHANISM FOR PNEUMOCEPHALUS FROM INTRAVENOUS INJECTION. T. P. Tran, E. Meyer-Reed, Jason Lambrecht*, J. C. McClay, F. Hahn, and M. F. Omojola, College of Medicine, University of Nebraska Medical Center, Omaha.
- 2:00 6. PATIENT EXPECTATION IN A FREESTANDING EMERGENCY DEPARTMENT. Eric J. Meyer-Reed*, K. R. Reeve, M. C. Wadman, R. L. Muelleman, and T. P. Tran, Department of Emergency Medicine, University of Nebraska Medical Center, Omaha.

- 2:12 7. EFFECT OF FRASS ON LONGEVITY IN POPULATIONS OF *DROSOPHILA MELANOGASTER*. Angela Y. Wang*, K. A. Carlson, and B. L. Ericson, Department of Biology, University of Nebraska at Kearney, and L. G. Harshman, School of Biological Sciences, University of Nebraska-Lincoln.
- 2:24 8. AVIAN IMMUNE RESPONSES TO WEST NILE VIRUS. Carol Fassbinder-Orth, Department of Biology, Creighton University, Omaha; and E. Hofmeister, USGS National Wildlife Health Center, Madison, Wisconsin.
- 2:36 BREAK
- 2:50 9. DOES HYBRIDIZATION BETWEEN TWO SPECIES OF MEADOWLARKS (*STURNELLA* SPP.) OCCUR IN NEBRASKA? SONG ANALYSIS EVIDENCE. Josef Kren, BryanLGH College of Health Sciences, Lincoln.
- 3:02 10. ROLE OF SUGGAMADEX IN ANTAGONISM OF NEUROMUSCULAR BLOCKADE. Katrina Longe, Graduate School of Nurse Anesthesia, BryanLGH College of Health Sciences, Lincoln.
- 3:14 11. CONTINUOUS REGIONAL ANESTHESIA FOR TREATMENT OF POST-SURGICAL PAIN. Joshua Mackie, Graduate School of Nurse Anesthesia, Bryan LGH College of Health Sciences, Lincoln.
- 3:26 12. CHARACTERIZATION OF MICROBES IN FRASS FROM TWO POPULATIONS OF *DROSOPHILA MELANOGASTER*. Stephanie N. Bonner*, A. Wang, J. Shaffer, and K. A. Carlson, Department of Biology, University of Nebraska at Kearney.
- 3:38 13. RESPONSES OF DNA REPAIR PROTEINS TO CISPLATIN AND UV DAMAGED *DROSOPHILA* POLYTENE CHROMOSOMES. Katie Brown*, A. Krause, and A. Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 3:50 14. THE EXPANSION OF THE RIBONUCLEASE A GENE SUPERFAMILY DURING EARLY MAMMALIAN EVOLUTION. Stephen M. S. Goo* and Soochin Cho, Department of Biology, Creighton University, Omaha.
- 4:02 15. THE ORIGIN AND GENETIC BASIS OF SEX REVERSALS IN SOUTH AMERICAN FIELD MICE. Daniel A. Belatti* and S. Cho, Department of Biology, Creighton University, Omaha; and O. Podlaha and J. Zhang, Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI.
- 4:14 16. THE *MANDUCA SEXTA* IMMULECTIN 2 (IML-2) PROTEIN ISOTYPES ARE ENCODED BY TWO UNIQUE GENES. Fiona Denge* and Brad L. Ericson, Department of Biology, University of Nebraska at Kearney.
- 4:26 17. TO STUDY THE QUALITY OF DATA GENERATED BY CHRONOSCAPE – AN REU PROJECT. Aaron Mills, Peter Kiewit Institute, Omaha; and Parvathi Chundi, Computer Science Department, University of Nebraska at Omaha.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

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

- 1:00 p.m. 1. INTRACELLULAR MECHANISMS UNDERLYING THE NEUROTROPHIC PROPERTIES IN MICROGLIA. Jesse Bayudan* and A. Shibata, Department of Biology, Creighton University, Omaha.
- 1:12 2. ANALYSIS OF NEUROGENESIS AND NEURODEGENERATION IN ATOH1-CRE DICER NULL MUTANT MICE. Kaitlin Campbell*, S. Hake, and A. Shibata, Department of Biology; and M. Pierce and G. Soukup, Department of Biomedical Sciences, Creighton University, Omaha.
- 1:24 3. INVESTIGATION OF THE EFFICACY OF NANOPARTICLE ANTIRETROVIRAL DRUG DELIVERY SYSTEMS. Shelby Takeshita*, Chemistry Department, A. Shibata, Biology Department, and T. Belgum and C. J. Destache, School of Pharmacy and Health Professions, Creighton University, Omaha.
- 1:36 4. INVESTIGATION INTO INTERGENIC PALINDROMIC REGIONS IN *COXIELLA BURNETII*. Adam S. Cornish* and M. A. Pauley, College of Information Science & Technology, University of Nebraska at Omaha; and D. H. Haft, J. Craig Venter Institute, Rockville, MD.
- 1:48 5. BUILDING ONTOLOGY FOR INFLUENZA PREVENTION, SURVEILLANCE AND CONTROL. Bill Sousan* and Z. Chen, Department of Computer Science, and G. Lu, Department of Biology, University of Nebraska at Omaha.
- 2:00 6. CHARACTERIZATION OF OTK18 FUNCTION IN MONOCYTIC CELLS USING RNAi. Amanda Calleroz* and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.
- 2:12 7. A BIOINFORMATIC APPROACH TO CLASSIFY INSERTS IN PROTEINS. Laura Heuermann* and D. Bastola, Department of Computer Science, University of Nebraska at Omaha, and D. H. Haft, J. Craig Venter Institute, Rockville, MD.
- 2:24 8. A BIOINFORMATIC APPROACH TO IDENTIFY PROTEIN SORTING MOTIFS IN PROKARYOTES. Caleb Schmid* and H. Ali, College of Information Science & Technology, University of Nebraska at Omaha; and D. H. Haft, J. Craig Venter Institute, Rockville, MD.
- 2:36 BREAK
- 2:50 9. CLASSIFICATION OF INFLUENZA A VIRAL SUBTYPE USING SUPPORT VECTOR MACHINE. Ximeng Zheng* and Z. Chen, Department of Computer Science, and G. Lu, Department of Biology, University of Nebraska at Omaha.

- 3:02 10. SURFING ALONG FILOPODIA; MECHANISMS OF HIGHLY-EFFICIENT INTERCELLULAR TRAFFICKING. Lokeshchandra Kalekar*, University of Nebraska at Omaha; and Irena Kadiu-Kieken, University of Nebraska Medical Center, Omaha.
- 3:14 11. SMALL MOLECULE INHIBITORS OF THE *STAPHYLOCOCCUS AUREUS* RNA TURNOVER MACHINERY DISPLAY ANTIMICROBIAL ACTIVITY. Patrick D. Olson*, L. J. Kuechenmeister, K. L. Anderson, T. L. Lewis, J. M. Morrison, and P. M. Dunman, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha.
- 3:26 12. IL-7 DECREASES APOPTOSIS AND IMPROVES SURVIVAL IN SEPSIS. Margaret McGlynn*, J. Usinger, A. S. Hoekzema, J. S. McDonough, J. E. McDunn, and R. S. Hotchkiss, Department of Anesthesiology, and J. T. Muenzer, Department of Pediatrics, and T. A. Ferguson, Department of Ophthalmology and Visual Sciences, and E. Watanabe, Surgery, Washington University School of Medicine, St. Louis, MO; and K. R. Kasten, J. Tschoep, and C. C. Caldwell, Department of Surgery, University of Cincinnati College of Medicine, Cincinnati, OH; and D. A. Hildeman, Division of Immunobiology, Cincinnati Children's Hospital, Cincinnati, OH.
- 3:38 13. CCR4-NOT ASSOCIATES WITH TRANSLATING RIBOSOMES UNDER STARVATION CONDITIONS. Kelly A. Westfall*, N. Barcomb, and M. J. Swanson, College of Arts and Sciences, University of Nebraska at Omaha.
- 3:50 14. ISOLATION OF A UNIQUE RECEPTOR INVOLVED IN THE DEVELOPMENT AND/OR PROGRESSION OF ALCOHOLIC LIVER DISEASE. C. A. Kreikemeier*, C. D. Hunter, C. S. Schaffert, M. J. Duryee, L. W. Klassen, and G. M. Thiele, University of Nebraska Medical Center and Omaha VA Medical Center, Omaha.
- 4:02 15. NEXT GENERATION SEQUENCING: ASSEMBLY OF SHORT READ SEQUENCES. Julia Warnke* and Hesham Ali, College of Information Science & Technology, University of Nebraska at Omaha.
- 4:14 16. HIV-1 GP120 INDUCES CYTOKINE EXPRESSION, LEUKOCYTE ADHESION, AND TRANSMIGRATION ACROSS THE BLOOD-BRAIN BARRIER: MODULATORY EFFECTS OF STAT1 SIGNALING. Sidra Akhter*, B. Yang, A. Chaudhuri, and G. D. Kanmogne, Department of Pharmacology and Experimental Neuroscience, Center for Neurovirology and Neurodegenerative Diseases, University of Nebraska Medical Center, Omaha.
- 4:26 17. COMPARATIVE STUDIES ON DUTPASES BETWEEN CHLORELLA AND ITS VIRUSES. Ishwari Poudel, Biological Systems Engineering and Hideaki Moriyama, Biological Sciences, University of Nebraska–Lincoln.

CHEMISTRY AND PHYSICS

Chairpersons:

Andy Zhong, Department of Chemistry, University of Nebraska at Omaha
Scott Darveau, Department of Chemistry, University of Nebraska at Kearney

SECTION A, CHEMISTRY

Olin A

- 11:00 MAIBEN MEMORIAL LECTURE, OLIN B
- 1:00 p.m. WELCOME
- 1:05 1. ANALYSIS OF DRUG BINDING TO SERUM PROTEINS IN DIABETES. Jeanethe A. Anguizola* and David S. Hage, Chemistry Department, University of Nebraska–Lincoln.
- 1:20 2. HOMOLOGY MODELING AND DOCKING STUDIES OF PI3K α/γ . Dima Sabbah* and Jonathan Vennerstrom, Pharmaceutical Department, College of Pharmacy, University of Nebraska Medical Center, Omaha; and Haizhen Zhong, Chemistry Department University of Nebraska, Omaha.
- 1:35 3. SPECTROSCOPIC ANALYSIS OF A β -HAIRPIN FORMING MINIPROTEIN. M. P. D. Hatfield*, R. F. Murphy, and S. Lovas, Department of Biomedical Sciences, Creighton University, Omaha.
- 1:50 4. ARENE ENDOPEROXIDES: SOURCES OF AND TRAPS FOR SINGLET OXYGEN. John M. Carney, Chad M. Lomas, Dayna Miyashiro, and Martin Hulce*, Department of Chemistry, Creighton University, Omaha.
- 2:05 5. ANALYSIS OF FREE DRUG FRACTIONS USING NEAR INFRARED FLUORESCENT LABELS AND AN ULTRAFAST REVERSED DISPLACEMENT IMMUNOASSAY. John E. Schiel*, Chainarong Sakulthaew, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 2:20 6. HOW TO KEEP UNDERGRADUATE STUDENTS INTERESTED IN THEIR RESEARCH PROJECTS. Andrea Holmes, Department of Chemistry, Doane College, Crete.
- 2:35 BUSINESS MEETING / SELECTION OF 2010 CHAIRS
- 2:45 7. STRUCTURAL DIFFERENCES IN ADSORBED PEPTIDES REVEAL MECHANISMS OF MINERALIZATION REGULATION. Helen A. Kraye, M. V. Wilson, and E. E. Wilson*, Department of Chemistry, Doane College, Crete.
- 3:00 8. DETERMINATION OF DRUG-PROTEIN DISSOCIATION RATE CONSTANT BY HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY. Zenghan Tong* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

- 3:15 9. WHY DENSITY FUNCTIONAL CALCULATIONS MISLEAD CONCERNING AROMATIC PHOTOSUBSTITUTION MECHANISMS. Ryo Tamura* and Gene Wubbels, Department of Chemistry, University of Nebraska at Kearney.
- 3:30 10. DFT Studies of CADMIUM-TELLURIUM CLUSTERS. Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 3:45 11. AFFINITY CHROMATOGRAPHIC STUDIES OF THE EFFECTS OF FATTY ACIDS ON THE BINDING OF DRUGS TO GLYCATED AND NON-GLYCATED HUMAN SERUM ALBUMIN DURING DIABETES. Sara B. G. Basiaga* and David S. Hage, Chemistry Department, University of Nebraska–Lincoln.
- 4:00 12. THE SYNTHESIS OF RARE-EARTH HEXABORIDE NANOWIRES. Robert M. Jacobberger*, Joseph R. Brewer, and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln.
- 4:15 CLOSING COMMENTS

CHEMISTRY AND PHYSICS

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

SECTION B, PHYSICS

Planetarium

- 1:00 p.m. WELCOME
- 1:05 1. KEYNOTE ADDRESS: PEER INSTRUCTION, COMPUTER SIMULATIONS, & EXTRASOLAR PLANETS. Kevin M. Lee, Department of Physics and Astronomy, Center for Science, Mathematics and Computer Education, University of Nebraska–Lincoln.
- 1:50 2. SIMULATING ULTRA PERIPHERAL COLLISIONS WITH A MONTE CARLO GENERATOR. Joey Butterworth, Department of Physics, Creighton University, Omaha.
- 2:05 3. SURFACE INDUCED MAGNETIZATION SWITCHING IN NANOPARTICLES. A. Hostetter*, N. Horrel, and R. Sabirianov, Department of Physics, University of Nebraska at Omaha.
- 2:20 4. DYNAMIC LIGHT SCATTERING IN ULTRAPHOSPHATE GLASS-FORMING LIQUIDS. Roberto Fabian Jr.*, and David Sidebottom, Department of Physics, Creighton University, Omaha.
- 2:35 5. DOUBLE QUADRATIC AND QUARTIC DOUBLE WELL IN AN ELECTRIC FIELD. Alex Holloway*, W.N. Mei, and R.F. Sabirianov, Department of Physics, University of Nebraska at Omaha.

- 2:50 BREAK
- 3:00 6. RHO MESON PRODUCTION FROM ULTRA-PERIPHERAL COLLISIONS OF COPPER NUCLEI. Olamide I. Osinkolu* and Janet Seger, Department of Physics, Creighton University, Omaha.
- 3:15 7. COHERENT CONTROL OF AZOBENZENE ISOMERIZATION. Ryan Riskowski*, Department of Physics, University of Nebraska at Omaha; and C.P. Singh, and Valeria Kleiman, Department of Chemistry, University of Florida, Gainesville, FL.
- 3:30 8. X-RAY FLUORESCENCE CROSS SECTIONS FOR ELEMENTS $55 \leq Z \leq 60$. Hans T. Wrage* and S.J. Cipolla, Department of Physics, Creighton University, Omaha.
- 3:45 9. JET QUENCHING SIMULATIONS FOR ALICE EMCAL AT CERN. A. Udara Abeyssekara* and Michael Cherney, Physics Department, Creighton University, Omaha.
- 4:00 CLOSING REMARKS

EARTH SCIENCES

Chairperson: Jennifer L. Balmat
Department of Physical and Life Sciences
Chadron State College, Chadron
Olin 224

- 8:00 a.m. OPENING REMARKS
- 8:05 1. THE GROWTH OF NORTH AMERICA – NEBRASKA’S CONTRIBUTION. Marvin P. Carlson, Nebraska Geological Survey, School of Natural Resources, University of Nebraska–Lincoln.
- 8:40 2. SUBSURFACE STRUCTURAL ANALYSIS OF THE YENTER OIL FIELD IN LOGAN COUNTY, COLORADO. Craig Kaiser, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 9:00 3. DETERMINING AN OPTIMUM PURGING PROTOCOL BASED ON CONTENT AND VOLUME. Chance Galey, Department of Physical Life Sciences, Chadron State College, Chadron.
- 9:20 BREAK
- 9:40 4. A SUBSURFACE STUDY OF THE CHAMBERLAIN PASS FORMATION IN BOX BUTTE COUNTY, NEBRASKA. Sam Holmgren, Department of Physical and Life Sciences, Chadron State College, Chadron.

- 10:00 5. ICHNOLOGY OF AN OLIGOCENE AGE TRACKWAY AT TOADSTOOL GEOLOGICAL PARK, NORTHWEST NEBRASKA. Jesse Zwiebel*and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron; and H. E. LaGarry, Department of Math and Science, Oglala Lakota College, Kyle, SD; and Brent Breithaupt, Geological Museum, University of Wyoming, Laramie, WY; and N. A. Matthews, National Science and Technology Center, Bureau of Land Management, Denver, CO.
- 10:20 CLOSING REMARKS and SECTION MEETING
- 11:00 MAIBEN MEMORIAL LECTURE – OLIN B

HISTORY/PHILOSOPHY OF SCIENCE
TEACHING OF SCIENCE AND MATH

Chairperson: Claire M. Oswald
College of Saint Mary, Omaha
Olin 325

- 9:15 a.m. 1. THE FOUNDATION OF DARWIN’S ORIGIN OF SPECIES: THE 1842 AND 1844 DRAFT OF HIS IDEAS. Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.
- 9:45 2. A BRIEF HISTORY OF THE REPROGRAMMING OF CELLS, Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.
- 10:15 3. BIRDS AND THE EARLY ELEMENTARY CLASSROOM. Kim Soper, Educational Consultant, SEPA Grant, University of Nebraska Medical Center, Omaha.
- 10:40 SECTION BUSINESS MEETING

COLLEGIATE ACADEMY
BIOLOGY

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

SESSION A
Olin LH-B

- 8:00am 1. LOCATION OF TOLL-LIKE RECEPTOR 3 IN THE RESPIRATORY EPITHELIAL CELL LINE HBE-16 USING IMMUNOFLUORESCENCE. Carrie Spelts* and T. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:12 2. INVOLVEMENT OF TLR3 IN HUMAN BRONCHIAL EPITHELIAL CELLS IN THE IMMUNE RESPONSE TO DSRNA. Lindsey C. Mustion* and T. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.

- 8:24 3. HOUSEHOLD RISK FACTORS ASSOCIATED WITH HUMAN HERPESVIRUS-8 (HHV-8) AND HIV-1 CHILDHOOD INFECTIONS IN LUSAKA, ZAMBIA. Carolyn E. Moore*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Charles Wood, Kay L. Crabtree, Veenu Minhas, and TieJun Zhang, School of Biological Sciences, University of Nebraska–Lincoln; and Chipepo Kankasa, University of Zambia School of Medicine and University Teaching Hospital, Lusaka, Zambia.
- 8:36 4. SURFING ALONG FILOPODIA: MECHANISMS OF HIGHLY-EFFICIENT HIV INTERCELLULAR TRAFFICKING. Lokeshchandra Kalekar*, University of Nebraska at Omaha; and Irena Kadiu-Kieken, University of Nebraska Medical Center, Omaha.
- 8:48 5. DEVELOPMENT OF PHAGOCYTOSIS ASSAYS TO BETTER UNDERSTAND AVIAN WEST NILE VIRUS SUSCEPTIBILITY. Charles Hurley* and C. Fassbinder-Orth, Department of Biology, Creighton University, Omaha.
- 9:00 6. INVESTIGATION OF POTENTIAL UPF1 KINASES IN *SACCHAROMYCES CEREVISIAE*. Chris Cummings, University of Nebraska-Lincoln.
- 9:12 7. ZEIN MICROSPHERES FOR DNA DELIVERY. A.Gilkey*, B.A. Duensing, N. Reddy, Y. Yang, and A.K. Pannier, Department of Biological Systems Engineering, University of Nebraska–Lincoln.
- 9:24 BREAK
- 9:36 8. PROBING BIOMINERALIZATION USING A NOVEL DOUBLE DIFFUSION GEL SYSTEM. Garrett E. Paulman*, M.W. Plano Clark, M.V. Wilson, and E.E. Wilson, Department of Chemistry, Doane College, Crete.
- 9:48 9. ISOLATION AND IDENTIFICATION OF SERUM CALCIFICATION FACTOR BY GEL DIFFUSION MINERALIZATION. Kaylee R. Troxel*, Garrett E. Paulman, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete.
- 10:00 10. STRUCTURE INDUCED CONFORMATIONAL CHANGE OF PEPTIDE SEQUENCES ADSORBED TO HYDROXYAPATITE. Helen A. Kraye*, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete.
- 10:12 11. EXPRESSION AND PURIFICATION OF THE HUMAN PREGNANE X RECEPTOR LIGAND BINDING DOMAIN: A COMPARISON OF NATIVE AND DENATURING CONDITIONS FOR IMMOBILIZED METAL ION AFFINITY CHROMATOGRAPHY. Thomas A. Harmon, Nebraska Wesleyan University, Lincoln; and Jeff L. Staudinger, Kristen Lichti, and Chensu Susan Xu, University of Kansas, Department of Pharmacology and Toxicology, Lawrence, KS.
- 10:24 12. NEUTROPHIL ADHESION TO BRONCHIAL EPITHELIAL CELLS IS MODIFIED BY EXPOSURE OF EPITHELIAL CELLS TO HOG CONFINEMENT DUST EXTRACT. Monica A. Hilger*, Department of Biology, Nebraska Wesleyan University, Lincoln; and A.J. Heires, T.A. Wyatt, and D.J. Romberger, Pulmonary, Critical Care, Sleep and Allergy Section, Department of Internal Medicine, University of Nebraska Medical Center, and Veterans Affairs Medical Center, Omaha.

- 10:36 13. HOG DUST ACTIVATES SKELETAL MUSCLE RYANODINE RECEPTORS (RyR1). Danielle S. Fenster*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Deborah J. Romberger, Internal Medicine, Pulmonary and Critical Care Medicine Section, University of Nebraska Medical Center, Omaha; and Myron Toews and Keshore R. Bidasee, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN LH-B
- 12:00 LUNCH
- 1:00pm 14. BIRD SPECIES IN THE DIET OF BARN OWLS (*TYTO ALBA*) NESTING IN ULYSSES, NEBRASKA. Rachel Woodburn*, Concordia University, Seward.
- 1:12 15. SEASONAL RAINFALL PATTERNS RELATED TO SMALL MAMMAL FREQUENCES IN A BARN OWL (*TYTO ALBA*) DIET. Ashton E. Mueller*, Concordia University, Seward.
- 1:24 16. AGE OF EUROPEAN STARLINGS (*STURNUS VULGARIS*) FROM A BARN OWL (*TYTO ALBA*) DIET. Alisha B. Clubb*, Concordia University, Seward.
- 1:36 17. STUDY AND ANALYSIS OF THE 2008 NEBRASKA INTRASTATE NURSERY WHEAT (*TRITICUM AESTIVUM*) LINES USING THE ALPHA LATTICE OF AGROBASE. Nicholas L. Zalewski*, Department of Biology, Nebraska Wesleyan University, Lincoln; and P.S. Baenziger, G.G. Dorn, R.S. Little, N. Mengistu, and M.L. Montgomery, Department of Agronomy and Horticulture, University of Nebraska–Lincoln.
- 1:48 18. A STUDY OF IMPROVING MANAGEMENT OF SOYBEAN CYST NEMATODE (*HETERODERA GLYCINES*). Bobbie L. Mansur*, Department of Biology, Nebraska Wesleyan University, Lincoln; and L.J. Giesler, T. Brovont, and A. Elliot, Extension Plant Pathology, University of Nebraska–Lincoln.
- 2:00 19. SELECTION OF BARLEY LINES FOR ADVANCEMENT TO THE 2009 BVT BASED ON THE PERFORMANCE OF PARTICULAR AGRONOMIC TRAITS. Joseph M. Plambeck*, Department of Biology, Nebraska Wesleyan University, Lincoln; and P.S. Baenziger, M.L. Montgomery, G.G. Dorn, R.S. Little, N. Mengistu, Department of Agronomy and Horticulture, University of Nebraska-Lincoln.
- 2:12 20. TESTING THE TOXICITY OF PLASTIC PRODUCTS USED IN AN ANIMAL IVF LABORATORY. Scott M. Ronshuagen*, Nebraska Wesleyan University, Lincoln; and N.M. Loskutoff, J.T. Aaltonen, and K.J. Mattson, Reproductive Physiology, Omaha’s Henry Doorly Zoo, Omaha.
- 2:24 BREAK

- 2:36 21. THE EFFECT OF VARIOUS PRAIRIE MANAGEMENT REGIMES ON VERTEBRATE AND INVERTEBRATE COMMUNITY COMPOSITION. Kyle H. Lowery*, Heather A. York, and Brad D. Elder, Department of Biology, Doane College, Crete.
- 2:48 22. GENETIC DIFFERENCES WITHIN AND BETWEEN BRISTLECONE PINES (*PINUS LONGAIEVA*). Ben J. Deaver* and Brad Elder, Doane College, Crete.
- 3:00 23. THE ISOLATION AND AMPLIFICATION OF MINISATELLITES IN THE MOUSE GENOME FOR APPLICATION IN DISEASE, MATERNITY/PATERNITY, AND FORENSIC ANALYSIS. Zach J. Genant*, K. Murch-Shafer, and T. Clark, Dana College, Blair.
- 3:12 24. TOXIN-ANTITOXIN ACTIVITY IN *SULFOLOBUS SOLFATARICUS*. Paige K. Mathew*, Yukari Maezato, Derrick White, Amanda Dougherty, and Paul Blum, School of Biological Sciences, College of Arts and Sciences, University of Nebraska–Lincoln.
- 3:24 25. INFLUENCE OF EXERCISE AND HYDROXYCUT ON WEIGHT LOSS AND BODY COMPOSITION. Jarod Murdoch*, College of Natural and Social Sciences, University of Nebraska at Kearney.

COLLEGIATE ACADEMY

BIOLOGY

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

SESSION B

Olin 249

- 1:00 1. DIET PALATABILITY AND DIGESTIBILITY BY *CAROLLIA PERSPICILLIATA*. Cassie L. Boggs*, Wayne State College, Wayne; and Cheryl Dikeman, Omaha's Henry Doorly Zoo, Omaha.
- 1:12 2. CLONING, OVER-EXPRESSION AND PURIFICATION OF INLB GENE/PROTEIN USING C41 SOLOS CELLS FOR POSSIBLE USE IN DRUG DELIVERY. Brittany Cody*, Shawn Percy and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.
- 1:24 3. USE OF *LISTERIA MONOCYTOGENE* INLA/INLB AS A POSSIBLE DRUG DELIVERY SYSTEM. Derek Moormeier*, Shawn Percy and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.
- 1:36 4. A COMPARATIVE STUDY OF MICROCYSTIN LEVELS AND ZOOPLANKTON CONCENTRATIONS IN SOUTHEAST NEBRASKA SURFACE WATERS. Rachel Ramsey* and Brad Elder, Department of Biology, Doane College, Crete.
- 1:48 5. POPULATION GENETICS OF THE SIDEWALK TIGER BEETLE. Katherine M. Talbott*, Kate Marley, and Heather York, Department of Biology, Doane College, Crete.

- 2:00 6. CHARACTERIZATION OF A TRANSCRIPTIONAL REPRESSOR REGION OF THE HUMAN N-CADHERIN GENE. Christa Flitcroft* and K. Marley, Department of Biology, Doane College, Crete.
- 2:12 7. THE ROLE OF METHYLMALONATE SEMIALDEHYDE DEHYDROGENASE IN *ARABIDOPSIS THALIANA* DURING GERMINATION. Kyla J. Ronhovde* and Kerry Lucas, Doane College, Crete.
- 2:24 BREAK
- 2:36 8. EVALUATION OF THE EFFICACY OF A COMMERCIAL PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS (PRRSV) SERUM BASED ON MEASUREMENT OF SEROLOGIC RESPONSE AND PROTECTION UPON CHALLENGE. Laura M. Mischnick*, Department of Biology, Nebraska Wesleyan University, Lincoln; and V. Hiep and F.A. Osorio, Department of Veterinary and Biomedical Sciences, University of Nebraska–Lincoln.
- 2:48 9. CHLORELLA VIRUS PBCV-1 INFECTION OF ALGA CHLORELLA NC64A CELLS CAUSES AN INITIAL INCREASE, FOLLOWED BY A DRASTIC REDUCTION IN SUPEROXIDE PRODUCTION IN CHLORELLA CELLS. Aaron L. Fuehrer* and G. Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:00 10. TRANSLOCATION OF TLR-3 IN RESPIRATORY EPITHELIUM VIEWED THROUGH CONFOCAL MICROSCOPY. Michael L. Dvorak* and T. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:12 11. COMPARISON OF POTENTIALLY ONCOGENIC PROTEINS THAT CAUSE AURORA A KINASE ACTIVATION AND ANALYSIS OF PHOSPHOSPECIFIC MONOCLONAL ANTIBODIES TO SHOW AURORA A'S ROLE IN MITOTIC SPINDLE FORMATION IN HELA CELLS. Kelly C. Erickson*, Department of Biology, Nebraska Wesleyan University, Lincoln; and B. Berrigan and M.-Y. Tsai, Eppley Institute for Research in Cancer and Allied Diseases, University of Nebraska Medical Center, Omaha.
- 3:24 12. FILTER AND PARAMETER OPTIMIZATION FOR REMOVAL OF 1% BOVINE SERUM ALBUMIN FROM EMJH MEDIA USING TANGENTIAL FLOW FILTRATION. Lucas J. Strehle, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:36 13. OPTIMIZATION OF A LYOPHILIZATION CYCLE OF A SWINE VACCINE. Lauren Brooks, Department of Biology, Dana College, Blair.
- 3:48 14. EFFECTS OF DESMOSOMES ON THE ACTIVATION OF EPIDERMAL GROWTH FACTOR RECEPTORS. Erin Bazata, Biology Department, Dana College, Blair; and J.K. Wahl, University of Nebraska Medical Center, College of Dentistry, Lincoln.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

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

SESSION A

Session Chairperson, David Treichel
Olin 324

- 8:10 a.m. 1. ENANTIO-DISCRIMINATION OF METHAMPHETAMINE BY CIRCULAR DICHROISM USING PORPHYRIN TWEEZERS. Marcus Anderson*, Mark V. Wilson, Kerry Lucas, and Andrea E. Holmes, Department of Chemistry, Doane College, Crete.
- 8:22 2. WILD PLUM®: DYES OF IMPROVED OPTICAL BRIGHTNESS AND FLUORESCENCE. Jordan Groathouse*, Casey Gustafson, Kerry Lucas, and Andrea Holmes, Department of Chemistry, Doane College, Crete.
- 8:34 3. NUTRITIONAL EFFECTS ON PROTEIN EXPRESSION IN HzAM1 CELLS. J. Warchol*, C. Collins, and E.J. Haas, Department of Chemistry, Creighton University, Omaha.
- 8:46 4. EFFECTS OF HEAT-SHOCK ON PROTEIN EXPRESSION IN HzAM1 CELLS. M. McDevitt* and E.J. Haas, Department of Chemistry, Creighton University, Omaha.
- 9:00 5. NMR ANALYSIS OF TWO NOVEL EUGENOL DERIVATIVES. Austin Lucht*, Travis Reed, Troy Beck, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 9:12 6. INVESTIGATING THE MATRIX STRUCTURE REQUIRED FOR MINERALIZATION BY SERUM CALCIFICATION FACTOR. Brittini N. Likes*, Blair K. Popple*, Frank Miller, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete.
- 9:24 7. PREDICTION OF THE PKA OF WEAK ACIDS FROM DFT STUDIES. Stephen Wright* and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 9:36 BREAK
- 9:48 8. EFFECTS OF pH ON THE GROWTH OF GREEN ALGA CHLORELLA. Shingairai Chiwara, Department of Physical Sciences and Life Sciences, Chadron State College, Chadron.
- 10.00 9. BINDING STUDY OF B- AND Z-POLY(DG-DC)₂ WITH ORGANIC DYES. Adrian Draney*, Han Chu, Michael A. Guericke, Kerry Lucas, and Andrea E. Holmes, Department of Chemistry, Doane College, Crete.

- 10:12 10. DESIGN OF POTENT GALECTIN INHIBITORS. T. Nguyen* and E.J. Haas, Department of Chemistry, Creighton University, Omaha; and W.G. Chaney, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.
- 10:24 11. COMPARISON OF TWO-PHOTON NADH INTENSITY IMAGING AND FLUORESCENCE LIFETIME IMAGING TO QUANTIFY CELLULAR ENERGETICS. Jorge Vergen*, Clifford Hecht, and Michael Nichols, Department of Physics, Creighton University, Omaha; and LeAnn Tiede, Department of Biomedical Science, Creighton University School of Medicine, Omaha.
- 10:36 12. DEVELOPMENT OF A MONOLITHIC HPLC COLUMN CAPABLE OF SEPARATING AND QUANTIFYING TAURINE, A COMMON COMPOUND FOUND IN ENERGY DRINKS. Danielle Policarpio* and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney.
- 11:00 MAIBEN LECTURE (OLIN B)

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS
SESSION A

Session Chairperson: Nathaniel Fackler and David Treichel
 Olin 324

- 1:00 p.m. 13. APTAMER-BASED COLORIMETRIC SENSOR FOR NARCOTICS. Jordan Beaber*, Jordan Groathouse, Kerry Lucas, and Andrea E. Holmes, Department of Chemistry, Doane College, Crete.
- 1:12 14. DETECHIP®: HIGHLY SELECTIVE MOLECULAR SENSORS FOR SMALL MOLECULES SUCH AS ILLICIT DRUGS. Jacob Francis*, Shari Pacquette, Casey Gustafson, Kerry Lucas, and Andrea Holmes, Department of Chemistry, Doane College, Crete.
- 1:24 15. ULTRA PERIPHERAL COLLISIONS AT RHIC. Jamison S. Duckworth* and J. Seger, Department of Physics, Creighton University, Omaha.
- 1:36 16. USE OF THE GENERALIZED EIKONAL APPROXIMATION METHOD TO TEST LIGHT SCATTERING BY A LEVITATED LARGE SPHERICAL DIELECTRIC. Jason Gerritsen, Physics Department, Hastings College, Hastings.
- 1:48 17. CELL SIGNALLING AND THE OPTICAL STRETCHER. Timothy Smith* and Michael Nichols, Department of Physics, Creighton University, Omaha.

- 2:00 18. SINGLE BUBBLE SONOLUMINESCENCE (SBSL) PRODUCTION IN A SPHERICAL RESONANT FIELD. Joe Jeanjaquet, Physics Department, Hastings College, Hastings.
- 2:12 19. INVESTIGATION OF THE SAFETY AND EFFICIENCY OF WIRELESS POWER TRANSFER USING COUPLED MAGNETIC RESONANCES. Jordan Neuhart, Physics Department, Hastings College, Hastings.
- 2:24 20. TRACER DIFFUSION FOR A CONCENTRATED LATTICE GAS IN A REGULAR COMB STRUCTURE. P. M. Garcia, Department of Physics, Doane College, Crete.
- 2:36 21. THE DESIGN, CONSTRUCTION AND TESTING OF A THERMOACOUSTIC REFRIGERATOR. Brian Steinert, Department of Physics, Hastings College, Hastings.
- 2:48 BREAK
- 3:00 22. CLUSTER GROWTH IN AQUEOUS MALTOSE SOLUTIONS MONITORED BY DYNAMIC LIGHT SCATTERING. Tri Tran* and D. L. Sidebottom, Department of Physics, Creighton University, Omaha.
- 3:12 23. COMPUTATIONAL STUDIES OF NATURAL AND SYNTHETIC ESTROGEN. Rachel Faust*, Rita Lindberg*, and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 3:24 24. A STUDY OF THE SOLAR CAPABILITIES OF THE NEBRASKA CLIMATE AND POSSIBLE PHOTOVOLTAIC SOLUTIONS. Eric J. Hauger*, D.P. Blair, J. Brewer, and M.G. Cherney, Department of Physics, Creighton University, Omaha.
- 3:36 25. BIOMECHANICAL MEASUREMENTS OF BONE CELLS USING THE OPTICAL STRETCHER. Anya Burkart, Department of Physics, Creighton University, Omaha.
- 3:48 26. MEASUREMENT THEORY. Nolan Aljaddou, University of Nebraska at Omaha.

JUNIOR ACADEMY OF SCIENCES

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

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

12:00 – 1:00 p.m. LUNCH BREAK, Senior High, Story Student Center

1:00 – 1:30 Junior High Registration and Set Up Project Displays
1:00 – 4:30 Senior High Competition (Final), Olin 110
1:30 – 4:30 Junior High Competition, Olin 124, Olin 131

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

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

6:30 – 8:30 BANQUET and AWARDS CEREMONY
First United Methodist Church
2723 N 50th Street, Lincoln, NE

PROCEEDINGS

AERONAUTICS AND SPACE SCIENCE

CATIA V5 SIMULATION IN SUPPORT OF CONSTELLATION GROUND OPERATIONS

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

This summer my internship took place in Boeing’s Design Visualization Group at Kennedy Space Center. Most tasks involved using CATIA V5, an advanced computer modeling software, to design and model various parts to support ground operations for the Constellation program. Models were created based on three different types of information: existing files, 3D scanned data, and written requirements. Other tasks included operating 3D scanning hardware and software and preparing a presentation on the 3D scanning and printing process.

THE ABORT FLIGHT TEST – FLIGHT TEST ARTICLES TESTING TEAM

Justin Green, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588; and Michael Titus, Department of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA 24061; and Caroline Gorham, Kings College London, London England

The objective of the Abort Flight Test – Flight Test Article (AFT/FTA) Testing Team was to assist The Orion Flight Test Office with their mission to create a reliable Launch Abort System and Crew Module that will save astronauts lives. In doing this the AFT/FTA Testing Team was given three projects. The first of which was to calibrate the six tension/compression load cells which are used on the Workmanship Testing Fixture. Next, testing was performed for the Container Loading Trailers (CLTs) in order to determine the accelerations exerted on the CLTs over different terrains and obstacles. Lastly, the AFT/FTA Testing Team helped further develop the Knife Edge Method for testing the moment of Inertia (MOI). The goal of this testing method is to reduce the cost and risk associated with testing the MOI.

DEVELOPMENT OF INTEGRATED LOW TEMPERATURE MECHANISMS FOR NEXT GENERATION ROBOTICS MISSIONS

Evan Luxon, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

Motor and gearbox systems are central to practically every robotics mission developed by the NASA Jet Propulsion Laboratory (JPL). However, as robots are sent to places much colder than Earth, heat sources are required for them to operate properly. In turn, they require the use of limited power that is essential to the functionality of other systems. Thus, an integrated motor and gearbox mechanism that can run without external heat at extremely low temperatures was recently developed to simplify future missions and make them more robust. In order to classify the performance of this mechanism, a test setup that utilized a thermal vacuum chamber while allowing a rotary interface through the wall of the chamber with minimal heat transfer was developed during an internship at JPL.

A SWARM-BASED MULTI-ROBOT SYSTEM FOR LUNAR AND MARS SURFACE MAPPING

Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

We consider the *distributed multi-robot terrain coverage* problem using mini-robots with limited capabilities. Addressing this problem is essential for autonomous exploration of extra-terrestrial surfaces such as the lunar and the Martian surface. However, there are several challenges involved in designing efficient multi-robot coverage techniques, including the limited computational and sensory capabilities of mini-robots and the presence of noisy data from sensors, which result in inaccuracies. We have developed novel techniques for the terrain coverage problem using emergent computing techniques such as swarming and flocking to allow mini-robots to dynamically form small teams and cover an initially unknown environment. We will present results from extensive simulations of our system within a robotic simulator called Webots, to show that our techniques improve terrain coverage by a significant amount over conventional terrain coverage techniques on a simulated lunar surface. We are currently investigating information theory-based techniques to further improve our terrain coverage techniques.

MINIATURE ROBOTS FOR MINIMALLY INVASIVE SURGERY

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

Traditionally surgeries are performed through large open incisions. Performing these procedures through multiple small incisions in the abdominal wall marked a significant step towards reducing invasiveness and improving patient outcomes. Currently, much work is focused on further reducing invasiveness by minimizing the number of incisions or through the complete elimination of external incisions by accessing the surgical site through a natural orifice. One approach to enable these types of surgeries is the use of miniature robots that can be completely inserted into the abdominal cavity. These robots can be arbitrarily positioned to provide visualization and task assistance capabilities. Prototypes of these robots have been demonstrated in multiple animal model procedures with the outcomes demonstrating the feasibility of using these robots to help reduce the invasiveness of surgical procedures. Future applications include the use of miniature robots to provide surgical care during long duration space flight.

PRINCIPAL COMPONENT ANALYSES OF ANTHROPOMETRIC DATA: A REVISIT OF A DIFFERENT APPROACH

M. Chandrasekaran and Ram Bishu, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588; and Sudhakar Rajulu, ABF Laboratory, Johnson Space Center, Houston, TX 77058

Principal component analyses (PCA) is a multivariate data reduction technique. An anthropometric data base used by NASA was subjected to PCA. The initial data of 19 variables and 512 cases were converted into three principal components accounting for 80% of the initial variability in the data. The data was converted to a three dimensional space. As each PCA was normally distributed, rules of tri variate normal distributions were used. For a trivariate normal distribution the quantity: $[X - \mu]^T \Sigma^{-1} [X - \mu] = K$ follows a chi-square distribution. Boundary points and extreme points were determined using this equation. On comparison with traditional methods, this appeared to better represent human variability. However, a physical validation is required before this can be generalized.

FLUID STRUCTURE INTERACTIONS FOR BLAST WAVE MITIGATION

Wen Peng, Christopher Bruening, Zhaoyan Zhang, and George Gogos, Department of Mechanical Engineering, University of Nebraska–Lincoln, NE 68588

The dynamic response of a free-standing plate subjected to a blast wave is studied numerically to investigate the effects of fluid-structure interaction (FSI) in blast wave mitigation. Previous work on the FSI between a blast wave and a free-standing plate has assumed a constant atmospheric pressure in the back of the plate and neglected the resistance caused by the shock wave formation due to the receding motion of the plate. This paper develops an FSI model which includes the resistance caused by the shock wave formation in the back of the plate. The numerical results show that the resistance to the plate motion is especially pronounced for a light plate, and as a result, the previous work over-predicts the mitigation effects of FSI. Therefore, the effects of the interaction between the plate and the shock wave formation in the back of the plate should be considered in the blast wave mitigation.

LYOTROPIC LIQUID CRYSTALS AND THEIR POLARIZING EFFICIENCY UNDER DIFFERENT TEMPERATURE AND CONCENTRATION CONDITIONS

Jeremy Stromer and Josh Beck, Department of Physics, University of Nebraska at Kearney, NE 68832

This project aims to develop the methods and techniques involved in the study of lyotropic liquid crystals and also to research into their specific properties with these main goals at hand: 1). Review of the recent publications on LC and LCLC, 2). To learn technology of preparation of samples; 3). To get familiar with the equipment, including Perkin-Elmer spectrometer with the temperature control, polarizing microscope, image capturing system, shearing device, analytic balance, electric signal function generator, etc.; and 4). To start experimental study of dependable of polarizing properties of LCLC vs temperature, concentration, frequency and amplitude of applied voltage.

EFFECTS OF PLACEMENT OF CROP COSMIC RAYS DETECTORS

Alejandro Echeverri, Thomas S. McShane, and Lyle S. Sass, Department of Physics, Creighton University, Omaha, NE 68178

Four scintillation detectors were placed on a 3x4 meter square inside a room on top of the Rigge Science Center at Creighton University. The detectors were rotated once a week from their original positions through each position to observe the effect of location on cosmic ray data collection. The counting rate of each detector changed according to its new position. The detectors were then placed in a 13x13 meter square on the roof of the Rigge avoiding the shielding of the concrete roof of the room. The detectors showed a reduced counting rate on the roof.

DESIGN AND CONSTRUCTION OF A PROTOTYPE LIDAR ENHANCEMENT DETECTOR FOR THE PIERRE AUGER COSMIC RAY OBSERVATORY

Emily Petermann, Gregory R. Snow, and Maria Becker, Department of Physics and Astronomy, Creighton University, Omaha, NE 68178

We will report on progress and plans for our project to design and construct a prototype LIDAR (Light Detection and Ranging) detector that will enhance the atmospheric monitoring capabilities

of the Pierre Auger Observatory, the world's largest cosmic ray observatory located in Mendoza Province, Argentina. This project has the potential to noticeably improve the primary cosmic ray energy measurements made by the Fluorescence Detectors of the Observatory. This work is partially funded by a NASA Nebraska Space Grant Research Mini-Grant.

DARK MATTER IN NON-STANDARD COSMOLOGIES

Gintaras Duda, Department of Physics, Creighton University, Omaha, NE 68178

Over the past decade astrophysical evidence has shown that the universe is dominated by an unseen, non-baryonic form of matter referred to as dark matter. The neutralino, a supersymmetric particle, is one of the most promising particle candidates for dark matter. However, extensive experimental searches have failed to detect the neutralino; these searches have so constrained the theoretical parameter space of the neutralino such that neutralino dark matter requires carefully constrained parameters and an unsatisfactory level of fine-tuning. We explore a possible solution to this dilemma: non-standard cosmologies. We focus on a non-standard cosmology where a scalar field dominates the early universe and ultimately decays into neutralinos. The existence of a scalar field can produce a wide range of dark matter densities and eliminates the need for fine-tuning. In essence, the neutralino may be a natural and viable dark matter candidate after all. We will present our work in progress in conducting a theoretical analysis of the behavior and properties of the scalar field and its effect on the neutralino relic density.

A NASA SPITZER SPACE TELESCOPE INFRARED STUDY OF QUASAR OUTFLOWS

Allison Showalter, Sandra Behncke, and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

This investigation examines the spectra of broad absorption line quasars (BAL) versus quasars without this feature (non-BAL) in the infrared range. We analyze the archived data from the infrared spectrophotometer on NASA's Spitzer Space Telescope for specific targets. The data includes continuum emission from the gas clouds excited by the active nuclei of the quasars and emission lines excited directly from the active nuclei. Through comparisons of the continuum and emission lines of the two categories of quasars, we seek to determine the role of outflows, specifically any major similarities or differences between the infrared spectra of BAL and non-BAL quasars. Engaging in this comparison will help answer if BAL quasars represent a specific stage of evolution, or if they are normal quasars with a specific orientation to our sightline. This information about BAL quasars corresponds to solving a piece of the puzzling nature of quasar evolution and how quasars affect the immediate environment.

RETRIEVAL AND PROCESSING OF LUNAR SOIL FOR ³HE, OXYGEN AND BUILDING MATERIALS

Juana Acosta and Cheslee Cornell, Department of Chemistry, College of Saint Mary, Omaha, NE 68106

The design, methods, and experiment will be conducted by Juana Acosta and Cheslee Cornell. Our research project is dedicated to design a special tool for NASA Lunar Rovers. Our experimental design is to propose an attachment for the NASA Rover in which soil from the moon will be collected to process and extract helium-3 and oxygen. In addition to this process the left over lunar aggregate could be used to fabricate building block material for developing structures on the moon. Our experiment entails background research of lunar soil, the construction of a scaled soil processing unit attachment to

the lunar rover used for the extraction of helium-3 and oxygen from lunar soil, and for the fabrication of construction materials. Our design for our rover attachment will use adjustable heating elements for the extraction of helium-3 and oxygen atoms from the Lunar soil for the subsequent collection and separation of the gas by a special charging process to storage cylinders. The resulting lunar aggregate can then be additionally heated and fused into building materials. Our hypothesis is to create an artificial lunar soil environment to test the lunar surface digging and processing implement. Furthermore in order to test the extraction process and storage of the gases, we would simulate the impregnation of the soil with a normal helium gas that would be frozen within the simulated lunar soil. The simulated soil will then be heated. Any gases released would be tested by a special detector for the presence of normal helium. The charging and separation process would then be tested for purity and transfer to a storage cylinder. We are testing for normal helium because helium-3 is not present on Earth naturally, therefore we must test for the detection of a similar gas that is available on Earth to test our hypothesis. The detection of normal helium will validate the process and the ultimate detection and processing of helium-3 and oxygen on the Moon.

USING A GEOGRAPHIC INFORMATION SYSTEM TO DEVELOP A VINEYARD SUITABILITY MODEL FOR SELECTED WINE GRAPE CULTIVARS IN SOUTHWESTERN NEBRASKA

Ellen Mickle, Donald Rundquist, and Ting Chen, School of Natural Resources and CALMIT; and Paul Read, Department of Agronomy and Horticulture, University of Nebraska–Lincoln, NE 68588

Grape production for wine making is increasing at a rapid rate in Nebraska. A need exists for decision-support tools to assist potential growers in both selecting appropriate cultivars and assessing geographic locations that may (or may not be) suitable for the cultivation of wine grapes. The objective of our research was to implement a geographic information system (GIS) culminating in a user-friendly tool for identifying and mapping suitable vineyard sites in a five-county area in Southeastern Nebraska. The prototype GIS model is based upon climatic information and soils. It was tested for a few selected cultivars including Riesling and Cynthiana-Norton. The model output maps depict zones of suitability for these cultivars in portions of Otoe, Johnson, Richardson, and Pawnee Counties in Nebraska.

ENHANCING TRIBAL ECONOMICS, CULTURE, AND ENVIRONMENTAL BENEFITS WITH CONSERVATION PLANTINGS

Hank Miller, Department of Natural Resources, Nebraska Indian Community College, Niobrara, NE 68760; and David Shelton, Northeast Research and Extension Center, University of Nebraska–Lincoln, NE 68588

Production of woody plants such as willow and dogwood species for the floral market is an emerging enterprise, with gross returns on the order of \$21,000/ha (\$8000/ac) possible when sold through wholesale markets. Growing these plants in a conservation buffer or similar practice will not only enhance the ecology of the region, but may also increase landowner acceptance of the practice, since sales could offset income lost from taking the land out of crop production. It may also provide income from marginal land that could greatly benefit from conservation plantings. An untapped woody floral craft market may also exist that could enhance economic opportunities for the tribal communities. These concepts are beginning to be evaluated in a conservation buffer at the University of Nebraska Haskell Agricultural Laboratory (UNL-HAL) and in Nebraska Indian Community College (NICC) plantings. A major problem is that less than 15% of the harvested stems typically meet market-quality

criteria, primarily because of too many lateral branches. If woody floral growth could be manipulated to significantly reduce branching, stem quality and hence income potential would substantially increase. This proposed project will utilize different pruning and restraint methods to enhance the quality of woody floral stems, evaluate the market potential of woody floral crafts produced by native artisans, and make woody floral plantings available to the Omaha and Santee tribal communities. Project focus areas are research, education, cultural needs, conservation, and economic opportunities. Pruning and restraint or training of lateral stem growth will be evaluated as simple approaches to reduce woody floral branch development. Investigations will be conducted at UNL-HAL and NICC on approximately 500 dogwood and willow plants, representing over 20,000 stems. The number and percentage of market-quality stems as well as gross costs and returns will be evaluated. This project represents a new partnership among NICC staff and students, UNL-HAL personnel, and the Game and Parks divisions of the Omaha and Santee tribes. Potential outcomes include increased income from the sale of higher quality woody floral plant stems and native craft products made from these materials; the environmental benefits of increased acceptance/adoption of conservation practices; greater availability of culturally significant plants; and dissemination of new research findings. NICC will lead the project while looking to UNL-HAL for guidance and direction on research methodology and other aspects. Both UNL-HAL and NICC will conduct woody floral research using a similar research model. NICC will recruit local artisans to utilize woody floral stems for craft production and determine if there is a suitable market for these crafts. The Game and Parks divisions from both nations will help distribute woody floral plants throughout the Santee and Omaha reservations, and assist NICC with educational workshops, and the planting and maintenance of these materials.

COASTAL WETLAND MAPPING AND AQUATIC CHLOROPHYLL PREDICTION USING HYPERSPECTRAL AIRCRAFT IMAGERY IN REDFISH BAY, TEXAS

Adam E. Altrichter, John Schalles, Tyler Craven, and Tyler Monahan, Department of Biology, Creighton University, Omaha, NE 68178

During July 2008 field surveys of emergent marsh vegetation in Redfish Bay, Texas were conducted in coordination with hyperspectral AISA imagery collected by a University of Nebraska Lincoln aircraft. Using the ground-truthing information as reference data to extrapolate over the bay area, we have worked to delineate black mangrove (*Avicennia germinans*) as well other vegetation types in an effort to construct spectral libraries for various species types and densities. Utilizing new digital analysis techniques we were able to determine vegetation fraction of different plant types based on digital photography of square meter quadrats. In addition, high spectral resolution water reflectance was measured with twin Ocean Optics USB2000 measurements, along with bulk optical properties including algal chlorophyll a and total suspended matter. Recently developed chlorophyll prediction algorithms for optically complex coastal waters are proving robust for these waters.

AIR POLLUTION FROM CHINA: GROUND TRUTH AND SATELLITE VIEW

Catherine May and Jun Wang, Department of Geosciences, University of Nebraska–Lincoln, NE 68588

China has undergone very rapid economic growth since its “open door policy” started in 1978. This economic growth has been accompanied by an expansion of the industrial developments including the increase of power plants, manufactories, infrastructure constructions, and vehicles. Consequently, the consumption of fossil fuels for Chinese energy supplies has increased dramatically in last two decades, releasing tremendous amount of pollutants in the atmosphere. Unfortunately, the few ground-based

observation stations now available in Asia are not adequate for us to monitor how these pollutants are transporting from China and crossing over the Pacific Ocean to the west coast of U.S. Not surprisingly, the huge emission of air pollution in China has become a central concern in environmental research and policy, both regionally and globally. To overcome the inadequacy of ground-based air quality monitoring, we will use NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) data to map air pollution on urban, regional and continental scales. MODIS is a sensor on NASA's Terra platform launched in 1999 as the first satellite of NASA's Earth Observation Systems. Due to its routine observation and large spatial coverage, MODIS data provides us a cost-effective approach to monitor the transport and estimate the amount of pollutants from China. By a combined analysis of air pollution data from satellite and ground observation during January 2007 – January 2009, this presentation will show: (1) the geographical variation of Chinese air pollution distribution in different seasons, (2) the time that Chinese pollution takes to transport across the northern hemisphere, and (3) the accuracy to which satellite observations can match the ground truth. In addition, this presentation will also show air quality changes due to the regulations used during the 2008 Beijing Olympics for reducing the air pollution emission.

COMPARATIVE ANALYSIS OF FOSSIL TRACK MORPHOLOGY AS A FUNCTION OF SUBSTRATE CONDITIONS

J. Zwiebel and M.B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337; and H.E. LaGarry, Department of Science and Math, Oglala Lakota College, Kyle, SD 57752; and B.H. Breithaupt, Geological Museum, University of Wyoming, Laramie, WY 82071; and N.A. Matthews, National Science and Technology Center, Bureau of Land Management, Denver, CO 80225

Toadstool Geological Park in northwestern Nebraska offers a wide range of Oligocene age (Orella Formation) vertebrate trackways. The substrate conditions in which these trackways were formed play a large role in their morphology and preservation, while providing an opportunity to carry out an ichnological study of the environment in which they were created. Preliminary textural analysis has identified that many subtle changes in substrate can potentially lead to appreciable change in track morphology and preservation, while providing information about the environment they were created in. The trackways have been observed in the field, on latex peels collected in 1994-95 by the University of Nebraska and the Nebraska National Forest, on casts at Chadron State College, and in the form of microscale digital elevation models (DEMs) made with GIS software. Further study is expected to lead to a wealth of information about the depositional environment, the track makers and diagenetic processes. Digital storage of trackways as DEMs shows promise of enabling widespread access and study of fossil trackways.

WEIGHTED RANKING SYSTEM FOR IDENTIFICATION OF GEOLOGICAL STRUCTURES FROM LINEAMENTS ON REMOTELY-SENSED IMAGES OF THE PINE RIDGE – BLACK HILLS REGION, USA

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

Remote sensing has been shown to be a useful tool for recognition of geologic structures. However, only a small fraction of lineaments identified by remote sensing techniques are typically verified by field work as actual faults or other structures. A data ranking system has been developed to select most likely candidates for structures from a large database of candidates, thus increasing

efficiency of ground truthing. Lineaments identified on SRTM digital elevation model, Landsat image, or topographic map receive one point each. One point each is also assigned to lineaments that cross watershed boundaries, exhibit sharp bends, or are longer than 10 km. Two points are assigned to lineaments which coincide with a mapped implied fault or a lineament which has a USGS earthquake epicenter data point plotted near its axis. Three points are assigned to lineaments that coincide with a mapped fault. The weighted ranking system is used to identify locations where field verification of geologic structures has the greatest opportunity of success.

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

AVIATION AND SPACE EXPLORATION CLUB

Diane Bartels, STARBASE Nebraska Inc., Lincoln NE 68506

STARBASE Nebraska, Inc. was able to hold a teacher-training workshop for Lincoln area middle school teachers, in September, 2008 due to a NASA-Nebraska Mini-Grant. Most attendees work with diverse populations in Title 1 schools. Our mission was to inspire teachers to motivate students in the fields of STEM. The goal was to provide an interactive, hands-on after school Aviation and Space Club curriculum. Course content included history of aviation, construction of hot air balloons and paper airplanes, as well as building and launching Estes rockets. Club participants were invited to visit the Nebraska National Guard Base to tour Blackhawk helicopters and fly airplane simulators from Seward to Lincoln. The teachers received Civil Air Patrol AEX memberships. STARBASE Nebraska, Lincoln Public Schools, Lincoln Community Learning Centers, Lincoln YMCA, Heartland Big Brothers and Sisters, and the Malone Center partnered with STARBASE Nebraska Inc. in this collaborative effort.

A SPITZER SPACE TELESCOPE INFRARED SPECTRAL STUDY OF QUASAR OUTFLOWS

Sandra Behncke and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

Infrared spectroscopy from one of NASA's Great Observatories, the Spitzer Space Telescope, is used to investigate highly energetic mass outflows from broad absorption line quasars (BALQSOs). We compare the infrared spectra of a sample of BALQSOs with a sample of control quasars to test if these outflows represent a special stage of evolution of a quasar. Specifically, we compare the infrared continuum emission in the two samples to test for differences in the dust temperature, quantity and distribution. These results have implications for understanding how quasars evolve and how they affect their environments.

DETECTING CORN-PLANTING FOR NEBRASKA USING LANDSAT DATA

Vijendra K. Boken and Kelsey A. Bard, Department of Geography and Earth Science, University of Nebraska at Kearney, NE 68832

Corn is a major crop of Nebraska and its low yield (i.e. production per unit area) can signal an agricultural drought. If corn-planting is delayed or advanced, the corn yield is likely to be lower than its optimum value. Thirteen locations were chosen south of Kearney, NE where farmers planted dry land corn. At these locations, automated weather stations were installed to record daily weather data during the corn growing season in 2008. Two Landsat scenes of May-June of 2008 which included the selected fields were downloaded from a USGS website and an NDVI image of each was generated. The NDVI

values were averaged for the corn fields using spatial analysis and a GIS. The corn planting dates, harvest dates, as well as yield data were collected from the field owners. The poster will explain the methodology to detect corn planting using the weather data and NDVI data. The funding for this project was provided by the NASA Nebraska Space Grant office.

UNO'S ONLINE EARTH SYSTEM SCIENCE COURSES USING NASA RESOURCES

Neal Grandgenett, Department of Teacher Education and Robert Shuster, Department of Geology, University of Nebraska at Omaha, NE 68182

This poster presentation updates the next phase of work of UNO's collaborative work with NASA/NSF's Earth System Science Education Alliance (ESSEA) efforts in undertaken online earth system science courses for teachers. The courses are facilitated by the UNO Departments of Teacher Education and Geography/Geology with funding assistance from ESSEA and the NASA Nebraska Space Grant. This poster presentation will provide the following: 1) a new scholarship fund for course enrollment, 2) an update on course attendance and recruitment, 3) the use of an in-person (but optional) orientation meeting, 4) the use of the UNO Blackboard system, 5) the offering of the course in a summer format, 6) the development process for the first UNO module, and 7) an impact study being initiated during Spring of 2009. The poster will also highlight UNO's collaborative work with the Henry Doorly Zoo related to the ESSEA module on the International Amphibian Crisis, which has been adopted for nationwide distribution by ESSEA. In addition to successes, challenges will also be discussed, such as teacher initial perceptions of online courses, tuition costs and its impact on teacher recruitment, and the overall challenge of coordinating the collaborative efforts from a variety of partners.

USE OF THE GENERALIZED EIKONAL APPROXIMATION METHOD TO TEST LIGHT SCATTERING BY A LEVITATED LARGE SPHERICAL DIELECTRIC

Jason Gerritsen, Department of Physics, Hastings College, Hastings, NE 68902

Light scattering is the redirection of light from its straight-line path. Light scattering occurs continuously in the Earth's atmosphere. Cloud droplets ranging from 20 to 150-micron in size scatter light via Mie scattering. An apparatus was designed to levitate droplets in this size range. Using a He-Ne laser, scattering from droplets was observed in the form of an interference pattern projected onto a CCD (Charge Coupled Device) array. Measurements of size parameter, refractive index and relative intensity as a function of scattering angle were made with the CCD. These measurements were then compared to the theoretical values predicted by the GEA (Generalized Eikonal Approximation).

SINGLE BUBBLE SONOLUMINESCENCE (SBSL) PRODUCTION IN A SPHERICAL RESONANT FIELD

Joe Jeanjaquet, Department of Physics, Hastings College, Hastings, NE 68902

Single Bubble Sonoluminescence (SBSL) consists of producing micrometer sized bubbles within a resonant acoustic field, resulting in the emission of light. The light is emitted when resonate sound waves cause the microscopic bubble to collapse and cavitate at supersonic speeds. This rapid and violent compression triggers the release of light and energy. Using an experimental set-up consisting of a spherical water-filled quartz flask, piezoelectric transducers and a power supply, SBSL was investigated. Bubble size was determined using Mie scattering techniques, while spectroscopic analysis allowed for measurements of light duration, composition and intensity.

INVESTIGATION OF THE SAFETY AND EFFICIENCY OF WIRELESS POWER TRANSFER USING COUPLED MAGNETIC RESONANCES

Jordan Neuhart, Department of Physics, Hastings College, Hastings, NE 68902

In 2007 a group of researchers at MIT developed and tested a method for wireless power transfer that used copper coils with strongly coupled magnetic resonances, achieving efficiencies between 40 and 50 percent when transferring 60 Watts over a distance of two meters. To verify their results, two helical copper coils with resonant frequencies of 10MHz are constructed. The current in each coil is measured and used to determine the efficiency of a transfer of 60 Watts over several distances up to two meters. The results are compared to theory. A handheld spectral analyzer is used to measure the magnitude of the electric and magnetic fields and the Poynting vector at various distances from the source. The results were then compared with IEEE allowable radio frequency exposure guidelines to determine if the setup falls within the established guidelines.

THE DESIGN, CONSTRUCTION AND TESTING OF A THERMOACOUSTIC REFRIGERATOR

Brian Steinert, Department of Physics, Hastings College, Hastings, NE 68901

Many engines, heat pumps and refrigerators have multiple moving parts, which increases their complexity. A thermoacoustic refrigerator, on the other hand, has few moving parts. A thermoacoustic refrigerator was constructed using a loudspeaker, PVC pipe, Mylar sheeting, nylon line and thermocouples. This resulted in a refrigerator that is reliable, low cost and simple. The operational parameters of stack position, gas type and gas composition were changed to investigate their affects on overall performance and efficiency. This optimization was verified by the maximum temperature differences measured within the refrigerator.

IN-SITU ELLIPSOMETRIC ANALYSIS OF CONDENSED RTV EFFLUENTS ON MGF2 COATED GLASS SUBSTRATES

N.J. Ianno and Jinya Pu, Department of Electrical Engineering, University of Nebraska–Lincoln, NE 68588

Room Temperature Vulcanized (RTV) materials are commonly used to bond components of communication satellites and other types of spacecraft. The elevated satellite operating temperature causes the unused catalyst material in the RTV to volatilize, which can then re-deposit or condense onto other spacecraft surfaces. In the this Volatile Condensable Material (VCM) can deposit onto optically-sensitive spacecraft surfaces and significantly alter their original, beginning-of-life (BOL) optical properties causing unintended performance loss of the spacecraft. Knowledge of the optical impact of condensed VCM's is therefore a major concern of spacecraft designers and spacecraft-contamination engineers. In view of this we have employed in-situ spectroscopic transmission ellipsometry to monitor in real time the condensation of the effluent of several common RTV's.

THE LUMINOSITY MEASUREMENT OF THE DZERO EXPERIMENT AT FERMILAB'S TEVATRON COLLIDER

Ioannis Katsanos and Gregory R. Snow, Department of Physics, University of Nebraska–Lincoln, NE 68588

We will report on the status and plans for the University of Nebraska's involvement in the measurement of the luminosity at the DZERO experiment at the Fermi National Accelerator Laboratory

in Batavia, Illinois. DZERO is one of two large experiments presently operating at Fermilab's Tevatron accelerator which studies collisions between very high-energy protons and antiprotons. The luminosity, a measure of the collision rate of the interacting particles, is an important ingredient in every particle physics result published by the experiment. This work is partially funded by a Department of Energy/EPSCoR grant to the University of Nebraska that supports partnerships between university researchers and national laboratories.

AMERICAN INDIAN SCIENCE & ENGINEERING SOCIETY CONFERENCE

Victor M. Leading Horse, Department of Psychology, University of Nebraska at Omaha, NE 68182

My NASA funding allowed me to go to an American Indian Science & Engineering Society Conference in Anaheim California, a trip otherwise impossible for me. I'm currently studying both Psychology and Information Assurance at UNO. The conference really allowed me to see just how many opportunities there are for me once I have my degree. Moreover, it showed me the types of research and projects I could've been doing all along my college career and can still do for the next conference. I saw college freshmen as well as high school seniors demonstrate a highly enviable level of professionalism and expertise. The best thing to come from the conference was that I now believe I want to be an Intelligence Analyst for the FBI. This conference gave me the idea to pursue this career with enthusiasm. I can think of no better outcome.

USING GEOSPATIAL INFORMATION TECHNOLOGIES TO ESTIMATE CORN PRODUCTION FOR ETHANOL

Andy McDowell, Department of Geography, University of Nebraska-Lincoln, NE 68588

There has been increasing interest in using corn (grain and/or stover) as feedstock for ethanol production. Current techniques for forecasting corn production and estimating final yield totals employ a variety of remote sensing and field surveying techniques. While these methods may be very accurate, they are also time consuming and costly. Satellite remote sensing has the potential to provide a rapid, cost effective estimate of corn production. The goal of this pilot project was to determine if Normalized Difference Vegetation Index data can be used to estimate corn yield at the county level. Landsat-5 Thematic Mapper imagery from 2005 was processed to extract NDVI data for irrigated and non-irrigated corn fields and the resulting data were compared to yield estimates provided by the National Agricultural Statistics Service. Estimated yield maps were subsequently used in a GIS to assess the viability of several proposed ethanol production facilities.

INNOVATIVE CHANGES AND PROCEDURES TO REDUCE FUEL CONSUMPTION

Joseph Rotterdam and Michael Cameron, Aviation Institute, University of Nebraska at Omaha, NE 68182

Fuel accounts for millions of dollars in airline budgets annually. Over the years, many attempts have been made to reduce this dollar amount for the airlines' bottom line including the upgrade of older aircraft, engine upgrades for older aircraft, reducing customer amenities, and by altering engine usage procedures. During the summer months of 2008, fuel prices soared to their highest level ever recorded. Airlines were forced to spend more and more of their budgets to pay for fuel, and were unable to remain profitable. Due to the uncertainty of the economic marketplace, airlines are looking to the future in search of new technologies and hoping for better financial security through the use of new technology, new fuel

and energy sources, and procedural changes. This research seeks to dissect the federal and airline procedures that could be potentially beneficial to modify for the reduction of fuel consumption of aircraft. By researching this subject, the authors hope to assist the FAA and airlines with procedural changes related directly to reducing fuel consumption.

ENHANCEMENT OF ONLINE PHYSICS COURSES, GENERAL PHYSICS I & II, WITH NASA EDUCATIONAL MATERIALS

Maria Becker and Gregory R. Snow, Department of Physics, University of Nebraska–Lincoln, NE 68588

We will report on progress and plans to enhance two online introductory, calculus-based physics courses that are under development at UNL with the integration of physics education materials created by NASA education specialists. Of special interest are video learning clips on topics related to classical mechanics and electricity and magnetism such as “Gravity and the Tethered Satellite” and “Optics: Light, Color, and Their Uses”. Examples of NASA video clips being integrated into the courses will be shown in the presentation. This work is partially funded by a NASA Nebraska Space Grant Higher Education Mini-Grant.

THE EFFECTS OF A LATE DECAYING SCALAR FIELD ON DARK MATTER DENSITY

Katherine Garrett and Stephanie Schuk, Department of Physics, Creighton University, Omaha, NE 68178

Over the past decade astrophysical evidence has shown that the universe is dominated by an unseen, non-baryonic form of matter referred to as dark matter. The neutralino, a supersymmetric particle, is one of the most promising particle candidates for dark matter. However, extensive experimental searches have failed to detect the neutralino; these searches have so constrained the theoretical parameter space of the neutralino such that neutralino dark matter requires carefully constrained parameters and an unsatisfactory level of fine-tuning. We explore a possible solution to this dilemma: non-standard cosmologies. We focus on a non-standard cosmology where a scalar field dominates the early universe and ultimately decays into neutralinos. The existence of a scalar field can produce a wide range of dark matter densities and eliminates the need for fine-tuning. In essence, the neutralino may be a natural and viable dark matter candidate after all. We will present our work in progress in conducting a theoretical analysis of the behavior and properties of the scalar field and its effect on the neutralino relic density.

OPTICAL SINGULARITIES

Carl Corder, Department of Physics, University of Nebraska at Kearney, NE 68849

Our group is investigating alternative ways of creating optical vortices by means of interfering three plane waves. Optical vortices are screw dislocations in the phase space of a light wave. Such light fields carry quantized orbital angular momentum and are usually characterized by a bright ring with a dark point of zero intensity at the center. Vortices are commonly produced in the lab by using computer-generated holograms or spiral phase plates to create Laguerre-Gaussian waves. However, by using a He-Ne laser (wavelength 632.8 nm, TEM₀₀ mode) in conjunction with a nested Mach-Zehnder interferometer, we can achieve small angle interference between the three beams. Then, a fourth reference beam is reflected off a movable mirror which is mounted to a piezoelectric motor. By shifting

the mirror a fraction of the wavelength we are able to finely increment the optical path difference between the beams and create a series of progressing patterns. Capturing each irradiance cross section on a CCD camera, we will be able to reconstruct the phase. Theoretically, we expect the intensity pattern of this interference to be a hexagonal tessellation with optical vortices located at each of the six vertices of the hexagon.

ANTHROPOLOGY

A PRELIMINARY SURVEY OF LESSER-KNOWN POLYANDROUS SOCIETIES

Kathrine E. Starkweather, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

To challenge the common misconception that there are only four societies in the world that allow polyandry, this paper uses types of polyandry suggested by Levine and Sangree (1980), to identify polyandrous societies from India, Africa, South America, and North America. Basic issues of these societies are examined within the context of four commonly cited attempts to explain the existence of polyandry. The goal of this paper is a preliminary look at the existence of polyandry around the world and an initial exploration of issues that may or may not be associated with this form of marriage

IN THE WAITING ROOM: USE AND PERCEPTIONS OF REPRODUCTIVE HEALTHCARE IN QUITO, ECUADOR

Emily R. Smith, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

In Latin America, because of social, political, and economic factors, improving quality and accessibility to reproductive health care for women is problematic. The purpose of this study was to examine the use and perception of reproductive health care services in Quito, Ecuador. Interviews were conducted with women (n=70) at seven health centers and hospitals, both private and public, throughout Quito. Women were asked to comment on various aspects of reproductive health, including: use of family planning methods, ideal vs. actual number of children, satisfaction with the health care they have received, and motivations for utilizing certain health centers. The level of satisfaction between users of public and private sectors was also assessed. This study focuses on women's perceptions of the quality of services they have received, and suggestions for improving health care services and access for women living near Quito's health facilities.

INTERNATIONAL POLITICAL ECONOMY EXPLANATIONS TO GUATEMALA'S ECONOMIC OPENNESS AND ITS IMPACT ON RURAL COMMUNITIES

José Nicolás Cabrera-Schneider, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

In recent times, (1980–2007), Guatemala's government has transitioned from military rule to a democracy. It has also transitioned from economic policies that protected the economy to promoting economic policies that open the economy. This article presents arguments based on International Political Economy to explain why the economic policy transitions happened and what political institutions promoted this change. I argue that the military and the owners of capital and land were influential in shaping these kinds of economic openness policies. These policies have had an impact on the society; on one hand it has reduced the level of poverty across Guatemala, but on the other hand it has reduced the wages in the urban areas.

UTOPIAN AND COMMUNAL SOCIETIES: THE IMPORTANCE OF INSTITUTIONALIZED AWE THROUGH IDEOLOGY

Matthew H. Brittingham, College of Arts and Sciences, Philosophy and Religious Studies Major,
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America's utopian and communal societies have a long history of using transcendence as a commitment mechanism to attract followers and converts. The most prevalent, transcendent focused, commitment mechanism is institutionalized awe through ideology. This means that an accepted ideology of a group becomes engrained in the community as a norm, yet it causes a certain reverence, inspiration, and power. Some examples of the kinds of ideologies that are typical in utopian communities can be economic ideology, religious ideology, and ideology of leadership. Institutionalized awe through ideology is crucial to all utopian community and their sustainability as a cohesive group, which means in most cases the ideology of communities must have either the capacity to fit problems the group faces through change, or have the capacity to keep a sense of awe and wonderment through revitalization. This principle can be seen through many different utopian and communal groups, such as the Ephrata Cloister, the Harmonists, Oneida, the Shakers, the Amana Colony, Brook Farm, New Harmony, the Hutterites, and the Old Order Amish. Sometimes the practices and beliefs (ideologies) need to be changed in order to help a community sustain awe, and, through the awe, membership. This allows for the leadership to have a large and broad role in the community since it controls the ideology, the awe it inspires, and the ideology's flexibility to sustain the utopia. Some of the most successful utopian communities in American history utilized the flexibility of their ideologies to maintain awe and sustain the needs of their members, especially in tragic and difficult circumstances. The American communal societies labeled as failures, in terms of longevity, did not use the flexibility of ideological awe to sustain their societies. Part of this could result from the differences between economic and religious ideologies that inspire awe. When one has a firm grasp of institutionalized awe through ideology it can be seen that ideological awe is extremely important and pervasive in utopian communities, as well as most religious traditions, and satisfies different human desires.

ARCHAEOLOGICAL RECONASSAINCE OF THE ROYAL BUFFALO HUNT OF 1872

Stephen Damm, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

In the winter of 1872-1873, the United States entertained the Grand Duke Alexis Alexandrovich, son of Tsar Alexander II of Russia, with a buffalo hunt on the plains of Nebraska. In addition to the unique gathering of both foreign diplomats and domestic celebrities, including George Custer, Phil Sheridan, and "Buffalo Bill" Cody, the site itself offers some interesting archaeological opportunities for short duration military camps. This paper looks at the archaeological reconnaissance techniques employed to determine the location and extent of the campsite, such as metal detection and cooperation with avocational archaeologists and private collectors, as well as some of the preliminary conclusions that the artifact collections can provide.

A LOOK AT A COLLECTION OF OIL LAMPS AND THEIR COLLECTORS

Geri J. Knight, Department of Anthropology, University of Nebraska–Lincoln, NE 68588

This paper examines the Greek and Roman oils lamps in the collections of the Nebraska State Museum. The collection houses 42 oil lamps made from bronze as well as clay. The collectors of these lamps were Rev. Iain C.G. Campbell, William Jennings Bryan, and Mr. and Mrs. Lininger and others.

Some of the collections date as early as the late 1800's and continued through the 1970s. The lamps were collected from Italy, Syria, Greece and Egypt. The goal of the paper is to document the lamps as well as the activities of the collectors. The thesis includes information about the socioeconomic background of these collectors and discusses their likely motives for collecting ancient artifacts which eventually were donated to or purchased by the Nebraska State Museum.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION A

QUANTIFICATION AND ISOLATION OF BACTERIOPHAGE IN HYPER ALKALINE-SALINE LAKES IN WESTERN NEBRASKA

Andrew A. Block and Julie J. Shaffer, Department of Biology, University of Nebraska at Kearney, NE 68849

The pH and salinity in the hyper alkaline-saline lakes in Western Nebraska fluctuates throughout the year. It is known that bacteriophage rely on ions for attachment and infection of bacteria; therefore this change in ion concentration could have a profound effect on bacteriophage replication. We are currently quantifying the viral populations of several hyper alkaline-saline lakes using fluorescent microscopy. Also from these communities bacteria have been isolated to serve as hosts for bacteriophage attachment studies. We are attempting to identify how bacteriophage replication success changes as the pH changes from 6 to 10. These results will help us to have a more realistic model of how bacteriophage replication changes throughout the year. This study is important in understanding microbial community dynamics and carbon flow in this unusual ecosystem. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

ANALYSIS OF SEX CHROMOSOMAL DNA AND MORPHOLOGY IN CHIMERIC MARMOSETS

Andrew Z. Lescelius and Jeffrey A. French, Biology and Psychology Departments, University of Nebraska at Omaha, NE 68182

Marmoset monkeys (*Callithrix* sp.) usually produce fraternal twins. Early in embryonic development, a close vascular connection is formed between the twin embryos, and they exchange embryonic stem cells with each other, forming natural genetic chimeras. In the case of male-female co-twins, some proportion of cells in females contain Y-chromosomes inherited horizontally from the male co-twin. In this study, we developed a method for determining the presence or absence of Y-chromosome by assaying for X- and Y-associated zinc-finger protein (ZFP) in female-female and female-male twin pairs. We extracted DNA, amplified it via PCR, and genotyped animals via specific primers for X-ZFP and Y-ZFP. In addition, we will assess whether the presence of Y-chromosomes in females alters genital morphology and behavioral profiles.

BUTTERFLY POPULATION TRANSECT STUDIES AT TWO EASTERN NEBRASKA TALLGRASS PRAIRIES

Collin J. Brennan and Theodore Burk, Environmental Sciences Program, Creighton University, Omaha, NE 68178-0103

Our research group conducted weekly Pollard Transect population studies at two prairies in eastern Nebraska for twenty weeks from early June to mid October in the summers from 1998 to 2008. One site was Allwine Prairie, a 65-hectare restored prairie owned and managed by the University of Nebraska at Omaha; habitats represented along the transect included newer and older prairie restorations, woods, a wetland, and disturbed areas. The second site was Bauermeister Prairie, a 12-hectare prairie remnant managed by the City of Omaha; habitats included prairie, woods, and disturbed areas. We obtained approximately 40,000 butterfly counts representing over 50 species at each site. In addition to general data on species diversity and abundance, we will present results documenting the effects of particular management practices, including three-year burn rotations, mowing, and restoration of prairie habitat in specific areas. Results from butterfly species of general public or conservation interest, such as the Monarch and the Regal Fritillary, will be emphasized.

BUTTERFLY NECTAR PLANT VISITS AT TWO EASTERN NEBRASKA TALLGRASS PRAIRIES

Katherine A. Cusack and Theodore Burk, Department of Biology, Creighton University, Omaha, NE 68178-0103

In conjunction with weekly Pollard Transect population studies, we recorded all observed flower visits by butterflies at two prairies in eastern Nebraska for twenty weeks from early June to mid October in the summers from 2002 to 2008. One site was Allwine Prairie, a 65-hectare restored prairie owned and managed by the University of Nebraska at Omaha; habitats represented along the transect included newer and older prairie restorations, woods, a wetland, and disturbed areas. The second site was Bauermeister Prairie, a 12-hectare prairie remnant managed by the City of Omaha; habitats included prairie, woods, and disturbed areas. We recorded approximately 4,000 flower visits by about 40 species of butterflies to over 50 species of plants. Visitation of particular species of butterflies to particular species of plants was significantly non-random. Using Simpson diversity indices, we show that butterflies varied in degree of specialization or generalization of nectar plant use, and plant species varied in the diversity of the visiting butterfly community. Butterfly nectar plant use also varied according to habitat type. Results from butterfly species of general public or conservation interest, such as the Monarch and the Regal Fritillary, are emphasized, as are results of nectar plants of significance in prairie areas of the sites.

RE-EXAMINATION OF DIET FOR THE COMMON BARN OWL (*TYTO ALBA*) AND GREAT HORNED OWL (*BUBO VIRGINIANUS*) AT CRESCENT LAKE NATIONAL WILDLIFE REFUGE, NEBRASKA

Stacey L. Bonner and K. Geluso, Department of Biology, University of Nebraska at Kearney, NE 68849-1140

Analysis of owl pellets is a well-known nondestructive process that provides information regarding owl diet, distribution of prey, and local communities of small mammals. Information on diet and prey preferences is presented for two species of owls inhabiting western Nebraska at Crescent

Lake National Wildlife Refuge (*Tyto alba* and *Bubo virginianus*). Previously at Crescent Lake National Wildlife Refuge, the diets of both species were examined in the early 1970s. Re-examination of their diets was conducted to determine whether the northern pocket gopher (*Thomomys talpoides*) still occurs at the site, examine whether the diets have shifted over 35 years, and compare frequency of prey with a recent survey of small mammals at the refuge. Approximately 500 owl pellets and pellet debris were collected from the refuge in October 2008. Diet determination was carried out through analysis of cranial and dentary bones extracted from these regurgitated materials. Small mammalian taxa were identified via examination of mandibular and maxillary tooth rows and cranial bones. Results obtained from pellet dissection will be presented and discussed.

DOES ENVIRONMENTAL ENRICHMENT ALTER THE LOCOMOTOR STIMULANT EFFECTS OF CAFFEINE IN RATS?

Jamie Fosdick and D. J. Stairs, Department of Biology, Creighton University, Omaha, NE 68178

While caffeine is one of the most widely used drugs very little research is conducted on caffeine's abuse potential. Research using the rodent environmental enrichment model indicate that exposure to an enriched environment decreases the vulnerability to major psychostimulants such as cocaine, amphetamine, while little is known of the ability of an enriched environment to alter abuse potential of caffeine. The aim of the current study was to determine whether differential exposure to environments can alter the sensitivity to the locomotor stimulus effects of caffeine. Male Sprague-Dawley rats were raised in one of three conditions: enriched condition (EC; N=8/group) with social cohorts and novel objects changed daily, social condition (SC) with one other social cohort and no novel objects, or impoverished condition (IC) with no social cohorts or novel objects under a 12/12 hr light/dark cycle, with lights on from 6:00-19:00 hr. Following exposure to the differential environments animals were given acute injections of various doses of caffeine (0, 10, 20, 30, and 40mg/kg; i.p.). Prior to caffeine injections rats were placed in the locomotor chambers for 30 minutes to measure baseline activity. Following the 30 min baseline period animals were removed from the locomotor chamber and injected with a dose of caffeine, then placed back in the locomotor chambers for an additional 30 minutes. This procedure was repeated every two days until each rat received each injection of caffeine at least once. Locomotor behavior was measured by the animal breaking photobeams, which were recorded on an adjacent computer. In all environmental conditions there were dose-dependent changes in locomotor behavior with the 30 mg/kg dose of caffeine resulting in the greatest increase in behavior with higher doses of caffeine resulting in a blunted increase in locomotor behavior. There were also differences in the caffeine dose-response curves across the three environmental conditions. The results of this study indicate that differential exposure environments during development may alter the sensitivity to the stimulant effects of caffeine.

ENVIRONMENTAL ENRICHMENT AND THE SUBJECTIVE EFFECTS OF CAFFEINE IN RATS

Beth Mittelstet and D. J. Stairs, Department of Biology, Creighton University, Omaha, NE 68178

Rats raised in an enriched environment show a decrease in numerous behavioral effects of psychostimulants. While a majority of research has focused on the enrichment-induced differences in the behavioral effects of amphetamine, no research has investigated the effects of enrichment on the psychostimulant caffeine. The purpose of the present study was to determine if environmental enrichment during development alters the discriminative stimulus effects of caffeine using an operant drug discrimination procedure. Male Sprague-Dawley rats were raised in either an enriched condition

(EC; N=8/group) or an isolated condition (IC) under a 12/12 hr light/dark cycle, with lights on from 6:00-19:00 hr. EC and IC rats were trained on a two lever operant procedure to discriminate 30 mg/kg (i.p.) caffeine from saline. Either saline or caffeine injections were administered using a two day alternating dosing regimen prior to the 15-min. drug discrimination session. Following acquisition of the caffeine discrimination (80% appropriate responding), a caffeine generalization curve was determined. The various doses of caffeine (0, 3, 5.6, 10, 30 mg/kg) were tested randomly twice a week with each animal experiencing each dose twice. Results from the study indicate that environmental enrichment does not alter the sensitivity to the discriminative stimulus effects of caffeine.

DOES ENVIRONMENTAL ENRICHMENT ALTER DRINKING BEHAVIOR IN RATS?

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Alcohol abuse is widespread in our society and few effective treatments exist for alcohol addiction. Previous research using the rodent environmental enrichment model indicates that exposure to a high level of environmental novelty during development decreases the vulnerability to abuse psychostimulants. While environmental enrichment has shown to have protective effects in the abuse of psychostimulants, very little research has investigated whether environmental enrichment can alter the vulnerability to drink alcohol. The purpose of the present study was to determine if environmental enrichment during development alters the propensity of rats to drink ethanol using a two-bottle choice drinking procedure. Male Sprague-Dawley rats were raised in either an enriched condition (EC) or an isolated condition (IC) under a 12/12 hr light/dark cycle, with lights on from 6:00-18:00 hr. EC and IC rats acquired drinking behavior through the use of a sucrose-fading procedure in which the animals first choose between a bottle containing water and a bottle containing a sucrose solution. Gradually the percentage of sucrose was decreased as the percentage of alcohol increased until the animals were choosing between a bottle which contains water and a bottle that contains an ethanol solution with no sucrose. Following the sucrose-fading procedure EC and IC rats were tested in their propensity to consume a 10% ethanol solution during 3-hour drinking sessions for 10 days. Following these sessions the percent of ethanol was decreased to 5% for an additional 10 days. Using the current procedures the results indicated that neither EC nor IC rats showed a preference for a 10% ethanol solution over water. Although when the percentage of ethanol was lowered to 5% there was a slight increase in the preference for ethanol over water in both EC and IC rats. This preference for 5% ethanol was accompanied by an increase in the volume of ethanol solution consumed. However, there was no effect of environment on either preference for ethanol or volume of ethanol consumed at both doses of ethanol tested. This study indicates that using the current procedures environmental enrichment does not alter the propensity to drink ethanol in rats.

A FLORISTIC STUDY OF BROWN COUNTY, NEBRASKA

Megan Killion and Steven J. Rothenberger, Department of Biology, University of Nebraska at Kearney, NE 68849

A botanical survey of Brown County, Nebraska, resulted in a total flora of 724 species representing 358 genera and 105 families. Four major plant communities are represented in the county including Sandhills mixed-grass prairie, Gravelly mixed-grass prairie, Ponderosa pine forests and savannas, and Sandhills borders mixed-grass prairie. The Nebraska Sandhills, which make up a large part of Brown County, cover about 20,000 square miles of the state, making this grassland one of the largest plant covered dune regions in the world. Approximately 600 species of native plants grow in the Sandhills.

The Niobrara River, which begins in Wyoming and flows 800 km east through Nebraska before it joins with the Missouri River, forms the north border of Brown County. The relatively high plant diversity of Brown County results from the postglacial forests in the Niobrara Valley that form several life zones above the river. The Niobrara Valley represents a transition zone where plant species with western, eastern, and northern affinities meet. Fourteen new county records were collected and are reported in this study. An annotated checklist of vascular plants was compiled for Brown County, and an index of similarity was used to compare Brown County to Banner, Dixon, Keith, and Seward Counties.

RECENT FLORISTIC DISCOVERIES IN THE NEBRASKA PINE RIDGE AND A COMPARISON TO THE FLORA OF THE BLACK HILLS

Steven B. Rolfsmeier, Kansas State University Herbarium, Manhattan, KS 66506-4901; and
Ronald R. Weedon, High Plains Herbarium, Chadron State College, Chadron, NE 69337-2690

Floristic surveys undertaken in the Nebraska Pine Ridge since 1991 and continuing herbarium work have revealed the presence of twenty species of vascular plants not previously reported from this ecoregion, including ten native species not previously recorded from the state: *Crataegus chrysocarpa*, *Danthonia spicata*, *Dryopteris filix-mas*, *Epilobium brachycarpum*, *Goodyera oblongifolia*, *Physocarpus monogynus*, *Polygonum douglasii*, *Rudbeckia laciniata* var. *ampla*, *Viola adunca*, and *V. vallicola*. Populations of ten species not collected in Nebraska since 1940 or earlier were also located as a result of such surveys, including *Agrostis exarata*, *Carex grisea*, *C. rossii*, *Corydalis aurea*, *Hieracium kalmii* var. *canadense*, *Navarretia intertexta* var. *propinqua*, *Orthilia secunda*, *Populus angustifolia*, *Prosartes trachycarpa*, and *Symphoricarpos albus*. A provisional floristic list of the Nebraska Pine Ridge includes between 540 and 580 native species, all but 27 of which are apparently also known from the Black Hills of South Dakota and Wyoming. The floristic affinities of these 27 species are about evenly divided between the Great Plains, eastern North America, and the Mountain West. The Great Plains species occur mostly on sandy soils of the High Plains, and may be limited by a lack of favorable habitat north of the Pine Ridge (though some occur along the fringes of the Black Hills). The eastern species mostly occur in deciduous woodland and are also found in the Niobrara River valley or the Sandhills, and may have migrated westward fairly recently. The western species appear most common in the Middle Rockies, but often occur sporadically eastward onto the Great Plains, and their apparent absence from the Black Hills may be due to chance or artifacts of collecting.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

CHARACTERIZATION OF PUTATIVE REGULATORY ELEMENTS 5' AND 3' OF EXON 1 OF THE HUMAN N-CADHERIN

Kate Marley, C. Flitcroft, K. Bryant, M. Wilson, B. Barelmann, and H. Kroese, Department of Biology, Doane College, Crete NE 68333

Cadherins are calcium-dependent transmembrane cell adhesion proteins. N-cadherin can become misexpressed in epithelial tumors and is linked to increased motility and invasiveness. Loss of N-cadherin expression in rat kidney cells is associated with degradation of kidney integrity and the N-cadherin promoter becomes methylated in these cells. The objective of this study was to characterize a putative repressor region of the human N-cadherin gene. N-cadherin promoter luciferase reporter constructs were transiently transfected into HeLa cells and MDA-MB-435 breast cancer cells, which both express N-cadherin, and expression levels from reporters were highest from the +10bp to -462bp

fragment and lowest from the +10bp to -1975bp fragment. Deletion reporters are narrowing the region of focus. A431 cells that do not express N-cadherin also do not express the reporters. However, BT-20 breast cancer cells that also do not express N-cadherin, express the luciferase reporter constructs in a pattern similar to HeLa and MDA-MB-435 breast cancer cells. It is possible that there are epigenetic modifications of the endogenous N-cadherin promoter. Examination of the methylation status of the human N-cadherin gene in BT-20 cells is underway. In addition, there is a putative LEF-1 binding site in the first intron 60 bp 3' of the first exon that is currently being evaluated with transient transfections of luciferase reporter constructs. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

A DIFFERENT VIRULENCE STRATEGY USED BY THE PLANT PATHOGEN *PSEUDOMONAS SYRINGAE*: MODIFYING HOST CHROMATIN

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The gram-negative plant pathogen *Pseudomonas syringae* infects plants cells by injecting effector proteins via a Type III secretion System (TTSS). Although the molecular function of many effectors is still unclear, we know that collectively these effectors enable bacteria to be pathogenic. Most of the studies on the roles of effectors have focused on those that interact with cytoplasmic components of host cells. However, several recent studies have identified effectors that can modify chromatin of host cells either indirectly or directly. To evaluate whether *P. syringae* induces epigenetic modifications in the plant model *Arabidopsis*, we infected plants with the wildtype strain DC 3000, a hrcC-e strain that lacks a TTSS, and a buffer only control. We have successfully extracted chromatin from the plant leaves and are using immunoblot analysis with various antibodies designed to detect histone modifications such as methylation, acetylation, and phosphorylation. This will enable us to determine whether there are global changes in histone modifications in the plants exposed to the pathogen.

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STRUCTURE AND FUNCTION OF A POTENTIAL MAMMALIAN RIBOSWITCH

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Riboswitches, which are found in untranslated regions of mRNAs, bind to specific cellular metabolites and undergo a conformational change which modifies expression of a nearby coding region of the mRNA. This coding region is involved in the synthesis of the same metabolite, thereby providing an efficient feedback mechanism of genetic control. To date, various riboswitches have been described to effectively control genetic expression in bacterial cells, but none have been discovered in mammals. We are investigating the structure and function of a potential mammalian riboswitch, thought to control polyamine biosynthesis. Polyamines surround a cell's DNA to stabilize the DNA negative charge. The conformational change that occurs when the potential riboswitch RNA interacts with polyamines may result in a feedback loop to control polyamine levels in the cell. To validate this small RNA as a new riboswitch, we are using in-line probing to verify its specific binding to a cellular metabolite and subsequent conformational change. Additionally, to verify the ability of the potential riboswitch to

control gene expression, a vector has been constructed in which the riboswitch RNA precedes a reporter gene. Reporter gene expression will be measured +/- polyamine. Successful results from both of these investigations will determine whether this small RNA is a true riboswitch. Further investigations will include determination of its structure using X-ray crystallography. It is known that cancer cells require a higher concentration of polyamine due to their increased replication rate. Thus, a combination of structural and functional studies of this RNA may prove useful in the development of novel cancer therapies.

This work was made possible by NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of NIH.

ANTIBIOTIC DEVELOPMENT BY INVESTIGATION OF THE *GLMS* RIBOSWITCH

Danielle N. Renner¹ and Juliane K. Soukup^{1,2}, ¹Departments of Chemistry and ²Biomedical Sciences, Creighton University, Omaha, NE 68178

Although bacterial infections have always been of significant interest to researchers and physicians, the drug-resistant bacterial strains that have recently developed are causing new concerns and are much more difficult to combat. The current methods for treating bacterial infections include broad-spectrum antibiotics which target only a small number of bacterial processes. However, with the discovery of riboswitches, we are developing new ways to fight bacterial infections which make use of their own natural metabolic pathways, essentially causing bacteria to destroy themselves. Riboswitches are found in non-coding regions of messenger RNAs and these RNA elements bind to ligands to control the expression of nearby genes. The glucosamine-6-phosphate (*glmS*) riboswitch is unique in that upon binding its ligand, glucosamine-6-phosphate (GlcN6P), it undergoes self-cleavage and is therefore also a catalytic RNA. The cleavage event targets the RNA for subsequent degradation, thereby repressing further gene expression. To study the *glmS* riboswitch, initial experiments were performed to determine the mechanism followed upon binding of the natural ligand. Since then, analogs of the natural ligand have been obtained and are being tested for their catalytic capabilities through kinetic analyses and rate constant calculations. Once successful candidates have been determined, these non-natural ligands will be introduced into live bacterial cultures, hopefully disrupting normal cell metabolism and reproduction. If successful, these analogs could be used as novel antibiotics, offering a more specific mode of targeting a wide variety of bacterial species.

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ANALYZING PAIRING INTERACTIONS IN THE 5' NONTRANSLATED REGION OF THE COXSACKIEVIRUS B3 RNA GENOME

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Coxsackievirus B3 (CVB3) is a member of the genus *Enterovirus* and family *Picornaviridae*. CVB3 infections cause pancreatitis and myocarditis, and play a role in type I diabetes. Upon entry into the host cell, the single stranded RNA genome serves directly as mRNA and contains an internal ribosome entry site (IRES) on the 5' end that is used to recruit ribosomes for translation. This IRES is

embedded in a long, highly structured 5' nontranslated region (5'NTR). The structure of the 5' NTR controls the process of translation and, after a conformational change, also controls genome replication. A large body of experimental evidence shows that specific structures in the 5' NTR are essential for all of these functions. Our lab is looking at a potential long range RNA pairing interaction between nucleotides 113-118 and 562-566, found in the IRES element of the 5'NTR. We seek to understand the 3-dimensional structure that is created from this pairing. Furthermore, we wish to evaluate the role of the long range pairing in the overall viral multiplication cycle and ultimately in the virulence of the virus.

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INVESTIGATION OF OTK18 BINDING TO VARIOUS PROMOTER ELEMENTS

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OTK18 is a human transcriptional suppressor implicated in regulation of human immunodeficiency virus (HIV) replication. In addition, it is also expressed in most uninfected tissues under normal homeostatic conditions. The role of OTK18 protein and the promoter elements to which it binds under homeostatic conditions is the focus of this research project. The human *OTK18* gene was engineered into *pET-28a* to produce a His-tag fusion protein. The His-tagged human OTK18 was purified from bacteria utilizing fast protein liquid chromatography (FPLC) and a Ni-NTA column. Western blot analysis was performed to determine the size and integrity of the protein. The proposed promoter regions were amplified using polymerase chain reaction (PCR). The purified OTK18 and promoter PCR products were analyzed by gel shift assay to determine if binding occurred. The results of this study provide insight on the role of OTK18 regulation not only under homeostatic conditions, but also with implication to severe HIV infection. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

STUDY OF CNBD DOMAIN IN EPAC PROTEINS

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Second messenger molecules such as cAMP play a vital role in signal-transduction in a eukaryotic cell. However, more recently exchange protein directly activated by cAMP (Epac), a guanine exchange factor-mediated signal transduction has been reported, which is found to function independent of protein kinase A (PKA). There are two types of Epac proteins: Epac1 and Epac2, both of which are multi-domain molecules. One of the characteristics of Epac protein is the presence of high-affinity cAMP binding domain called CNBD. However, Epac2 consist of an additional CNBD domain in the N-terminal region that is characterized as low-affinity CNBD of uncertain significance. In the present study, we utilize bioinformatics tools to trace the evolutionary history of the domains in Epac protein. It is expected that the result from this study will allow us to characterize the function of this low-affinity CNBD domain in Epac2 protein.

EFFECT OF NICOTINE ON AVIAN EMBRYO DEVELOPMENT

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Nicotine is believed to be one of the major teratogenic chemicals that cross the placenta in smoking pregnant women. Previous teratogenic studies in animals used nicotine levels exceeding those measured in human amniotic fluid of smoking mothers or were conducted at rather late stages of embryonic development. Here, we injected physiologically relevant amounts of nicotine (100-1,000 nM) into the air sac of chicken eggs after 24 hours of development to determine its teratogenic effects in younger embryos. Four days after this single nicotine injection, specimens were collected and examined. Embryos exposed to 1,000 nM nicotine exhibited delayed development and were roughly 22% underweight. Additionally, about 81% of embryos exposed to a 1,000 nM nicotine solution were found to be abnormal. Embryos treated with a 100 nM nicotine solution were also about 25 % underweight, however development did not appear to be delayed. Gross morphological anomalies such as anencephaly and distortion of the trunk were most common. These results indicate that even a single exposure to a low dose of nicotine is detrimental to early embryogenesis. Thus nicotine replacement therapy in smoking cessation programs should be carefully considered before being used in pregnant patients. The project described was supported by the NIH grant number P20RR016469 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.

UNDERSTANDING THE ROLE OF TIMP-2 IN CARDIAC NEURAL CREST CELL MIGRATION

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Neural crest (NC) cells are a population of cells that migrate from the neural tube of the embryo early in development. One subpopulation of NC cells, called cardiac NC cells, migrates to the developing heart and assists in the organization and construction of a fully functioning cardiac system. TIMP-2 is expressed in cardiac NC cells and is required for their proper migration. In other systems, TIMP-2's two known functions are to facilitate extracellular protease activation or bind to integrins on the cell surface and trigger intracellular signaling pathways. It is unknown which of these roles is most essential for cardiac NC migration. To address this question, we designed a mutant form of TIMP-2 that is unable to help activate extracellular proteases but can still bind to integrins. Next we determined the optimal transfection conditions for achieving maximal expression of the mutant TIMP-2 expression construct in chicken embryos without decreasing embryo viability. Using those conditions, we are currently analyzing how expression of the mutant TIMP-2 protein effects cardiac NC migration.

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TIMP-2/ $\alpha_3\beta_1$ INTEGRIN INTERACTION MEDIATES CARDIAC NEURAL CREST CELLS MIGRATION

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Neural crest cells emerge from the neural tube, a structure that forms the spinal cord and brain. Cardiac neural crest cells (CNCs), which form between the otic placode and the third somite, aid in heart development. Our previous research on the *Gallus domesticus* or chicken embryo shows that tissue inhibitor of metalloproteinase, TIMP-2, is uniquely expressed in CNC cells and is required for their normal migration. In other systems, TIMP-2 can bind to the $\alpha_3\beta_1$ integrin and alter levels of cAMP, cyclins, and cdk inhibitors. Hence, we hypothesized that TIMP-2 binding to $\alpha_3\beta_1$ integrin mediates CNC cell migration and proliferation. Using immunohistochemistry against the α_3 integrin subunit, we saw expression in the ectoderm but not in the CNC cells. However, we were able to detect the $\alpha_3\beta_1$ integrin mRNA in CNC cells using RT-PCR. Currently, we are analyzing the migration patterns of CNC cells after blocking the interaction between TIMP-2 and α_3 integrin subunit *in vivo*. This work is supported by INBRE Program for the National Center for Research through the NIH (#P20 RR016469). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION C

DIFFERENTIAL GENE EXPRESSION IN BUFFALOGRASS CULTIVARS INFESTED WITH CHINCH BUGS

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Buffalograss (*Buchloe dactyloides*) is a low-growing warm season grass native to the central U.S. It is low growing and quite drought resistant. These characteristics make buffalograss appealing for home use. It however has problems, which make wide adoption difficult. The color and texture of buffalograss are not quite the same as bluegrass, which most homeowners prefer. The other more significant problem is that most varieties are susceptible to chinch bug infestation. Susceptible cultivars will quickly turn brown when infested. Breeding efforts have largely focused on the appearance of the grass without directly considering insect susceptibility. Our efforts have been focused on helping to combat this problem using subtractive hybridization to identify candidate genes involved in tolerance of some buffalograss cultivars to chinch bugs (Prestige) and susceptibility in others (378). Once identified, we have measured the levels of some transcripts using qRT-PCR. We will present and analyze our findings for these cultivars at advanced damage levels. This project was supported by NIH grant P20 RR016469 from the BRIN program of the National Center for Research Resources and a grant from the United States Golf Association.

SOYBEAN RESPONSES TO SOYBEAN APHIDS ASSESSED USING SUBTRACTIVE HYBRIDIZATION

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Aphids are perhaps the most damaging group of agricultural pests worldwide. They transmit diseases, withdraw phloem sap, and can elicit drastic responses in the plant. Recently, the soybean aphid (*Aphis glycines*) has been introduced to the Midwest, and represents a growing risk to soybean production. The development of insecticide resistance is common, and plant resistance based on antibiotic factors is often short-lived. In our study, we attempt to address this problem by examining soybeans tolerant to aphid infestation. Tolerance has a much broader genetic basis than resistance and is therefore more durable. We infested soybean plants tolerant to soybean aphid and in parallel another variety that was susceptible. For each, total RNA and mRNA were extracted to perform subtractive hybridization. From the resulting subtracted libraries, we sequenced 100 clones each to get an overview of the differences in the reactions of the two genotypes at the transcript level. The sequences were submitted to GenBank through a BLAST search to find putative identities and functions. These were further classified into functional groups. We will present and discuss the results of this analysis. This project was supported by NIH grant P20 RR016469 from the BRIN program of the National Center for Research Resources and a grant from North Central Soybean Research Project.

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

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Over-activation of the renin-angiotensin system (RAS) and elevated Angiotensin II (Ang II) in the brain play a critical role in sympatho-excitation which worsens chronic heart failure (CHF). Exercise training (EX) normalizes sympathetic outflow and plasma Ang II. The central mechanisms by which EX reduces the sympathoexcitatory state are unclear, but EX may alter components of the brain RAS. Angiotensin-converting enzyme (ACE), which synthesizes Ang II, may mediate an increase in sympathetic nerve activity (SNA). ACE2, a homologue of ACE, metabolizes Ang II to Ang-(1-7) which has antagonistic effects to Ang II. Little is known about the regulation of ACE and ACE2 in the brain and the effect of EX on the enzymes. This study aimed to investigate the balance and regulation of ACE and ACE2 in various areas of the brain with a pacing induced CHF-EX model. We hypothesized that the ratio of ACE to ACE2 would increase in CHF, to mediate increased SNA, and be normalized by EX. Experiments were performed on four groups of New Zealand White rabbits: normal, normal+EX, CHF, and CHF+EX (n=4-5 per group). The cortex, cerebellum, medulla, hypothalamus, and punches of the paraventricular nucleus (PVN), nucleus tractus solitarius (NTS), and rostral ventrolateral medulla (RVLM) were analyzed. Western blotting, PCR, and double immunofluorescence were performed to measure and localize expression of ACE and ACE2. ACE protein and mRNA expression in the cerebellum, medulla, hypothalamus, PVN, NTS, and RVLM were significantly upregulated in CHF rabbits (0.3 ± 0.03 to 0.8 ± 0.1 [ratio of ACE to GAPDH] in the RVLM, $P < 0.05$). EX normalized this upregulation compared to CHF (0.8 ± 0.1 to 0.4 ± 0.1 in the RVLM). ACE2 protein and mRNA expression

significantly decreased in CHF(0.3 ± 0.02 to 0.1 ± 0.01 [ratio of ACE2 to GAPDH] in the RVLN). EX increased ACE2 expression compared to CHF in all areas measured (0.1 ± 0.01 to 0.8 ± 0.1 in the RVLN). Immunofluorescence indicated that ACE2 is present in the cytoplasm of neurons and ACE in endothelial cells. The results suggest that activation of the central RAS system involves an imbalance of ACE and ACE2 in regions of the brain that regulate autonomic function. EX may be a therapeutic modality for CHF mediated by normalized expression of ACE and ACE2 and sympathetic outflow.

CONSEQUENCES OF TOILET LID USE ON TOOTHBRUSH CONTAMINATION BY AEROSOLIZED COLIFORM BACTERIA

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Toothbrushes can become contaminated with microorganisms by a number of sources. One of those sources, the toilet, induces the aerosolization and spread of fecal coliforms. Brushing our teeth then becomes a method of transportation for potentially infectious bacteria into our bodies. The introduction of these microorganisms into our bodies may have detrimental effects on our oral and whole body health. The use of a toilet lid to act as a physical barrier to inhibit the dispersal of aerosolized bacteria and pathogenic organisms is currently under investigation. Results are expected to show a distinct difference in levels fecal coliform contamination of toothbrushes based on toilet lid use. Also, oral health routine questionnaires were administered to volunteers. A correlation is expected between oral health routines and toothbrush contamination. As experimentation strengthening the link between oral and overall health continues, the means to improve our oral health care techniques have become significant.

INCIDENCE, RADIOGRAPHICAL FEATURES, AND PROPOSED MECHANISM FOR PNEUMOCEPHALUS FROM INTRAVENOUS INJECTION

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Pneumocephalus implies that there is a traumatic breach in the meningeal layer or the presence of an intracranial gas-producing infection. Pneumocephalus on a head CT in an emergency setting compels the emergency physician to undertake an aggressive evaluation and consultation. In this paper, we report three cases of pneumocephalus which appear to result from retrograde injection of air through an intravenous (IV) catheter as well as identify distinguishing clinical and radiographical features common to this type of pneumocephalus. We also performed a prospective study for all CT's that were ordered in the ED between May of 2005 and May of 2007 to determine the incidence of IV-induced pneumocephalus and the etiologies of pneumocephalus in our ED population. A computer query using the free text method and search terms pneumocephalus, pneumocephally, (intracranial) air, (intracranial) gas, (intracranial) arocele, (intracranial) pneumocyst, and (intracranial) pneumocele was used to identify cases. Three cases of pneumocephalus whose occurrence appears to be the result of retrograde injection of air from an intravenous (IV) line were identified. In this prospective cohort study, the incidence of IV-induced pneumocephalus among all head CT's ordered in the ED is 0.034%. These cases of pneumocephalus have distinct clinical and radiographic features that can facilitate efficient workup of this subset of patients in the emergency department.

PATIENT EXPECTATION IN A FREESTANDING EMERGENCY DEPARTMENT

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Freestanding Emergency Departments (FSED) have received renewed interest in the United States in response to changing trends in hospital outpatient services and market incentives. There is little academic health care literature that specifically addresses the issue of patient expectation at a FSED. We conducted one of the first comprehensive patient expectation surveys at a suburban FSED. Surveys were administered using convenience sampling over 10 months. The 24/7 FSED is located in a suburban area of a midsize city in the Midwest with a census of 14K/yr and a 4.71% admission rate. Outpatient adults (≥ 19 yo) were eligible for enrollment. Patients were excluded if hospitalized, had altered MS, or trauma-activated. The 43-question survey covered various areas of patient expectation, including 1) Staff-related attributes 2) Nursing attributes, and 3) Throughput variables. Patient response was recorded using a 5-point Likert scale. Data are reported as percentage or mean (95% CI); proportional data are compared using χ^2 . 162 surveys were returned with a capture rate of 68.4% (61.2 - 75.5). Of respondents reporting a preference, 93.3% (89.4 - 97.1) preferred to be seen by a staff physician. Expectations for various wait times were consistently short: 13.8 min (9.0 - 15.4) in the waiting room, 23.4 min (22.7 - 25.9) for laboratory testing, 31.3 min (29.7 - 33.0) for special imaging studies, and 64.0 min (59.2 - 65.6) for the total visit. A higher proportion of patients rated seeing a competent physician as “5-Extremely important” compared to seeing a caring physician [94.4% (90.9 - 98.0) vs. 82.1% (76.2 - 88.0), $p < 0.001$]. Other top attributes that received the “5-Extremely important” rating were a clear explanation of condition and treatment, cleanliness, and to have a say in the care. Patients seen in this FSED desired competent, caring, fast medical care, and a clean facility. In addition clear explanation of treatment, courteous and quick staff, and to have a say in their care were a priority. A clear majority of patients preferred to be seen by a staff physician. Medical competence and bedside manner were both desirable with a clear statistical margin ($p < 0.001$) of patients preferring a competent physician to a caring one.

EFFECT OF FRASS ON LONGEVITY IN POPULATIONS OF *DROSOPHILA MELANOGASTER*

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Drosophila melanogaster are naturally afflicted by microbes endogenous to each population. The same is true for laboratory reared populations of *D. melanogaster*. Laboratory populations of *D. melanogaster* are constantly exposed to their excretions, frass, which may contain microorganisms affecting life span. In this experiment, two populations of *D. melanogaster* were exposed to different treatments of frass and longevity was monitored. RNA was isolated and reverse transcription-polymerase chain reaction with known virus primers was conducted on the frass to identify two types of *Drosophila* viruses in the frass, *Drosophila X virus* (DXV) and Nora virus. In order to quantitate the amount of DXV, a plaque assay was conducted. In addition, a plaque assay was developed for the Nora virus. The results of this project will provide further insight as to the role of microorganisms in regulation of life span. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

AVIAN IMMUNE RESPONSES TO WEST NILE VIRUS

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It is well established that different orders of birds vary widely in their susceptibility to and severity of West Nile virus (WNV) infection, but the reasons for this continuum of susceptibility are unknown. Previous studies have shown that antibody-mediated immune responses are required to effectively clear WNV and provide long-term protection, but a comparative analysis of immune responses following WNV infection in multiple avian species has yet to be reported. Here we report the results of a comparative analysis of the antibody-mediated immune responses of three avian species (domestic chicken, pigeon and vesper sparrow) following WNV infection and report on the development of several immunoassays to compare innate immune responses of various avian species. Future work in this area will dramatically improve our understanding avian immune responses to WNV infection, and the factors involved in avian susceptibility to WNV.

DOES HYBRIDIZATION BETWEEN TWO SPECIES OF MEADOWLARKS (*STURNELLA* SPP.) OCCUR IN NEBRASKA? SONG ANALYSIS EVIDENCE

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The Western Meadowlark (*Sturnella neglecta*) and Eastern Meadowlark (*S. magna*) are commonly occurring species across Nebraska. Although habitat preferences are slightly different, Western Meadowlarks typically frequent drier and more open environment; both species are found in the same areas. It has been suggested that hybridization between these sibling species occur in zones of secondary contact. Captivity experiments on hybridization of both species produced very low fertility of eggs. I recorded 380 singing males of meadowlarks from across the state of Nebraska in 2007 and 2008. I generated spectrograms of songs using Raven sound analysis software. Range of repertoire size, correlation across individual birds within a species, maximum power, maximum frequency, and singing rate were analyzed and statistically evaluated. Based on the analyses I was able to classify songs as either of the Western Meadowlark or Eastern Meadowlark respectively. None of the collected recordings showed any features of a 'hybrid' song.

ROLE OF SUGGAMADEX IN ANTAGONISM OF NEUROMUSCULAR BLOCKADE

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Neuromuscular blocking agents (NMBAs) are commonly used in anesthetized patients. The current agents used for reversal of NMBAs are anticholinesterases, which can cause adverse events. Sugammadex is γ cyclodextrin compound and the first of its class. The nature of its design allows for a rapid reversal of a rocuronium-induced neuromuscular blockade. The purpose of this literature review was to explore the existing studies of and uses for sugammadex, along with identifying potential adverse events and areas for further research. Current internet searches for journal articles were conducted via PubMed or through the library at BryanLGH College of Health Sciences. Key words searched included

sugammadex, ORG 25969, rocuronium, and reversal agents. In multiple studies, sugammadex has been shown to rapidly reverse a profound rocuronium-induced blockade. The safety of sugammadex was also explored in depth and few side effects were identified when compared with anticholinesterases. Sugammadex is a novel agent in the world of anesthesia and has successfully been shown to reverse rocuronium-induced neuromuscular blockade with few untoward events. Further research is needed to evaluate its use in pediatric patients and its role as a “rescue” reversal drug.

CONTINUOUS REGIONAL ANESTHESIA FOR TREATMENT OF POST-SURGICAL PAIN

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Continuous regional anesthesia is a widely used method of analgesia for post-surgical pain. Selective nerves or nerve plexuses may be targeted nerves are located with the use of electric current applied through a special infusion catheter in order to elicit an action potential in a motor neuron, and it's subsequent muscle contraction. Is the quantity of electric current necessary for motor neuron location predictive of post-operative analgesia using a continuous infusion technique at the brachial plexus? A retrospective, non-experimental data analysis of 100 medical records from 2008 was done to differentiate the analgesic efficacy of blocks placed with a low electrical current threshold (< 0.5 mA) versus a higher threshold (> 0.5 mA). The results may affirm historical practice with regard to motor nerve stimulation in regional anesthesia, or confirm the growing call to re-evaluate this popular anesthetic technique. The results of this study reflect the evolving techniques in the area of regional anesthesia, with a basis in the science of neuromuscular physiology.

CHARACTERIZATION OF MICROBES IN FRASS FROM TWO POPULATIONS OF *DROSOPHILA MELANOGASTER*

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Throughout an organism's life span, it is constantly being bombarded with various external and internal agents that can damage its' DNA. For more than 90 years, *Drosophila melanogaster* has served as a pivotal model organism allowing the study of genetics and to uncover what factors can contribute to the understanding of aging and longevity. One of these factors may be the presence of bacteria, which may influence both host-fitness and longevity. *Drosophila* lives in perpetual contact with their frass and are therefore constantly being exposed to the microbes within it. Preliminary studies using two different populations of *D. melanogaster* show that exposure of one population to another population's frass affects life span. In this experiment, the identity of bacterial species within the frass of the two populations was determined by standard microbiological techniques and 16S polymerase chain reaction. Because the relationship between microbes and the evolution of life span is unclear, characterization of microbes influencing life span is important to understanding the evolution of aging. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

RESPONSES OF DNA REPAIR PROTEINS TO CISPLATIN AND UV DAMAGED *DROSOPHILA* LARVAE POLYTENE CHROMOSOMES

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Drosophila polytene chromosomes have been replicated hundreds of times, resulting in large structures which show fine details not seen in cells with a 2N content of DNA. These polytene chromosomes have been previously used to study transcription as transcription factors can be visualized on actively transcribing genes using immunofluorescence. We have now adapted this technique to study DNA repair on *Drosophila* chromosomes. *Drosophila* larvae were treated with either cisplatin for 2 hours or with different doses of UV irradiation before harvesting the larvae and dissecting out the salivary glands. The salivary glands were then exposed to antibodies generated against thymidine dimers, which is a marker of DNA damage, and the phosphorylated form of histone H2AX, which is a marker of DNA repair. Both antibodies showed discrete bands on the chromosomes, allowing us to directly visualize areas of DNA damage and its subsequent repair. This technique will allow us to directly follow the progression of proteins involved in the repair of cisplatin or UV damaged DNA.

THE EXPANSION OF THE RIBONUCLEASE A GENE SUPERFAMILY DURING EARLY MAMMALIAN EVOLUTION

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The ribonuclease (RNase) A superfamily is a vertebrate-specific gene family, whose members are associated with various biochemical and physiological functions including host defense. It has been known that non-mammalian vertebrates, such as fish and birds, have relatively fewer RNase genes than placental and marsupial mammals, suggesting that the superfamily experienced an expansion during early mammalian evolution. However, it is still unclear when the expansion occurred and how various extant subfamilies were formed during the expansion by gene duplication. To answer these questions, we implemented a comparative, evolutionary genomics approach to determine the RNase A superfamily repertoires of a wide variety of placental mammals and platypus, a monotreme, covering the entire spectrum of the mammalian class. Using the gene sequences we made from various databases such as NCBI and ENSEMBL, we construct phylogenetic trees of the mammalian RNase genes to elucidate how the superfamily diversified to form major subfamilies during early mammalian evolution. Determining how and when the expansion occurred is important as it will help us to understand the various functions that present-time RNase genes.

THE ORIGIN AND GENETIC BASIS OF SEX REVERSAL IN SOUTH AMERICAN FIELD MICE

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One of the eukaryotic genome's most vital functions is directing sex determination. The mechanism driving this process seems highly conserved across mammalian species: the presence of the Y chromosome triggers the male developmental cascade, while its absence results in the female

phenotype. However, cases of sex reversal due to aberrant chromosome content have been observed in many species, including humans. The South American mouse genus *Akodon* provides an excellent experimental group to study these intriguing cases. In some, but not all, species of *Akodon*, the Y chromosome can fail to trigger the male pathway, leading to sex reversed “XY*” females. We examine the genetic differences between the inactive Y* and the active Y chromosomes, which will shed light on the sex-determining process involving the mammalian Y chromosome. Additionally, we determine when Y* arose during the *Akodon* evolution by testing two alternative hypotheses, the single-origin and the multiple-origin hypotheses, using a molecular phylogenetic approach. Elucidating the origin of Y* will help us to understand why this atypical mating system has been stably maintained in multiple *Akodon* species in spite of the expected selected disadvantage for XY* females.

THE *MANDUCA SEXTA* IMMULECTIN 2 (IML-2) PROTEIN ISOTYPES ARE ENCODED BY TWO UNIQUE GENES

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Insects, just like all other eukaryotic organisms, must have a means to defend themselves from microbial pathogens. Insects have an innate immune system comprised of both cell-mediated and humoral components. C-type lectin proteins are important players in the insect’s humoral immune response. Immulectin-2 (IML-2) is a C-type lectin found in *Manduca sexta* and is involved in the recognition of lipopolysaccharide ligands. IML-2 protein levels increase in the insect’s hemolymph upon challenge with Gram-negative bacteria. Two isotype forms of the IML-2 protein are known, but the mechanism of their production is unclear. We have used PCR to amplify two IML-2 genes from *M. sexta* genomic DNA. The predicted amino acid sequences showed that the two isotypes differed by only 13 amino acids. The major nucleotide sequence differences between the two genes were found in introns 1, 3, and 4. This study has shed some light on the origin of the two IML-2 isotypes and provided some data on immulectin gene evolution in *Manduca sexta*.

TO STUDY THE QUALITY OF DATA GENERATED BY CHRONOSCAPE – AN REU PROJECT

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Keyword extraction from text documents is a major field of study in computer science. Chronoscape is a project written in Perl which extracts keywords and keyphrases from time-stamped documents, in order to determine the most important topics in a given time interval. The source material for Chronoscape is a large body of some 16,000 SGML-tagged news stories, approximately half from CNN and half from Reuters, published during 1994-1995. The current REU project seeks to produce keywords for a given time interval which, in terms of perceived significance, are on-par with those that a human reader would extract from the same set of news stories. We devised novel and efficient algorithms that combine the context of a keyword/phrase with the coverage of the document set to measure the quality of keywords/phrases deemed significant by Chronoscape. The algorithms generate metrics to study the quality of the output generated by Chronoscape for several different parameter settings. The quality metrics can then be used by Chronoscape users to assess its performance.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

INTRACELLULAR MECHANISMS UNDERLYING THE NEUROTROPHIC PROPERTIES IN MICROGLIA

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Microglia are the resident immunocompetent and phagocytic cells of the central nervous system (CNS). Within the scientific community, it has been debated whether microglial activation protects or exacerbates CNS damage due to disease or injury. While a significant body of evidence supports a neurotoxic role for microglia, the ability to phagocytose dead or damaged cells, kill pathogens, and control the production of secretory factors has led scientists to question whether microglia can function as neuroprotective cells. It is likely that microglia possess modifiable neurotoxic and neurotrophic properties depending on their state of activation and method of stimulation. In this study, we hypothesized that microglia, activated by neuronal cell damage; enhance neuronal survival, proliferation and differentiation by activating specific intracellular signaling pathways. To test this hypothesis we constructed an in vitro model system of primary neuronal cultures which were mechanically disrupted using the stylet transaction protocol. Microglia are cultured on transwell inserts and suspended above damaged and undamaged neuronal cultures allowing the cells to communicate via soluble factors. Western blot analysis shows that increased neurogenesis and viability is associated with activation of the PI3/AKT pathway in neurons cultured with microglia. Viability assays in which the JAK/STAT and PKC pathways were inhibited demonstrated a decrease in cell viability. However, unlike the PI3/AKT pathway, cell viability trends were not particular to cultures containing microglia. This result suggests that the two pathways may play a different, but nonetheless essential, role in promoting an enhanced viability state in neurons. Viability assays in which the MAPK(p44/p42) and MAP(p38) signaling pathways were inhibited showed no significant trends. RT-PCR data demonstrates that microglia exposed to damaged neurons decrease transcription of TNF mRNA suggesting a downregulation of inflammatory cytokine secretion. To confirm our findings, neuronal and microglial cell protein lysates collected from co-cultures will be analyzed using FLOW cytometry. Collectively, these results suggest that microglia exposed to damaged neurons serve a neuroprotective role. Increasing the understanding of the mechanisms by which activated microglia drive neuronal survival and neurogenesis may aid in the development of neuroprotective therapies following CNS damage or disease.

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

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Small regulatory RNAs such as microRNAs (miRNAs) and short-interfering RNAs (siRNAs) are non-coding RNAs that play a fundamental role in the expression of genes and the formation of protein effector complexes. RNase III type endonuclease Dicer cleaves precursor miRNAs and siRNAs making them functional. An emerging area of neuroscience research investigates the role

of small regulatory RNAs; they have been implicated in neurogenesis, neuronal differentiation, neuroplasticity, neurodegeneration, and stress responses. To explore the functions of small regulatory RNAs in the nervous system, we hypothesized that Dicer and miRNA regulation of protein translation is required for proper development, differentiation, and survival of neurons and non-neuronal cells in the central nervous system. To test this hypothesis, conditional Dicer null mutants under the control of a developmentally regulated promoter, *Atoh1*, were generated. *Atonal/Atoh1* encodes the basic helix-loop-helix (bHLH) protein Atoh1, and is expressed in and regulates neurogenesis in the dorsal spinal cord, cerebellum, Merkel cells in the skin, and hair cells of the auditory and vestibular systems. Atoh1-Cre Dicer null animals, while born viable, begin to demonstrate tremors and ataxic behavior by ~2 weeks of age and severe seizures and death by ~4 weeks of age. Because of these motor difficulties and Atoh1's previously recognized role in cerebellar granule-cell loss, we have utilized immunohistochemical analyses and confocal imaging to compare cerebellar development between control and mutant mice. Atoh1-Cre Dicer null mice exhibit cerebellar granule cell layers that are significantly narrower than those of wild type mice possibly due to compaction or loss of granular and/or Purkinje cell layer neurons. Loss of cerebellar folia or merging of folia is evident. CatWalk-assisted gait analysis has been used to assess behavioral effects of Dicer loss. Preliminary results suggest that proper anatomical and motor pattern development requires the activity of Dicer and miRNA. Future goals of this study include complete characterization of neurodegeneration and behavioral abnormalities in Atoh1-Cre Dicer null mice. Results are expected to enhance our understanding of the role of Dicer and miRNA regulation of protein translation during neuronal development and neurodegeneration.

INVESTIGATION OF THE EFFICACY OF NANOPARTICLE ANTIRETROVIRAL DRUG DELIVERY SYSTEMS

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Antiretroviral drug therapy (ART) has significantly reduced HIV-1 morbidity and improved life expectancy. However, drug expenses, treatment failures, dosing complexities, and limited global access has prevented the full utility of ART. Previous work has shown that nanoparticles (NPs) coated with a single antiretroviral drug promote sustained local drug release and deliver drug concentrations exceeding what is reported to be necessary to inhibit HIV-1 strain replication. This project is designed to investigate the ability of nanoparticle drug carrier systems to deliver a combination of three clinically relevant ART drugs to immune cells targeted by HIV-1. Initial experiments involve the development of cellular assays to test uninfected immune cell viability and function following ART-NP loading. MTT assays and cell counts are used to assess cell viability, HPLC was to assess the amount of drug in cells and media over time, and immunocytochemistry to observe cellular structure and ART-NP localization. Pharmacodynamics of ART-NPs will be investigated using a hollow-fiber drug dosing system. The hollow-fiber drug dosing system is a culture model system comprised of hollow fiber bioreactors that simulate a central and peripheral compartment of the central nervous system. Using this hollow-fiber drug dosing system, the ability of ART-NP to diffuse across a membrane and be phagocytosed by immune cells will be assessed. Future work will utilize the bioreactor data to determine the effectiveness ART-NP to induce rapid and sustained attenuation of viral replication in HIV-1 infected immune cells. Information gathered from this project will help to determine whether nanoparticle drug carrier systems will help to overcome pharmacokinetic obstacles of ART and provide successful universal therapy for HIV-1 infected individuals world wide.

INVESTIGATION INTO INTERGENIC PALINDROMIC REGIONS IN *COXIELLA BURNETII*

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In bacteria, DNA transcription is terminated by either rho-dependent terminators or rho-independent terminators, both of which involve the formation of stem loops in the RNA. In the recently sequenced genome of *Coxiella burnetii* RSA 493, a family of intergenic palindromic repeats has been found throughout the genome. Their palindromic nature suggests that they may form stem loops. This, along with their positions with respect to operons leads to us to believe that they may be a new class of transcription terminators. The goal of our project is to develop bioinformatics tools to find palindromic repeats in bacterial genomes and to compare their locations with respect to operons in order to provide evidence for their role as terminators. These tools will initially be used on *Coxiella* but will later be applied to other bacterial genomes. In this talk, we will provide a brief review of transcription termination in bacteria and then describe our tools and summarize our findings.

BUILDING ONTOLOGY FOR INFLUENZA PREVENTION, SURVEILLANCE AND CONTROL

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It is difficult to find influenza-relevant information in the overwhelming amount of data distributed in many resources such as literature and Web. An influenza ontology consists of flu characteristics such as strains, variations, genotypes, hosts, victims, locations, vaccinations, and many others. There is a need for building an ontology for influenza prevention, surveillance and control, which can help researchers acquire flu-related information to track various strains and their proliferation across the world. We syntactically analyze unstructured text and extract parts of speech sequences such as noun-verb-noun and adjective-noun and combine these sequences into a domain specific ontology that focuses on the Influenza domain. The process consists of several steps that execute in a pipeline-based fashion that also uses NLP tools for determining the grammatical structure of sentences. Our preliminary results show the output of breaking down 4 medical abstracts into ontologies through the extraction of nouns, verbs, and adjectives. It is desired that these concepts and relationships contain information regarding locations, strains, hosts, victims, and other flu event related attributes. We combine and integrate ontologies created from medical abstracts into a single unified ontology that will be used later for indexing and searching medical abstracts.

CHARACTERIZATION OF *OTK18* FUNCTION IN MONOCYTIC CELLS USING RNAI

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Information about the molecular mechanisms involved with Human Immunodeficiency Virus (HIV) replication and integration into the host genome is imperative. Attention has turned toward *OTK18*, a human transcriptional suppressor expressed in all normal human tissues that has a role in the regulation of HIV-1 infection of mononuclear phagocytes. Although *OTK18* is expressed in all normal human tissues, its homeostatic function is yet to be characterized. In an effort to begin to determine

the homeostatic function of *OTK18*, RNA interference (RNAi) experiments were performed to inhibit *OTK18* gene expression in a human monocytic cell line, U937. The monocytes were subjected to RNAi with *OTK18* micro RNAs (miRNA), *GAPDH* miRNA (positive control), and water (negative control). Detection of *OTK18* and *GAPDH* mRNA silencing was completed using quantitative reverse transcriptase polymerase chain reaction (qRT-PCR). In addition, target immune genes hypothesized to be regulated by *OTK18* will be uncovered using PCR superarrays in conjunction with the RNAi in the future. The results of this study provide information on the regulation of *OTK18* of immunity genes, as well as the homeostatic function of this molecule. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

A BIOINFORMATIC APPROACH TO CLASSIFY INSERTS IN PROTEINS

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Proteins are fundamental components of all living cells and are necessary for functioning of an organism. Various segments of protein ranging in size from 25 to 500 amino acids, called domains, are known to define the functional character of protein. Such protein segments are inserted and deleted during divergent evolution. Proteins are also known to contain auto-catalytic protein domains called inteins, which are inserted in-frame within highly conserved regions of proteins. Additionally, many proteins are found to contain repeating sequences. The long term goal of this project is to develop a high-throughput method to find protein inserts of different kinds. In this study, we will present the result obtained from the analysis of protein sequences using reduced protein alphabet and an information theoretic quantity called mutual information.

A BIOINFORMATICS APPROACH TO IDENTIFY PROTEIN SORTING MOTIFS IN PROKARYOTES

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Certain signals in the primary protein sequences may be used in order to determine the proper destination for a particular protein in a cell. Previously characterized systems such as the LPXTG/sortase system found in Gram-positive bacteria and the PEP-CTERM/EpsH system analogous to the LPXTG system include hydrophobic transmembrane alpha helices followed by a small motif. It has been conjectured by several researchers that similar sequence structures analogous to these systems do exist in other domains. However, there has been no clear methodology or a tool for discovering such structures. In this project, we are exploring various sequence properties of the previously characterized domain structures to identify other domains that exhibit similar properties. To do this we are developing bioinformatics tools for determining with high accuracy and specificity similar structures and are using them to identify protein identifying signals in other organisms analogous to LPXTG/sortase and PEP-CTERM/EpsH.

CLASSIFICATION OF INFLUENZA A VIRAL SUBTYPE USING SUPPORT VECTOR MACHINE

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Influenza A viruses are classified as H and N subtypes based upon their antigenic properties of the hemagglutinin (H) and neuraminidase (N) glycoproteins expressed on the surface of virus particles. This antigenic assay is time-consuming and cost-inefficient. Here, we apply the Support Vector Machine (SVM), a powerful data mining tool, for the subtype prediction of influenza A viral sequences. SVM is used because it is an alignment-free method and uses less memory and time compared with multiple alignment methods. In our preliminary experiment, even with very small training, we have obtained high precision as well as high recall (up to 100%). This suggests SVM can be considered as an efficient and accurate classification method in classifying influenza A virus subtypes. In this talk, we present the methodology used in our research, and show examples of our findings.

SURFING ALONG FILOPODIA; MECHANISMS OF HIGHLY-EFFICIENT HIV INTERCELLULAR TRAFFICKING

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There may be numerous ways through which HIV infects human cells. It is an emerging theme in virology that mammalian viruses commonly exploit cell membrane protrusions for intercellular dispersal. In this paper we propose that HIV-1 induces formation of direct intercellular contacts in human macrophages called filopodia and uses these structures for direct cell-cell infection. It thus escapes immune surveillance, thereby increasing infection efficiency. We used confocal imaging to establish that HIV-1 infected macrophages form these filopodial bridges. Then we determined that cytoskeletal proteins ezrin, moesin and radixin are involved as structural components of these filopodia. The localization of viral particles along the filopodia in HIV infected macrophages was also demonstrated. These findings supported our proposal.

SMALL MOLECULE INHIBITORS OF THE *STAPHYLOCOCCUS AUREUS* RNA TURNOVER MACHINERY DISPLAY ANTIMICROBIAL ACTIVITY

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Methicillin-resistant *Staphylococcus aureus* is estimated to cause more US deaths annually than HIV/AIDS. The emergence of hypervirulent and multidrug-resistant strains has further amplified public health concern and accentuated the need for new classes of antibiotics. RNA degradation is an essential cellular process that could be exploited for novel antimicrobial drug development. However, such discovery efforts have been hindered because components of the gram-positive RNA turnover machinery are incompletely defined. We found that the essential *S. aureus* protein, RNase 7, catalyzes rRNA and mRNA digestion. Exploiting this activity, high-throughput- and secondary- screening assays identified a small molecule inhibitor of RNase 7-mediated RNA degradation. This agent was shown to profoundly

diminish cellular mRNA degradation and exhibited antimicrobial activity against predominant methicillin-resistant *S. aureus* (MRSA) lineages circulating throughout the US, as well as other gram positive bacterial pathogens with high RNase 7 amino acid conservation. Finally, we demonstrate that this RNase 7-inhibitor is efficacious in a systemic mouse infection model. Taken together, these findings indicate that RNase 7 plays a previously unrecognized role in *S. aureus* RNA degradation and establish that mRNA turnover inhibitors represent a new therapeutic option for the intervention of microbial infections.

IL-7 DECREASES APOPTOSIS AND IMPROVES SURVIVAL IN SEPSIS

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Sepsis is a major growing health problem in the United States. 750,000 sepsis cases arise every year, of these approximately 250,000 people die. Sepsis is the leading cause of fatality in surgical intensive care units and the 10th leading cause of death in the US. In the third world, sepsis causes death through infectious diseases such as tuberculosis, malaria, HIV, and diarrhea. This makes sepsis a global burden. Sepsis is the response of the individual resulting from bacteria or bacterial products in the blood. This condition causes lymphocytes and other immune cells to undergo a type of cell death called apoptosis. The death of these cells is detrimental to the functioning of the immune system which plays a central role in the pathophysiology of sepsis. It causes patients to develop a state of "immunoparalysis" making them unable to eradicate the bacteria that causes sepsis. This makes individuals susceptible to secondary infections. The goal of this project was to prevent cell death by administering the cytokine interleukin 7, IL-7. A cytokine is a class of immunoregulatory proteins secreted by cells especially of the immune system. IL-7 is a critical mediator in T lymphocyte homeostasis. It induces proliferation of B and T lymphocytes and promotes survival of mature T cells. Its protective effect is at least partially anti-apoptotic; bcl-2 family members are up regulated. It is already in four multi-national clinical trials for HIV-1, cancer, and hepatitis C. In this study, the effects of IL-7 were tested in a widely utilized mouse model of sepsis, the cecal ligation and puncture (CLP) model. Results demonstrated that IL-7 leads to increased Bcl-2, blocked apoptosis in CD4+ and CD8+ T-cell populations, and significant improvement in survival. In addition, IL-7 did not exacerbate the circulating pro- or anti-inflammatory cytokines. In conclusion, IL-7 reverses a significant defect in sepsis, the loss of critical immune cells. If further studies demonstrate it is beneficial in sepsis and if current clinical trials verify its safety, IL-7 could move into clinical trials in sepsis.

CCR4-NOT ASSOCIATES WITH TRANSLATING RIBOSOMES UNDER STARVATION CONDITIONS

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When a cell detects a change in its environment, it alters its behavior to adapt to the stimulus. In response to a life threatening stimulus, such as nutrient deprivation, genes important for cell survival are activated, whereas genes less important are repressed. Genes are activated by being transcribed from DNA into messenger RNA (mRNA), and then, translated from mRNA into proteins by a ribosome. When the yeast *Saccharomyces cerevisiae* receives an environmental stimulus indicating low amino acid availability, the General Amino Acid Control (GAAC) pathway is activated. Activation of the GAAC pathway causes increased translation of Gcn4p, an activator that allows the yeast cell to produce its own amino acids. During starvation, the cell must down-regulate overall gene expression, while up-regulating genes essential for the cell to overcome the starvation. As soon as the cell no longer needs to produce amino acids, the cell must turn off the GAAC pathway, returning to normal gene expression. Our data indicate that several subunits of the Gcn4p co-activator, CCR4-NOT, associate with the ribosome during starvation conditions. This suggests that this co-activator, which is required to turn on amino acid synthesis genes, can also act post-transcriptionally in regulating gene expression. The project described was supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources.

ISOLATION OF A UNIQUE RECEPTOR INVOLVED IN THE DEVELOPMENT AND/OR PROGRESSION OF ALCOHOLIC LIVER DISEASE

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It is believed that the major products from alcohol metabolism are responsible for serious liver disease. Metabolites such as reactive oxygen species, hydroxyethyl radical, 4-hydroxynonenol, Malondialdehyde (MDA), and Acetaldehyde (AA). These metabolites are thought to form adducts with proteins in the liver, which in turn, cause an autoimmune response. Specifically, MDA and AA form a complex on proteins we have termed MAA, which has been shown to elicit many interesting biological responses. Previous studies have shown that scavenger receptors are responsible for the clearance of MAA proteins as they are important in the removal of modified macromolecules from the body. They are also important in the innate immune response as they elicit the numerous responses associated with alcoholic liver disease (ALD). Therefore, experiments were designed to isolate and purify the receptor that binds MAA-modified proteins. J774 cells were incubated with MAA-Alb, RT-PCR was performed to test for receptor upregulation of mRNA expression for CD14, CD36, SRBI, SREC, and TLR4. To extract the receptor, a Pierce Membrane Prep kit was utilized. Further studies used a bead pull down assay with Lysine and Lysine MAA beads. To assess receptor expression, RT-PCR for the different scavenger receptors was developed. RT-PCR results showed an increase in SREC (3.8 fold), TLR4 (1.7 fold), and CD14 (1.3 fold) mRNA expression. The J774 Lysine MAA bead elution run on a 10% SDS PAGE and silver stained, showed two bands with higher concentrations expressed at 35kD and 40kD. These intensified bands arose after preclearing the bead with Lysine, indicating that MAA modification was necessary for the presence of these macromolecules. These data indicate that MAA potentially binds scavenger receptors on the J774 cell line. Potential receptors may include SREC, CD14, and TLR4 as seen by increased mRNA expression following MAA incubation. Further studies will be performed to determine the validity of these bands and their binding to MAA-modified proteins.

NEXT GENERATION SEQUENCING: ASSEMBLY OF SHORT READ SEQUENCES

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Next-generation sequencing is regarded by many biomedical researchers as a key component in furthering the understanding of genomic characteristics and functionality. The large quantities of comprehensive biological data that is being produced by this technology will clearly be the cornerstone of many advances in different biomedical fields of research. This is primarily due to the very high throughput production of short read sequences produced by this advance sequencing technology. However, like the pieces of a complex genomic puzzle, short read sequences do not provide a clear insight into genomic structure in their row format. They need to be assembled into long, contiguous stretches of genetic data to be helpful. The sequence reads produced by next generation sequencing are short but plentiful; enough so that each region of a genome corresponds to multiple reads. Relationships between overlapping sequence reads assist the identification of fragments which are consecutive within the genome, allowing the recursive merging of these overlapping sequences until long stretches of contiguous genetic data, known as contigs, are recovered. This assembly problem is computationally difficult due to numerous reasons: 1) the large expanse of information that is produced by next generation sequencing technologies must be processed and managed efficiently; 2) strategies to identify and correct inaccurate sequence data caused by base insertion or deletion must be developed; and 3) repetitious sequence regions, leading to false-positive sequence overlap detection, must be isolated. To address the difficulty of short-read sequence assembly, we are developing a computational model that employed graph theoretic concepts to explore the relationship between multiple short read sequence fragments. The proposed model is tested using various sets of sequence reads representing different types of genomic structure.

HIV-1 GP120 INDUCES CYTOKINE EXPRESSION, LEUKOCYTE ADHESION, AND TRANSMIGRATION ACROSS THE BLOOD-BRAIN-BARRIER: MODULATORY EFFECTS OF STAT1 SIGNALING

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How neuroinflammatory activities affect signaling pathways leading to blood–brain barrier (BBB) injury during HIV/AIDS are currently unknown. Our previous work demonstrated that HIV-1 exposure activates pro-inflammatory genes in human brain microvascular endothelial cells (HBMEC) and showed that these genes are linked to the janus kinase (JAK)/signal transducers and activators of transcription (STAT) pathway. Here, we report that HIV-1 gp120 protein activated STAT1 and induced interleukin (IL)-6 and IL-8 secretion in HBMEC. IL-6, IL-8, and gp120 increased monocyte adhesion and migration across in vitro BBB models. The STAT1 inhibitor, fludarabine, prevented gp120-induced IL-6 and IL-8 secretion. Inhibitors of STAT1, mitogen activated protein kinase (MEK) (PD98059), and phosphatidyl inositol 3 kinase (PI3K) (LY294002), blocked gp120-induced STAT1 activation and significantly diminished IL-8-, IL-6-, and gp120-induced monocyte adhesion and migration across in vitro BBB models. These data support the notion that STAT1 plays an important role in gp120-induced inflammation and BBB dysfunction associated with viral infection. Results also suggest crosstalk between STAT1, MEK, and PI3K pathways in gp120-induced BBB dysfunction. Inhibition of STAT1 activation could provide a unique therapeutic strategy to decrease neuroinflammation and BBB dysfunction in HIV/AIDS.

COMPARATIVE STUDIES ON DUTPASES BETWEEN CHLORELLA AND ITS VIRUSES

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Host and virus interactions are important research topics. When a host is infected with the virus, the metabolisms of the host are often completely taken over by the virus. Our lab is using deoxyuridine triphosphate (dUTP) pyrophosphatase (dUTPase) to elucidate the complex mechanism behind it. It is because double stranded DNA viruses often encode extra genes beyond minimal compositions including dUTPase. The dUTPase hydrolyzes dUTP into deoxyuridine monophosphate and diphosphate. This reaction provides the substrate for thymidylate synthetase, which is a key enzyme in the synthesis of deoxythymidine triphosphate (dTTP). In addition, dUTPase helps to maintain low cellular levels of dUTP, preventing misincorporation of uracil into DNA. Incorporation of uracil into DNA induces excision repair, DNA fragmentation and cell death. We chose chlorella and its viruses as the model system due to abundant collection of viruses by Dr. James Van Etten at University of Nebraska-Lincoln. We have conducted series of kinetic measurements of dUTPase and found the efficiency of the enzyme from chlorella host had ten times higher than that of viruses. This fact indicates viruses casting dUTPase not only as the enzyme but also utilizing other functions including scaffold.

CHEMISTRY AND PHYSICS

CHEMISTRY

ANALYSIS OF DRUG BINDING TO SERUM PROTEINS IN DIABETES

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Human serum albumin (HSA) is the most prominent protein in the blood. It is believed that modification of this protein in some disease states can have appreciable consequences and affect the binding, transport, metabolism and displacement of drugs. In diabetes, glucose builds up in the blood instead of being taken into cells. The increased glucose concentration results in glycation, or the non-enzymatic addition of glucose to proteins such as HSA. To study the changes in drug interactions with HSA that occur upon glycation, ultrafiltration was performed to measure the changes in the association equilibrium constants and binding capacities of this protein for various drugs used to treat diabetes. This method was also used to provide information on the effects produced by increased fatty acids levels on drug binding to HSA, a situation commonly found in diabetes. Normal and glycated HSA were incubated at pH 7.4 and 37°C with various commercial sulfonylurea drugs. A temperature-controlled centrifuge was used to perform ultrafiltration on the samples and to obtain a sample of the free drug fraction. The amount of the drug in the free fraction was determined using high-performance liquid chromatography. The results of this research are being used to study the model the effects of diabetes on drug-protein binding and to compare the results obtained by ultrafiltration and high-performance affinity chromatography in the study of these interactions.

HOMOLOGY MODELING AND DOCKING STUDIES OF PI3K α/γ

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The phosphatidylinositol 3-Kinases (PI3K) are lipid kinases that phosphorylate phosphoinositide at the D3 position of the inositol ring. The PI3K p110 alpha (PIK3A) has been genetically validated as a very attractive target for anticancer agents. In order to search for residues that are critical for ligand binding, we carried out docking studies against the PI3K α and its homolog PI3K γ isoform. Homology modeling was used to build up the missing residues of PI3K α and PI3K γ using the MOE. Docking studies against the native and mutated PI3K α as well as the PI3K γ were performed on two sets of compounds. Our docking results were in good agreement with the available experimental data. In addition, the docking studies suggest some residues which may have an important role in ligand binding.

SPECTROSCOPIC ANALYSIS OF A β -HAIRPIN FORMING MINIPROTEIN

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Electronic and vibrational circular dichroism are often used to determine the secondary structure of proteins, because each secondary structure has a unique spectrum. In order to determine the spectral features of these structures it is ideal to use polypeptides that are known to adopt the desired

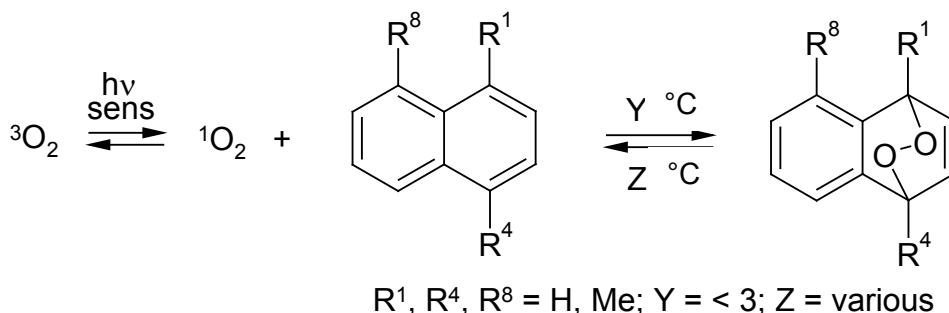
conformation along the entire length of the polypeptide. Presently, little is known about the vibrational circular dichroism spectroscopic features of the β -hairpin. In this study, we used a decapeptide, YYDPETGTWY (CLN025), which forms a stable β -hairpin that is stabilized by intramolecular weakly polar interactions and hydrogen bonds. CLN025 was synthesized by microwave assisted solid phase peptide synthesis with $N\alpha$ -Fmoc protected amino acids. During purification of the peptide, it was shown that on C18 reversed phase HPLC column it adopts two or more conformations, which is typically only seen in much larger polypeptides. The structure of CLN025 was examined in aqueous and organic solvents using electronic and vibrational circular dichroism spectroscopy. The presence of β -hairpin was confirmed by ECD and a unique VCD signal was assigned for the structure.

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ARENE ENDOPEROXIDES: SOURCES OF AND TRAPS FOR SINGLET OXYGEN

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Singlet oxygen plays roles in tissue damage associated with cardiovascular disease and skin cancer, in plant defense and photosynthesis regulation, and in photodynamic therapy to treat esophageal cancer and macular degeneration. In an investigation of the use of arene endoperoxides to store and subsequently to generate singlet oxygen, we have synthesized various naphthalenes and anthracenes, efficiently photooxidized these under controlled conditions, and monitored the thermal decomposition of their endoperoxides by ^1H and ^{17}O NMR spectroscopy. Preparation of the arenes and arene endoperoxides studied and the half lives of endoperoxide thermolyses will be discussed.



ANALYSIS OF FREE DRUG FRACTIONS USING NEAR INFRARED FLUORESCENT LABELS AND AN ULTRAFast REVERSED DISPLACEMENT IMMUNOASSAY

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A method for measuring free drug fractions was developed based on the use of high-performance immunoaffinity chromatography and a reversed displacement immunoassay (RDIA) format with near-infrared (NIR) fluorescent labels. This approach was tested and evaluated by using it to determine the free fractions of phenytoin in samples containing the binding protein human serum albumin (HSA). Items considered in the design of this method included the development of an immobilized phenytoin affinity microcolumn, the preparation and behavior of labeled monoclonal antibodies (mAb) in a displacement format, and the overall response and stability of the resulting assay. In the final method,

the free fraction of phenytoin displaced a proportionate quantity of labeled mAb in approximately 140 ms during sample passage through a phenytoin microcolumn. The resulting displacement peak of labeled mAb produced a signal allowing quantitation of free phenytoin in the original sample. The limits of detection, dynamic range, and comparison of the RDIA method versus other assay methods will be discussed. RDIA using affinity microcolumns and NIR fluorescent labels offers a high throughput alternative to current free drug assays that is less prone to biological interferences. This approach is not limited to phenytoin but can be adapted for other analytes through the use of appropriate columns and labeled antibodies.

HOW TO KEEP UNDERGRADUATE STUDENTS INTERESTED IN THEIR RESEARCH PROJECTS

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Undergraduate research in chemistry presents many challenges. Students who remain engaged and interested in their research projects strengthen the sustainability of research at predominately undergraduate institutions. Important strategies to keep students involved and successful are presented.

STRUCTURAL DIFFERENCES IN ADSORBED PEPTIDES REVEAL MECHANISMS OF MINERALIZATION REGULATION

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Glutamic acid-rich and aspartic acid-rich amino acid sequences have been reported in proteins influencing bone mineral growth. Polyglutamic acid has been shown to promote or initiate mineral growth, while polyaspartic acid strongly inhibits growth. Oligoglutamic acid and oligoaspartic acid of 10- and 50-repeat unit length were adsorbed onto hydroxyapatite and their structures investigated by circular dichroism and FTIR. While circular dichroism of all peptides revealed a polyproline II helix in solution, the aspartic acid peptides show a shift to a distinct secondary structure upon adsorption to hydroxyapatite, while the glutamic acid peptides do not. This difference could be the basis for their dissimilar effects on bone mineral growth.

DETERMINATION OF DRUG-PROTEIN DISSOCIATION RATE CONSTANT BY HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHY

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Carbamazepine is a drug that is commonly used for epilepsy and bipolar disorder treatment. This drug has significant binding to human serum albumin (HSA), which is an important serum protein that helps to bind and transport a wide range of drugs throughout body. Information on the dissociation rate constant for carbamazepine-HSA interactions can be useful in describing the pharmacokinetic behavior of this drug and aid in the creation of new analytical methods for determining carbamazepine in biological samples. A new method for measuring drug-protein dissociation rate constants was used for this work that combined the use of high-performance affinity chromatography with peak profiling. This approach compares the peak profiles for a drug (carbamazepine) and a non-retained substance

(sodium nitrate) on an immobilized HSA column over a broad range of flow rates. These experiments were conducted at pH 7.4 and a 37°C on both the HSA column and on a control column to correct for the presence of any non-specific binding. This approach is not limited to carbamazepine but is also being applied to a variety of other drugs and is anticipated to be a useful tool for the high-throughput analysis of drug-protein dissociation rates.

WHY DENSITY FUNCTIONAL CALCULATIONS MISLEAD CONCERNING AROMATIC PHOTOSUBSTITUTION MECHANISMS

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We recently probed photosubstitution of halogens by nucleophiles in nitrophenyl ethers such as 2-halo-4-nitroanisole by investigation of the element effect of halogens as leaving groups. The order found for the nearly diffusion-controlled substitutions was $F > Cl > Br > I$. This strongly implicates a stepwise mechanism from the triplet state and a sigma complex intermediate. Simultaneous with our report appeared a report of Pinter, et al, of extensive density functional calculations on intermediates in these same photoreactions. They reported that the photodisplacement of chlorine by hydroxide ion from 2-chloro-4-nitroanisole was concerted, directly contradicting our experimental results. The disagreement may result from the notorious tendency of density functional calculations to underestimate energy barrier heights. We have investigated this by doing a variety of calculations of these reaction pathways. Since solvent models cannot be used in our Spartan software with triplet states, we introduce a new calculation technique of pairing an anionic reagent with an alkali metal cation to reduce spurious gas phase ion-ion or ion-dipole attractions.

DFT STUDIES OF CADMIUM-TELLURIUM CLUSTERS

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Zinc sulfide[1], cadmium sulfide, and cadmium selenide[2] clusters have been investigated as potential semiconductor quantum dots. ZnS quantum dots have also been investigated as fluorescent probes for biomedical applications to help diagnose disease or discover new drugs through their fluorescent tagging capabilities. The present DFT study extends the investigation to cadmium telluride clusters. Several different $CdxTey$ compounds were optimized to a stationary point on the Born-Oppenheimer potential energy surface utilizing the B3LYP/LanL2DZ model chemistry as implemented in the Gaussian 03 software suite. Preliminary results of the relative compound energies, bonding energies and the through space interaction energies several are presented.

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AFFINITY CHROMATOGRAPHIC STUDIES OF THE EFFECTS OF FATTY ACIDS ON THE BINDING OF DRUGS TO GLYCATED AND NON-GLYCATED HUMAN SERUM ALBUMIN DURING DIABETES

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Diabetes affects over 23.5 million Americans, with the majority of these patients having type 2 diabetes. Since the pancreas of type 2 diabetes patients does not make enough insulin on its own, many patients have to take drugs such as sulfonylureas to control their blood sugar levels. However, patients with diabetes also tend to have elevated levels of free fatty acids in the blood, ranging from 4-8 times the normal patient levels. One reason these elevated levels of fatty acids are of concern is they may affect the binding of drugs to their blood transport proteins. The main drug transport protein in serum is human serum albumin (HSA), which is present in both normal and diabetes patient serum as both non-glycated and non-enzymatically glycated HSA. Because of the elevated serum glucose levels in diabetics, there is approximately 20-50% higher levels of glycated HSA in the serum compared to healthy patients. In this work high-performance affinity chromatography (HPAC) was used to study how increased free fatty acid levels in blood may effect the binding of sulfonylureas to non-glycated HSA and glycated HSA. Unlike most drugs, fatty acids act as “global coaters” and bind to a minimum of seven sites on HSA. Several of these fatty acid binding sites are at or near the two main binding sites for drugs on this protein. This provides a challenge to quantitatively describing the competition between drugs like sulfonylureas and fatty acids. This study will describe the results of these binding studies and show how the results of such experiments can be used to help predict the secondary effects of a disease such as diabetes on the behavior of a drug in an individual with this disease. The differences in drug binding to glycated and non-glycated HSA in the presence of fatty acids will also be discussed.

THE SYNTHESIS OF RARE-EARTH HEXABORIDE NANOWIRES

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Rare-earth hexaborides (RB₆) are remarkable materials due to their refractory nature and unique physical properties such as low work function, local moment magnetic order, spin fluctuations, mixed valence, heavy fermions and pressure induced metal-insulator transition. Because of the shape enhanced electric field in the one dimensional structures, nanowires made of RB₆ are important potential efficient field-induced electron emitters. Here we report a general chemical vapor deposition method to synthesize a variety of single crystalline nanowires of LaB₆, NdB₆, YB₆, PrB₆, SmB₆, GdB₆, CeB₆, DyB₆, HoB₆ and TbB₆ via the vapor-liquid-solid growth mechanism. In these syntheses, rare-earth metal chlorides were chosen to react with decaborane to yield the products. Electron microscopy analysis indicates that these nanowires have a preferred [100] growth direction. Effect of the reaction temperature, precursor flux, and catalyst type and size on the growth of these nanowires will be discussed.

CHEMISTRY AND PHYSICS

PHYSICS

PEER INSTRUCTION, COMPUTER SIMULATIONS, AND EXTRASOLAR PLANETS

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In 1995 astronomers assumed that planets were common around other stars, but were frustrated by their inability to detect one. Today around 300 extrasolar planets have been detected by radial velocity and transit techniques, and the Kepler project has the potential to greatly increase this number. Pedagogy in the college science classroom has undergone a similar renaissance in the last 20 years due to widespread recognition of the importance of interactive engagement techniques. This presentation will survey two computer-based curriculum projects that are very useful for engaging students: ClassAction – a database of visual think-pair-share questions and resources for feedback, and the Nebraska Astronomy Applet Project – a collection of high-quality computer simulations and supporting materials. Examples from both of these projects will be used to illustrate how concepts related to extrasolar planets can be taught in the college science classroom. This material is based upon work supported by the National Science Foundation under Grants #0231270, #0404988 and #0715517, a CCLI Phase III Grant for the Collaboration of Astronomy Teaching Scholars (CATS).

SIMULATING ULTRA PERIPHERAL COLLISIONS WITH A MONTE CARLO GENERATOR

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Ultra peripheral collisions occur when nuclei pass one another without overlapping. The intense electric fields present can be treated as a flux of photons; these photons can interact with the other nucleus, producing a range of particles, including vector mesons (Upsilon, J/Psi, rho, ...) and pairs of oppositely charged pions. In order to effectively study ultra peripheral collisions at the STAR (Solenoidal Tracker At the Relativistic heavy ion collider) experiment, a Monte Carlo event generator was created to optimize particle selection criteria and to assess whether rarer physics processes are possible to study. A FORTRAN program was initially designed in 1995 to simulate ultra-relativistic Au-Au interactions. Since then, changes have been made to the program to fit the needs of newer experiments and as a result, different versions have been created. I will present the physics modeled by the program, comparisons to data, and upgrades made to the Monte Carlo. My work has been to consolidate versions into one C++ application that includes additional final states, asymmetric collisions of arbitrary nuclei, and improved expandability.

SURFACE INDUCED MAGNETIZATION SWITCHING IN NANOPARTICLES

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The modification of the magnetic properties of surface atoms in nanostructure immediately affects the properties of the whole particle. We show that the competition between FM and AFM interactions between surface and interior in nanoparticles can lead to surface induced magnetization switching if surface exchange parameters are changed by external stimuli. The modification of the surface exchange parameters of nanoparticle may lead to a magnetic structure that is nearly non-magnetic, non-collinear or FM, depending on the relative strength of the competing exchange interactions. We consider model particles with the shape of cube and we use Monte Carlo method to obtain the magnetization as function of temperature. There are number of ways to implement this in actual devices. The direct way is to form so-called core-shell particles where the shell is active to the external signal and the core being coupled to the shell changes its magnetic properties. (Meaning that the external signal changes the electronic state of the surface which leads to the modification of exchange coupling or magnetization at the interface) The core of the particle can be made out of well-known materials such as Fe₂O₃, FePt or CoF₂. The shell of the particle can be made out of materials which are photosensitive (photochromic molecular layer[2] of azobenzene, or TiO₂), sensitive to electric field (piezo- or ferroelectric materials), or electric current pulse. The shell/core can also be magneto-elastic and exhibit a strain-assisted modification of magnetic properties (for example, control of magnetocrystalline anisotropy in FePt by applied biaxial strain).

DYNAMIC LIGHT SCATTERING IN ULTRAPHOSPHATE GLASS-FORMING LIQUIDS

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We report results of an extensive study of the viscoelastic response of several compositions of sodium ultraphosphate liquids. The study covers a wide compositional range from pure P²O⁵ whose bridging oxygens form a three dimensional network to the sodium metaphosphate, NaPO³, which form two dimensional chains. Spectra of the time-dependent structure factor were obtained using photon correlation spectroscopy and values of the glass transition, fragility, and the heterogeneity parameter have been determined. A decrease in fragility was observed with alkali addition which is shown to parallel changes in fragility occurring in alkali-free chalcogenide glass forming materials.

DOUBLE QUADRATIC AND QUARTIC DOUBLE WELL IN AN ELECTRIC FIELD

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There is a continuous interest in one-dimensional double wells (DW) for example $x^4 - \gamma x^2$, $\gamma > 0$. Periodic DW without field may also be suitable to model nanostructures made of ferroelectric materials or produced by molecular beam epitaxy. Solving the Schroedinger equation involving DW has proved to be a difficult task. In this paper we offer simple and elegant solution of DW problem based on solutions of Heun equation first introduced over a hundred years ago and then not widely mentioned until recently. During last 20 years when computation softwares became abundant, there was observable increase of interest toward Heun equation. Finally, Maple Edition 10 introduced Heun functions in its

standard software package which helped to conduct part of the work analytically using computer algebra techniques and toward the end numerically solve transcendental equations by regular PC. We will report eigenvalues, eigenfunctions, and normalization constants for ground and excited states. We will discuss avoided crossing phenomenon with applied electric field.

RHO MESON PRODUCTION FROM ULTRA-PERIPHERAL COLLISIONS OF COPPER NUCLEI

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This study will focus on the production of rho mesons from ultra-peripheral collisions of copper nuclei at relativistic speeds. In ultra-peripheral collisions (UPCs) the heavy ions pass by each other at large impact parameters and do not interact through the strong interaction; still, there are interesting effects due to the very strong electromagnetic fields present in these collisions. The Cu-Cu data to be used are obtained from the Solenoidal Tracker at RHIC (STAR), a particle detector at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory. Previous studies have detected rho meson production in Au-Au and d-Au collisions; adding Cu-Cu data helps to determine the dependence of cross sections on nuclear species. I will present an introduction to ultra-peripheral collisions and briefly discuss the prospective methods to analyze the Cu-Cu UPC data.

COHERENT CONTROL OF AZOBENZENE ISOMERIZATION

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Coherent control is the process of using light to control the dynamics of a molecule. It can be used to induce isomerization, to select a desired pathway in a chemical reaction or to control the direction of motion of electrons in a semiconductor. New uses are being developed continuously. The goal in our experiment is to increase the trans to cis photoisomerization of azobenzene by excitation with modulated ~ 400 nm pulses. By using feedback from the isomerization process we employ a genetic algorithm along with a spatial light modulator to create a pulse that iteratively improves the quantum yield of isomerization. We start with ~ 800 nm pulses from a mode-locked Ti:Sapphire femtosecond laser amplifier which is passed through a spatial light modulator and a nonlinear crystal, generating a second harmonic excitation pulse at ~ 400 nm. In order to generate maximum intensity at 400 nm we use a feedback-loop control algorithm to ensure that, after leaving the spatial light modulator, the pulses are transform limited. Evaluation of the length and modulation of the pulses is achieved by imaging the pulses using frequency resolved optical gating (FROG). We monitor the isomerization of the sample by probing at a wavelength in which the difference in absorption between the cis and trans isomers is maximum. The probing pulse arrives 50-200 ps after the modulated excitation pulses and measures the differential absorption. It is this data that is fed back into a genetic algorithm to improve the isomerization induced by the pulses.

X-RAY FLUORESCENCE CROSS SECTIONS FOR ELEMENTS $55 \leq Z \leq 60$

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The x-ray cross section of the elements Cs, Ba, La, Ce, Pr, and Nd is found using x-ray fluorescence (XRF). The samples are ionized by a radioactive source of ^{55}Fe and the resulting fluoresced x-rays are detected using a lithium drifted silicon detector. Parameters such as the detector efficiency, attenuation of the x-rays in the sample, and decay corrections of ^{55}Fe are accounted for before calculating the total x-ray cross section. These results are compared to theoretical calculations of the total ionization cross section by accounting for x-ray fluorescence yields and Coster-Kronig transition probabilities.

JET QUENCHING SIMULATIONS FOR ALICE EMCAL AT CERN

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Hard scattering that occurs in relativistic heavy ion collisions produces quark/antiquark pairs with very high transverse momenta. In order to conserve momentum the parton and antiparton leave the point of interaction back to back. When the quark/antiquark pair moves apart their potential energy converts into additional parton-antiparton pairs. These quark/antiquark pairs form mesons with momenta in the direction of the primary partons. These collections of emerging mesons are called jets. A jet interacts with the dense nuclear matter produced in the collisions by losing its energy. This is called jet quenching. Jets created from light partons quench rapidly. Jets created from heavy partons quench less rapidly and so show momenta closer to that of the original parton. These heavy partons jets can be identified on the basis of their electron content. These electrons can be detected by the Electromagnetic Calorimeter (EMCAL). The time projection chamber in the ALICE experiment at CERN provides information for jet reconstruction. The magnitude of this jet energy loss strongly depends on the nuclear material. Measurements of jet quenching reflect the properties of the nuclear material. In this study of primary quark/antiquark production we will present a specific application of the Monte Carlo simulators PYTHIA and HIJING that are used to simulate jets and the AliRoot detector simulator that is used to study the jet reconstruction.

EARTH SCIENCES

THE GROWTH OF NORTH AMERICA – NEBRASKA'S CONTRIBUTION

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Prior to about 1.83 billion-years-ago (Ga), the Wyoming and Superior provinces were separate continents accumulating accretionary material along their margins. The collision of these two provinces and their accumulated marginal materials produced the intervening mixed terrane of the Trans-Hudson orogen. These combined units, the Hudsonian continent, became proto-North America. During the period from 1.8 to 1.6 Ga, this continent grew southward (current orientation) by accretion of a series of arc terranes constituting the Central Plains orogen. The Nebraska region makes up a significant portion of this orogen. This growth by accretion created individual terranes linked to the growing North America by suture zones. This process created terranes of schist and gneiss containing fore-arc basins and intruded by granitic plutons. The sutures bounding the terrains created permanent zones of

structural weakness in the crystalline basement that were subject to reactivation during the remainder of geologic time. The rocks of the Central Plains orogen were intruded by a series of granitic plutons at about 1.4 Ga. The youngest feature (1.1 Ga) in the Precambrian record is the Midcontinent Rift System. One segment of both the rift basalts and the flanking sedimentary basin is preserved in southeast Nebraska. There is no rock record from 1.1 Ga until about 0.52 Ga, a gap in time equal to the entire Phanerozoic. The initial advance of the Phanerozoic seas into Nebraska was in the latest Cambrian. Marine sediments (limestone, dolomite, shale, and sandstone) were deposited across Nebraska as a relatively complete transgressive section during the upper Cambrian and lower Ordovician. Uplift then occurred on the Southeast Nebraska Arch and erosion removed these sediments over much of this portion of Nebraska. Deposition resumed in the middle Ordovician as one of the major Paleozoic transgressions. Deposition, mostly marine, continued through the Mississippian. However, there were periods of nondeposition and erosion that make the rock record incomplete. The lack of obvious shoreline facies suggest that, although not widely distributed now, most of the rock units in Nebraska were originally more extensive. The current patterns of distribution of the Cambrian through Mississippian units suggest periodic reactivation of the sutures in the crystalline basement. Major uplift and erosion began in Late Mississippian time that caused widespread erosion on the larger structures in the midcontinent. The seas returned gradually through the Pennsylvanian and Permian. Deposition was restricted to western Nebraska during Early Mesozoic time until the development of the major continental seaway in the Cretaceous. Basin development in western Nebraska allowed accumulation of over 2,000 meters of sediment (shale and sandstone). At the end of the Cretaceous, uplift of the Rocky Mountains caused the seas to retreat for the last time in Nebraska. A thick wedge of sediments (silts, sands and volcanic ash) were deposited eastward across the state during Tertiary time. While Pleistocene glaciers occupied eastern Nebraska, the Tertiary surface was eroded in central and western Nebraska and some of the modern drainage systems were established. After retreat of the glaciers and a period of erosion, central and eastern Nebraska were blanketed by windblown silts and clays (loess). The modern soil profiles were developed on the Cenozoic sediments. It is expected that tectonic activity, including earthquakes, will continue to reflect the Precambrian suture zones.

SUBSURFACE STRUCTURAL ANALYSIS OF THE YENTER OIL FIELD IN LOGAN COUNTY, COLORADO

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The Yenter oil field is located in central Logan County, Colorado, and was discovered in 1950. Geologic studies have not been done on this field since then when the British-American Oil Co. completed a survey based on several exploratory wells. Not until now has a detailed study been done on this field that has produced over 10 million barrels of oil and 24 million cubic feet of gas. I used well completion data sheets to retrieve information about target depths, well locations/elevations, and production data. This data was then used to create well location surface maps, isopach maps of the J-Sand (producing formation), and subsurface structural maps of the J-Sand. Using these maps along with current statuses and production levels, a clear understanding of the combination trap and unproduced zones was established. The well Yenter A-21 and several others should still hold hydrocarbon potential due to their situation over the gas cap and limited past production capabilities. With only 7 of the original 77 wells still active (5 producing, 2 injecting), this information could be very beneficial to the 2 remaining production companies in the Yenter field.

DETERMINING AN OPTIMUM PURGING PROTOCOL BASED ON CONTENT AND VOLUME

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This research was conducted at Crow Butte Resources, an in-situ leach recovery uranium mine west of Crawford, NE. This study was conducted to determine whether or not water that had been present in a monitor well for two weeks had become stagnant. If the water is stagnant it would fail to give an accurate representation of the formation water that is to be collected and tested. To ensure that formation water is collected properly regulatory agencies require the company to pull samples from two types of monitor wells, commercial and shallow, according to one of three regulatory approved parameters. The accepted parameters are formation stability (three consecutive samples, at half casing volume intervals, that are within +/- 0.2 for pH and +/- 10% for conductivity), purging of three casing volumes, or when the mine unit baseline average for pH and conductivity has been achieved. In the study, water was collected at first draw, half a casing volume, and a full casing volume and was then analyzed and compared to the regulatory collected sample. Each sample was analyzed for alkalinity, chloride, and conductivity. To further confirm the results they were also compared to each mine unit's baseline average, maximum, minimum and standard deviation for each parameter. The samples that were collected in this study appeared to conclude that water in a monitor well for a two week period between purging is not stagnant and would serve as a representative sample of the formation. One would need to extend the sampling periods to determine the point at which the casing water has become stagnant, and not representative of the formation water.

A SUBSURFACE STUDY OF THE CHAMBERLAIN PASS FORMATION IN BOX BUTTE COUNTY, NEBRASKA

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The Chamberlain Pass formation is a sandy unit, Oligocene in age, on top of the Upper Cretaceous Pierre Shale. It is the host rock to the Crow Butte uranium deposit near Crawford, NE. The Chamberlain Pass Formation has been interpreted as a paleochannel fill. An isopach map of the Chamberlain Pass Formation south of Crawford into Box Butte County reveals the shape of the channel. Data was derived from oil well logs. In northwestern Nebraska the Chamberlain Pass Formation has an average thickness where it exists of approximately 59 feet. In southwestern Box Butte County however, it is up to approximately 150 feet thick. This area is all a very good prospect for the possibility that the Chamberlain Pass Formation could host uranium roll front deposits. Along the edges of the channel fill, where the sand pinches out, is typically where the roll front will exist because it cannot migrate any further. More exploration drilling will need to be done in this area to find the oxidation/reduction front. Once the oxidation/reduction front is found it can then be followed until a high grade ore zone is found. There is a very good chance that if the roll front is followed from the Crow Butte deposit along the eastern edge of the formation that high grade uranium ore could be found in Box Butte County.

ICHTHOLOGY OF AN OLIGOCENE AGE TRACKWAY AT TOADSTOOL GEOLOGICAL PARK, NORTHWEST NEBRASKA

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Latex molds of fossil trackways collected at Toadstool Park (Orella Formation, Oligocene of northwestern Nebraska) in 1994-95 by the University of Nebraska and the Nebraska National Forest have provided an opportunity for detailed ichnological interpretation. Preliminary analysis of track morphology and gait length leads to the conclusion that at least two different mammals are represented. A track with a diameter averaging 13 cm and gait of 40 cm is differentiable from another averaging 16 cm with a gait of 47 cm. Preliminary analysis has also identified a change in travel direction by the larger mammal based on track superposition. This is also supported by a textural change in the trackway, leading to the conclusion that the animal possibly changed direction after approaching water. This is evidenced by a change in substrate texture as well as morphology of the tracks as they approach the more water-saturated substrate. Further study could likely lead to identification of the track makers, as well as recognition of other tracks and activity represented on this and other associated trackways.

HISTORY AND PHILOSOPHY OF SCIENCE

THE FOUNDATION OF DARWIN'S ORIGIN OF SPECIES: THE 1842 AND 1844 DRAFT OF HIS IDEAS

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

After a few delays, HMS Beagle left Plymouth, England on December 27, 1831. After almost five years of exploration the HMS Beagle docked at Falmouth, England on October 2nd, 1836, and Darwin departed immediately for home.

While working on the Zoology and Geology of the voyage of the Beagle, Darwin kept notebooks on a variety of subjects and his earliest statements on evolution are to be found there. Darwin's son Francis did not discover the text of the early essay, known as the Sketch of 1842, until 1896 when Down House was being cleared. By 1844 Darwin had expanded the sketch considerably. The second essay was called the *Essay of 1844*. Francis already knew the second sketch when he edited the *Life and letters* in 1887 and was quoted from in Darwin's famous paper with Alfred Russel Wallace, published in the *Journal of the Proceedings of the Linnean Society of London* for 1858.

A BRIEF HISTORY OF THE REPROGRAMMING OF CELLS

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

Briggs and King reported in 1952 on their work producing normal tadpoles by transplanting a nucleus into an enucleated frog egg. Gurdon, in 1962, working with *Xenopus laevis* demonstrated nuclei transferred from mature cells to enucleated cells produced mature fertile male and female frogs.

Ian Wilmut produced Dolly in 2002 by transferring the nuclei of mature mammary cells to enucleated sheep eggs. In 2008 scientists were able to take diseased cells and reprogram them into stem cells. This work benefited from work done ten years earlier by scientists at Wisconsin when they took human embryonic (hES) cells and demonstrated an ability of these cells to form any cell in the body. In 2007 two groups, Shinya Yamanaka and James Thompson reported on the successful conversion of skin cells in Pluripotent stem cells.

TEACHING OF SCIENCE AND MATH

BIRDS AND THE EARLY ELEMENTARY CLASSROOM

Kim Soper, Educational Consultant, SEPA Grant, University of Nebraska Medical Center, Omaha, NE 68198

Birds are a wonderful way to teach many different science and math skills as well as life science to elementary children.

In light of the recent identification of Nature Deficit Disorder, where children are unfamiliar with the flora and fauna in their own backyards, birds again seem to be a wonderful vehicle for gaining knowledge about common science facts. The Bird curriculum highlights sixteen birds common to Nebraska and South Dakota, with a wide variety of activities that vary from size estimation to an original coloring book that can be used for language arts and foreign languages.

COLLEGIATE ACADEMY

BIOLOGY

SESSION A

LOCATION OF TOLL-LIKE RECEPTOR 3 IN THE RESPIRATORY EPITHELIAL CELL LINE HBE-16 USING IMMUNOFLUORESCENCE

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Viruses affecting the pulmonary epithelia have a direct link to the immense inflammation that shortly follows viral infection. Influenza is one such virus that affects the pulmonary epithelia. Viruses infecting the pulmonary cells start inflammation through the recognition of the virus through pathogen recognition Toll-like receptors (TLR). The TLR then signal a series of events that leads to inflammation of the epithelia. Exact location of TLR3, which recognizes double-stranded RNA, is known to be in the endosome in dendritic cells, but the location of TLR3 in epithelial cells is currently not known. Through the use of antibodies specific for TLR3 and the early endosome antigen (EEA1) and immunofluorescence microscopy, it was discovered that TLR3 is localized within the early endosome in epithelial cells. With this knowledge, further research can be done on the mechanisms of signaling that leads to inflammation and drug producers can use this information to develop drugs to limit the amount of inflammation that occurs from viral infection of the airway epithelia.

INVOLVEMENT OF TLR3 IN HUMAN BRONCHIAL EPITHELIAL CELLS IN THE IMMUNE RESPONSE TO DSRNA

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Respiratory disease is a significant health problem in the industrialized nations. Toll like receptors, a family of evolutionarily conserved pathogen recognition receptors, are key molecules of the innate immune system and play a key role in inflammation and pathogen destruction. More specifically, TLR3, a receptor fundamentally expressed in human alveolar and bronchial epithelial cells, is looked at more closely when studying diseases of the airways. TLR3 is capable of identifying dsRNA viruses and then stimulating the NF- κ B pathway to produce chemokines and cytokines to begin the immune response. We observed respiratory epithelial cell line 16 HBE and looked at specific amounts of NF- κ B, TNF α and Poly I:C concentrations needed to create a positive immune response.

HOUSEHOLD RISK FACTORS ASSOCIATED WITH HUMAN HERPESVIRUS-8 (HHV-8) AND HIV-1 CHILDHOOD INFECTIONS IN LUSAKA, ZAMBIA

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Human herpesvirus-8 (HHV-8) or Kaposi's sarcoma-associated herpesvirus (KSHV) has been linked to all forms of Kaposi's sarcoma (KS). Both sexual and non-sexual transmission routes have been reported in adults, while transmission routes of HHV-8 in early childhood remains to be elucidated. Previous studies have indicated salivary exposure as a likely source of early childhood infection. Our study objective is to determine whether children will have an increased risk of HHV-8 in households where increased salivary exposure behaviors occur. Our approach was to identify HHV-8 seropositive children and determine if risk factors within the household with positive children correlate with the presence of infected children. The study cohort consists of children and their household members recruited at the University Teaching Hospital (UTH), in Lusaka, Zambia. To determine salivary exposure a risk analysis was determined using instruments including detailed questionnaires on socio-demographics, household living conditions, and behaviors that increase salivary exposure. In addition, HHV-8 and HIV-1 serology status were determined for each individual. The preliminary analysis of 331 households with children under the age of five did show a significant correlation with child HHV-8 status and the presence of an HIV-1 positive adult, aged sixteen and above, within the household (odds ratio 2.1, confidence interval 1.01 to 4.35, P value .047, $p < .05$). There was no significant correlation between child HHV-8 status and household living conditions as measured by electricity, water source and type of toilet. Increased salivary exposure as reported by the use of saliva to soothe childhood injuries was significantly correlated with the child's HHV-8 status (odds ratio 1.2, confidence interval 0.35 to 4.40, P value .738, $p < .10$). Study is ongoing to follow HHV-8 negative children to identify those who were subsequently infected by HHV-8 and determine risk factors associated with seroconversion.

SURFING ALONG FILOPODIA: MECHANISMS OF HIGHLY-EFFICIENT HIV INTERCELLULAR TRAFFICKING

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There may be numerous ways through which HIV infects human cells. It is an emerging theme in virology that mammalian viruses commonly exploit cell membrane protrusions for intercellular dispersal. In this paper we propose that HIV-1 induces formation of direct intercellular contacts in human macrophages called filopodia and uses these structures for direct cell-cell infection. It thus escapes immune surveillance, thereby increasing infection efficiency. We used confocal imaging to establish that HIV-1 infected macrophages form these filopodial bridges. Then we determined that cytoskeletal proteins ezrin, moesin and radixin are involved as structural components of these filopodia. The localization of viral particles along the filopodia in HIV infected macrophages was also demonstrated. These findings supported our proposal.

DEVELOPMENT OF PHAGOCYTOSIS ASSAYS TO BETTER UNDERSTAND AVIAN WEST NILE VIRUS SUSCEPTIBILITY

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Although birds are the primary reservoirs for West Nile virus (WNV), some birds are more competent reservoirs for the virus than others, and WNV susceptibility widely among bird species. The reasons for the wide range of susceptibility that exists in the bird community are largely unknown, although it has been hypothesized that the ability to mount a robust neutralizing antibody response to WNV infection is likely correlated with disease resistance. However, most susceptible birds die of WNV infection within the first week, before a measurable antibody response has been mounted. Therefore, we are exploring the involvement of the innate immune system in avian susceptibility to WNV. One particularly important aspect of the innate immune system are phagocytic cells which are responsible for engulfing foreign particles and pathogens. However, little is known about the role of phagocytic cells in an animal's immune response to WNV infection. For my research, I developed an assay to measure the phagocytic activity in avian macrophages, monocytes and heterophils.

INVESTIGATION OF POTENTIAL UPF1 KINASES IN *SACCHAROMYCES CEREVISIAE*

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Nonsense-mediated mRNA decay (NMD) functions in cells to degrade mRNAs containing a premature termination codon, in order to protect these cells from the potentially harmful effects of a truncated protein. Additionally, NMD is also known to regulate certain wild-type mRNA transcripts. Post-translational modifications of the proteins required for NMD are important for coordination of the sequential steps involved in this process. Upf1, one of the proteins required for NMD, must be phosphorylated for mRNA decay by the NMD pathway. SMG-1 is the kinase responsible for phosphorylating Upf1p in *Caenorhabditis elegans* and humans. SMG-1 is regulated by two additional proteins that are required for NMD, Upf2 and Upf3. Currently a homolog of SMG-1 has not been identified in *Saccharomyces cerevisiae*. In order to identify this kinase, we have selected seven (7) kinases as possible candidates for Upf1 phosphorylation: Cka1, Mec1, Mip6, Pro1, Tao3, Tor1, and Tor2. We chose these kinases based on sequence homology to SMG-2 and their known cellular

functions. For each kinase of interest, we have a mutant that does not make the kinase. The mutants have been transformed with *FLAG-UPF1* and *FLAG-upf1_{C65S}*, an allele that encodes a Upf1 protein whose phosphorylation is mis-regulated and that does not interact with Upf2. Upf1 phosphorylation will be analyzed in the mutants by Western blotting and polyribosome profiles for differences.

ZEIN MICROSPHERES FOR DNA DELIVERY

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Gene delivery approaches provide a mechanism to directly alter gene expression within a cell population. However, inefficient delivery is a critical factor limiting its use in therapeutic applications, including gene therapy to treat genetic deficiencies or tissue engineering matrices for treatment of organ loss and failure. Nonviral vectors, while much less efficient than viral vectors, are less toxic and lack immunogenicity, making these vectors attractive alternatives to viruses. In non-viral gene delivery, a biomaterial is used to deliver DNA to a cell. We are investigating the use of a novel biomaterial, zein, as a potential DNA carrier. Zein, a storage protein from corn, has been used in the past to form coatings resistant to microbial attack, for tableting and films in the pharmaceutical industry, and as an edible packaging material. Zein is a natural polymer, and is regarded as biocompatible, biodegradable, and biologically stable. Various properties of zein allow it to be formed into a microsphere, and it has been investigated as a drug carrier for sustained release because of its hydrophobic nature. We hypothesize that zein microspheres could be formulated to include DNA instead of a drug and thus be used for nonviral gene delivery, in applications of oral gene therapy and DNA vaccination, as well as tissue engineering. Coacervation techniques were used to fabricate microspheres composed of zein and DNA, capitalizing on the solubility properties of zein and DNA in aqueous ethanol solutions. Spheres were formed using various ratios of zein and DNA, to determine optimal fabrication conditions. After formation, spheres were harvested through centrifugation, washed, and then DNA encapsulation efficiency and integrity, sphere size, and DNA release were measured. Encapsulation efficiency of DNA within the spheres was determined through radiolabeled DNA (P^{32}), and was dependent on the zein:DNA ratio, with highest encapsulation efficiencies over 80% . Integrity was measured using gel electrophoresis, and fabrication conditions could be tailored to eliminate DNA damage. Sphere size was measured using microscopy techniques combined with image analysis and microsphere diameter was dependent on initial ratios of zein to DNA. Finally, radiolabeled DNA was used to determine how much DNA was released from the zein microspheres over time in different medias. The zein prevented a rapid release of the DNA from the spheres, which demonstrates the potential of zein microspheres for sustained release to the surrounding cells. This publication was made possible by NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources

PROBING BIOMINERALIZATION USING A NOVEL DOUBLE DIFFUSION GEL SYSTEM

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

ISOLATION AND IDENTIFICATION OF SERUM CALCIFICATION FACTOR BY GEL DIFFUSION MINERALIZATION

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Non-collagenous matrix proteins guide and control mineral crystal growth within calcified tissues. Changes in the normal complement of non-collagenous proteins in the organic matrices of these tissues can cause abnormal calcification. We will present a gel electrophoresis/gel diffusion method for the isolation and characterization of mineralization-regulating proteins from normal and abnormal calcified tissues. Coupled with modern mass spectrometry protein identification, this approach makes it possible to compare protein complements between different calcified tissues, as well as between normal and abnormal tissue, using small sample sizes. We will show preliminary results of efforts to isolate and identify serum calcification factor from bovine blood serum.

STRUCTURE INDUCED CONFORMATIONAL CHANGE OF PEPTIDE SEQUENCES ADSORBED TO HYDROXYAPATITE

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Bone mineral is hydroxyapatite (HA), a calcium phosphate mineral. Its growth is thought to be mediated by proteins in bone matrix to produce the biologically and mechanically optimized mature bone tissue. It is important to determine the physicochemical mechanism of peptide/protein-mineral interaction so that we may mimic biomineralization strategies to make synthetic materials with novel nanostructures and mechanical properties. Peptide sequences containing contiguous strings of glutamate have been shown to initiate and promote mineral growth in vitro, while aspartate rich sequences inhibit mineral growth. Glutamate and aspartate oligomers of various lengths (10, 50) as well as peptides derived from known bone mineralization proteins were adsorbed onto HA crystals and characterized by circular dichroism (CD) spectroscopy and IR. Structural differences detected between mineralization promoters and inhibitors will be presented.

EXPRESSION AND PURIFICATION OF THE HUMAN PREGNANE X RECEPTOR LIGAND BINDING DOMAIN: A COMPARISON OF NATIVE AND DENATURING CONDITIONS FOR IMMOBILIZED METAL ION AFFINITY CHROMATOGRAPHY

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A major function of hepatocytes, liver cells, is the detoxification of blood. This is accomplished through several intracellular metabolic pathways that are regulated by proteins called nuclear receptors. Nuclear receptors sense for toxins and activate the production of necessary enzymes at the translational and transcriptional levels. The nuclear receptor of interest, hPXR-LBD, needs to be isolated in order to be studied. This is accomplished through immobilized metal ion affinity chromatography. Two different buffer sets, native and denaturing condition, were compared to determine which produced the most pure product. The denaturing condition produced the most pure product but precipitated the protein following purification.

NEUTROPHIL ADHESION TO BRONCHIAL EPITHELIAL CELLS IS MODIFIED BY EXPOSURE OF EPITHELIAL CELLS TO HOG CONFINEMENT DUST EXTRACT

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Employment in the agricultural environment, particularly in hog confinement facilities, is associated with increased risk of illnesses, including respiratory disorders and airway inflammation. Mechanisms by which dust modulates inflammation are not completely defined, although exposure to dust can influence both epithelial cell and inflammatory cell immune response. A hallmark of airway inflammation is the migration and adhesion of neutrophils to the bronchial lumen. The focus of this study is on the contribution of the epithelial cells to adhesion events. Airway epithelial cells (BEAS-2B) exposed to hog barn dust extract (HDE) for 24 hours were co-cultured with freshly isolated peripheral blood neutrophils to investigate airway epithelial cell/neutrophil adhesion interactions *in vitro*. Adherent neutrophils were quantified using a fluorescence-based 96-well assay. It was found that treatment of airway epithelial cells with hog barn dust extract dose-responsively resulted in an increase in peripheral blood neutrophil adhesion to epithelial cell cultures *in vitro*. Additionally, blocking the epithelial cell adhesion molecule ICAM-1 during the 24-hour HDE exposure period using a specific neutralizing antibody caused neutrophil adhesion to markedly decrease. These data suggest that HDE exposure to airway epithelial cells enhances neutrophil adhesion to epithelial cells, which is mediated in part by ICAM-1.

HOG DUST ACTIVATES SKELETAL MUSCLE RYANODINE RECEPTORS (RYR1)

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Individuals working in industrial pig farms and residents in communities surrounding these confinement facilities report increased muscle weakness and fatigue. However, causative factors and molecular mechanisms responsible for this remain poorly characterized. In this study we investigated whether pig dust contains components that can bind to and activate RyR1. Dust collected 1-2 meters from the ground of pig confinement facilities in Nebraska were extracted with chloroform, filtered and rotor evaporated to dryness. The residues were redissolved in hexane:chloroform (20:1) and precipitates were filtered and air-dried. Thin layer chromatography revealed three major compounds in hexane insoluble fractions and ¹H NMR suggests these compounds contained fatty acid moieties. In binding assays, hexane insoluble fractions displaced [³H]ryanodine from rabbit skeletal muscle RyR1 in a dose-dependent manner, with an IC₅₀ of 2.0 μg/ml. The hexane insoluble fraction also displaced [³H]ryanodine from RyR2 (dog heart), but was significantly less potent (IC₅₀ of 21.0 μg/ml). Hexane insoluble fraction displacement curves were parallel to that of ryanodine and occurred principally at activating Ca²⁺ concentrations. These data are the first to demonstrate that pig confinement dust contains component(s) that selectively bind to and activate RyR1, providing a mechanism rationale for reported muscle weakness and fatigue. (Supported in part by grants from NIH (R01-HL085061, R01-OH008539) to DJR and KRB and ADA (06-RA-11)).

BIRD SPECIES IN THE DIET OF BARN OWLS (*TYTO ALBA*) NESTING IN ULYSSES, NEBRASKA

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Barn Owls (*Tyto alba*) prey on small mammals with birds making up a small percentage of the diet (<1%). Pellets collected in Ulysses Nebraska from 2005-2008 contained a total of 48 birds (4.3%) out of 1113 identified prey items. Avian skulls, keels, and synsacra from pellets were compared with specimens at the Nebraska State Museum vertebrate collection to determine species. European Starlings (*Sturnus vulgaris*) were the most common bird (12%) in the diet. European Starlings roosted in the enclosure where the Barn Owls nested and may have been taken due to easy accessibility. Other avian prey identified included: House Sparrow (*Passer domesticus*), American Tree Sparrow (*Spizella arborea*), Red-winged Blackbird (*Agelaius phoeniceus*), Grasshopper Sparrow (*Ammodramus savannarum*), Horned Lark (*Eremophila alpestris*), and Northern Bobwhite (*Colinus virginianus*). The avian prey identified suggests these Barn Owls captured birds in fields and roadside ditches. Less than 6% of the habitat within a one-mile radius of the nest site was fields. Limited small mammal habitat along with European Starling availability may have contributed to the higher percentage of birds in the diet.

SEASONAL RAINFALL PATTERNS RELATED TO SMALL MAMMAL FREQUENCIES IN A BARN OWL (*TYTO ALBA*) DIET

Ashton E. Mueller, Concordia University, Seward, NE 68434

The barn owl (*Tyto alba*) is a common nocturnal bird of prey that hunts in grasslands and meadows. Barn owls feed primarily on small mammals and typically swallow their prey whole, regurgitating a pellet composed of fur and bones later. Prey species from barn owls nesting in Ulysses, Nebraska were identified from pellets collected from 2005-2008. The total number of prey identified was 1113 and mammal species made up 96% of all prey. Four dominant prey species were identified: *Microtus pennsylvanicus* (30%), *Reithrodontomys megalotis* (19%), *Blarina brevicauda* (18%), and *Peromyscus species* (18%). Prey abundance data were converted to percent composition per year for the four year collection period. Monthly rainfall data was collected from the Water/Wastewater Department of Seward, Nebraska for 2004-2008. Rainfall data were categorized in three-month increments for each year (December-February, March-May, June-August, and September-November). Statistical analyses were run to determine correlations between rainfall and prey abundances in barn owl diet. Rainfall from March to May of the year previous to the pellet collection date was positively correlated to *M. pennsylvanicus* ($r=0.99$, $P=.003$, $df=2$) and negatively correlated to *Peromyscus* ($r=-0.93$, $P=.036$, $df=2$) in barn owl diet. Rainfall may have an indirect influence on prey abundances in barn owl diet.

AGE OF EUROPEAN STARLINGS (*STURNUS VULGARIS*) FROM A BARN OWL (*TYTO ALBA*) DIET

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Barn owls (*Tyto alba*) are known for a nocturnal diet of rodents that typically includes *Microtus*, *Reithrodontomys*, and *Peromyscus* species with small numbers (<1%) of birds in the total diet. During 2005 to 2008 barn owl pellets were collected from the attic of building also housing European Starlings (*Sturnus vulgaris*) in Ulysses, Nebraska. Of 1,113 total prey, 48 birds (4.3%) were identified in the diet, European Starling was the most common bird species identified. Apparently, starlings were easy prey

due to their roost being in the same building as the barn owl nest. To determine whether barn owls were preying on adult or young starlings, 11 of the 12 starlings identified were able to be aged based on skull ossification. Starling skulls complete ossification at the end of the December in the same year they were hatched. Birds with incomplete ossification were classified as juveniles and with complete ossification as adults. Three juveniles and eight adults were identified. The date suggests that barn owls did not select prey based on age (e.e., only juveniles). Starlings were more likely common in the diet than expected due to a combination of limited availability of small mammal habitat within the vicinity of the nest site and the availability of starlings in the shared roost.

STUDY AND ANALYSIS OF THE 2008 NEBRASKA INTRASTATE NURSERY WHEAT (*TRITICUM AESTIVUM*) LINES USING THE ALPHA LATTICE OF AGROBASE

Nicholas L. Zalewski, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and P.S. Baenziger, G.G. Dorn, R.S. Little, N. Mengistu, and M.L. Montgomery, Department of Agronomy and Horticulture, University of Nebraska–Lincoln, NE 68583-0915

The University of Nebraska Wheat program has a vital attachment to the production of wheat for several million people. The goal of the program is to continually develop new lines of wheat that will thrive in the future and stay resistant to disease and pests. To give an understanding of the selection process, the NINs from Alliance, which were in their 8th to 10th generation, were measured for their height, yield, and test weight. The computer program Agrobases was used to help show the statistical importance of selecting varieties of wheat in the UNL wheat breeding program. 34 of the 51 2008 NINs were selected to be planted next season along with 9 checks. The r-squared value showing the correlation between Agrobases yield and Raw Yield, Agrobases yield and TestWt, and Agrobases yield and Height was .95, .10, and .05, respectively. This helped show the predictability that Raw Yield gives but Test Weight and Height do not.

A STUDY OF IMPROVING MANAGEMENT OF SOYBEAN CYST NEMATODE (*HETERODERA GLYCINES*)

Bobbie L. Mansur, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and L.J. Giesler, T. Brovont, and A. Elliot, Extension Plant Pathology, University of Nebraska–Lincoln, NE 68503

Soybean cyst nematode (SCN) has been studied for many years throughout several areas of the North Central United States. Through various protocols and studies, researchers are attempting to learn better management skills to decrease the effects seen by SCN. In this current ongoing study, data from the SCN soil collections was used for a variety of analyses of which included Reproduction factor (Rf) values, HG type, and concentration of SCN in the variously treated plots. This portion of the study done in Nebraska focused on two similar plots in the towns of Lyons and Tekamah. Research was done to determine the effectiveness of different resistant and susceptible treatment varieties, some of which included a widely used source PI88788 that has been seen to decrease the population of SCN in the soil. The data from plots in Lyons and Tekamah, along with other strip trials throughout the Midwest will eventually be compiled and used by soybean growers in order to manage the SCN present in soybean crops in the future.

SELECTION OF BARLEY LINES FOR ADVANCEMENT TO THE 2009 BVT BASED ON THE PERFORMANCE OF PARTICULAR AGRONOMIC TRAITS

Joseph M. Plambeck, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and P.S. Baenziger, M.L. Montgomery, G.G. Dorn, R.S. Little, and N. Mengistu, Department of Agronomy and Horticulture, University of Nebraska–Lincoln, NE 68583-0915

The development of a new barley cultivar is a long process, involving years of experimentation in order to find the best variety of barley to be selected and advanced. This research project was conducted to assess certain agronomic characteristics including anthesis date, plant height, grain yield, winter survival, moisture, and test weight, to determine which variety of barley will be advanced to the 2009 Winter Barley Variety Trial. Thirty different lines of specially bred barley (*Hordeum vulgare* L.) were selected for experimentation across three different locations. Of the thirty lines, variety NB07411 had the highest rank value among the others concerning grain yield, along with having moderately high values for other traits.

TESTING THE TOXICITY OF PLASTIC PRODUCTS USED IN AN ANIMAL IVF LABORATORY

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Quality control is an important aspect for any IVF laboratory. The bovine sperm assay was used for quality control testing on products used in an animal IVF laboratory. The effects of plastic products were evaluated with sperm motility, rate of forward progression, and percentage of acrosome intact. This analysis was performed on 41 products and the semen was evaluated at 0, 30, 60, and 120 minutes exposure to the plastics. The results showed that there was little difference between the products and their controls. The results also showed little difference between products made in different batches. These tests helped to confirm that the products used in lab are safe and are not causing inconsistent results.

THE EFFECT OF VARIOUS PRAIRIE MANAGEMENT REGIMES ON VERTEBRATE AND INVERTEBRATE COMMUNITY COMPOSITION

Kyle H. Lowery, Heather A. York, and Brad D. Elder, Department of Biology, Doane College, Crete, NE 68333

The timing of burns in prairie ecosystems affects community composition, yet the response of animal communities to fire disturbance is currently understudied in prairie systems. The arachnid and small-mammal communities in four burn regimes were studied at the Spring Creek Audubon Prairie, near Denton, Nebraska. Each study plot was surveyed along transect lines containing pitfall and Sherman traps. These methods were used to investigate effects of various prairie management regimes on vertebrate and invertebrate community composition. It was hypothesized that there would be different species of animals found under the different management conditions. As expected, our results revealed differences in species composition across the plots, with genus *Peromyscus* being found in the plots near wooded areas and genus *Reithrodontomys* being found in the plots that were open prairie. There was also a significant difference in wolf spider (family *Lycosidae*) size in one of the plots.

GENETIC DIFFERENCES WITHIN AND BETWEEN BRISTLECONE PINES (*PINUS LONGAeva*)

Ben J. Deaver and Brad Elder, Doane College, Crete, NE 68333

This study examined the differences in DNA within and between *P. longaeva*. In short lived multi-cellular organisms it is likely that there is very little genetic difference between cells, but in large long lived multi-cellular organisms the possibility exists for differences among the cells within individuals. In somatic cells these differences are probably not evolutionarily important. This is not true in germ line cells. In plants, particularly trees, germ cells often are distant physically from each other. This distance is not only spatial but in terms of cell lineage it also represents a separation in time. This provides the opportunity for long lived species to generate significant genetic differences between germ cells within a single individual. We examined the genetic differences within and between *P. longaeva*. *Pinus longaeva* were chosen because they are known to live as much as 5,000 years. Tissue samples were taken at three sites on each branch, three branches on each tree and five trees total. The DNA was extracted and using amplified fragment length polymorphism (AFLP) the sequence diversity of the DNA was evaluated. Results will be presented.

THE ISOLATION AND AMPLIFICATION OF MINISATELLITES IN THE MOUSE GENOME FOR APPLICATION IN DISEASE, MATERNITY/PATERNITY, AND FORENSIC ANALYSIS

Zach J. Genant, K. Murch-Shafer, and T. Clark, Dana College, Blair, NE 68008

Minisatellites in the mouse genome were characterized by isolation and amplification through polymerase chain reaction. DNA was extracted from tail biopsies of an adult mouse and its suspected offspring. Three primer pairs were chosen to initiate the polymerase chain reaction of three minisatellite regions in the extracted DNA. The size of the minisatellites was determined through agarose gel electrophoresis, which was then used to determine relatedness between the two mice. Successful amplification and characterization of one of the three minisatellites in both mice showed the mice were possibly related. Further minisatellite characterizations would be needed to statistically show relatedness.

TOXIN-ANTITOXIN ACTIVITY IN *SULFOLOBUS SOLFATARICUS*

Paige K. Mathew, Yukari Maezato, Derrick White, Amanda Dougherty, and Paul Blum, School of Biological Sciences, College of Arts and Sciences, University of Nebraska–Lincoln, NE 68508

This study uses the microorganism *Sulfolobus solfataricus* an extremophile that grows at low pH and high temperature. *S. solfataricus* is a member of the Archaea and is used as model to understand this group of prokaryotic organisms. Toxin/antitoxin proteins are recently discovered but widely distributed among prokaryotes with as yet poorly understood functions; some are thought to be ribonucleases. We are looking at a single pair of the Vap family of toxin/antitoxins, called vapB6 (antitoxin) and vapC6 (toxin) and their role as modulators of the heat shock response. In previous studies, it was found that a mutant lacking vapC6 lost thermotolerance creating the first heat sensitive hyperthermophile. To understand the biochemical function of VapC6, this study has focused on efforts to make recombinant VapC6. Since the protein was insoluble in *E. coli*, a strain of *S. solfataricus* was constructed that encoded a poly-histidine tagged copy of vapC6 on a plasmid. Earlier studies had also shown that vapC6

transcription could be induced by heat shock. To purify this protein, a heat shock regimen was therefore developed using cultures of this strain that are enriched with VapC6 as indicated by western blot analysis. Once sufficient protein is available, studies will be conducted on whether it has ribonucleolytic activity.

INFLUENCE OF EXERCISE AND HYDROXYCUT ON WEIGHT LOSS AND BODY COMPOSITION

Jarod Murdoch, College of Natural and Social Sciences, University of Nebraska at Kearney, NE 68849

The prevalence of obesity in the United States has led to a widespread use of dietary supplements that are portrayed as being a quick, safe, and natural way to lose weight. I want to study the effect of one of these supplements, Hydroxycut®, on individuals that are and are not participating in an exercise program. I conjecture that little body fat or weight loss will be demonstrated by those taking Hydroxycut® without exercise while those taking Hydroxycut® with exercise and those taking a placebo with exercise will generate similar body fat and weight loss. Weight and body fat percentage will be analyzed before and after subjects take part in an eight week exercise program to determine effectiveness of Hydroxycut® and exercise on weight loss and body composition. By performing this study I will demonstrate that use of the supplement Hydroxycut® is ineffective unless enhanced with proper exercise.

COLLEGIATE ACADEMY

BIOLOGY

SESSION B

DIET PALATABILITY AND DIGESTIBILITY BY *CAROLLIA PERSPICILLIATA*

Cassie L. Boggs, Wayne State College, Wayne Ne 68787; and Cheryl Dikeman, Omaha's Henry Doorly Zoo, Omaha NE 68107

To better understand the palatability and digestibility of diets in the short tailed fruit bat, *Carollia perspicillata*, there were nine choice trials conducted, and subsequent digestibility trials on common bat diets. Nine different diets composed of a combination of nutrient gel and one of three treatments were offered to the bat group for three separate trials. Treatments were a fruit diet, a mixed greens diet, or an insect diet. Following this initial study, the three most palatable diets, as determined by total food consumption, were then measured for digestibility. The top three diets from the initial study were the 25% greens/75% nutrient gel, 75% Fruit/25% nutrient gel, and 50% Fruit/50% nutrient gel. The 75% fruit diet had the highest calculated rate of digestibility of dry matter, organic matter, and calories, but the 25% greens had the highest calculated rate of protein digestibility. The ease of digestibility of the 75% fruit diet was most likely due to *Carollia perspicillata*'s digestive tract that is best equipped to digest a high fruit diet.

CLONING, OVER-EXPRESSION AND PURIFICATION OF INLB GENE/PROTEIN USING C41 SOLOS CELLS FOR POSSIBLE USE IN DRUG DELIVERY

Brittany Cody, Shawn Percy, and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Listeria monocytogenes is a food-borne pathogen has an exceptional ability to invade mammalian host cells that would normally not internalize the bacterium. The surface protein Internalin B (InlB) plays an important role in this internalization by initiating phagocytosis in the host cells. This unique ability may make this protein a good candidate for a drug delivery module. To assess this possibility, the *inlB* gene was cloned into C41 SOLOS Chemically Competent *E. coli* cells. Cellular components were then isolated and screened for the presence of the protein. Once isolated, the protein will be used to assess the ability of InlB to induce phagocytosis of itself and an inert carrier molecule within host cells. This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

USE OF LISTERIA MONOCYTOGENE INLA/INLB AS A POSSIBLE DRUG DELIVERY SYSTEM

Derek Moormeier, Shawn Percy, and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Listeria monocytogenes is a food borne Gram-positive bacteria with a special ability to internalize in mammalian cells that would not normally internalize bacteria. Many proteins are important in the internalization into the host cells. However, the internalin proteins *inlA* and *inlB* play vital roles of binding to the host cell membranes and initiating the internalization and spread of the bacterium. This innate ability has become of special interest in trying to create a drug delivery model. By cloning *inlA* and *inlB* genes into plasmids for over-expression of the protein in *E. coli*, purified proteins may eventually be attached to a drug that can selectively target specific mammalian cells. This work was funded by the Nebraska IN-BRE grant NIH grant # P20RR16469.

A COMPARATIVE STUDY OF MICROCYSTIN LEVELS AND ZOOPLANKTON CONCENTRATIONS IN SOUTHEAST NEBRASKA SURFACE WATERS

Rachel Ramsey and Brad Elder, Department of Biology, Doane College, Crete, NE 68333

Cyanobacteria, a naturally occurring bacterium in surface water, have become a problem worldwide when their numbers become so dense that they are considered a bloom. Human activities that increase the levels of phosphorus and nitrogen in surface waters are believed to have increased bloom occurrence and concentration. The reasons why the natural biotic systems within the surface waters have not adjusted to control bloom growth are varied and unclear. This study attempts to find a correlation between the zooplankton population levels and the level of the cyanobacteria toxin microcystin within the surface water. This was accomplished by sampling surface water from June, 2008 to September, 2008 at five Southeastern Nebraska lakes: Swan Creek Reservoir 5A, Holmes Lake, Oak Lake, Branched Oak Lake, and Pawnee Lake. During this time, microcystin was found in all five lakes sampled and the levels ranged from 0.0 ppb to 231.88 ppb. The microcystin was measured by the Nebraska Department of Environmental Quality. The zooplankton were visually identified to the lowest taxonomic level possible. The most common zooplankton were copepods, *Bosmina* spp., and *Daphnia* spp. Analysis of the data revealed that there was no correlation between total zooplankton density and microcystin levels. Future analysis will be conducted to determine the correlation between individual zooplankton species and microcystin levels.

POPULATION GENETICS OF THE SIDEWALK TIGER BEETLE

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This study investigates the correlation between physical distance and genetic differences among individuals in the species *Cicindela punctulata* found in Hall, Lancaster, and Saline Counties, Nebraska. DNA was isolated from specimens collected from several locations in each county, and pairwise differences in several regions of mtDNA among all individuals will be calculated and compared to the corresponding pairwise differences in collection location. The results of this study will be useful in assessing whether dispersal among populations is a significant factor in the maintenance of genetic diversity in tiger beetles, with potential conservation implications for the closely related and endangered Salt Creek tiger beetle.

CHARACTERIZATION OF A TRANSCRIPTIONAL REPRESSOR REGION OF THE HUMAN N-CADHERIN GENE

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Cadherins are a family of calcium-dependent transmembrane cell adhesion proteins that form homodimers with cadherins on neighboring cells. The expression of N-cadherin is important because its expression in cancer cells results in increased motility and invasiveness. Additionally, the inappropriate expression of N-cadherin has been previously correlated with the reduction of E-cadherin expression, which suggests that the switching from E-cadherin to N-cadherin is important in cancer development.

Previous research led to the identification of human N-cadherin fragments of the promoter that are possibly relevant to transcriptional regulation. The +10 to -462bp fragment showed a high level of luciferase expression and is thus considered a minimal promoter. The +10 to -1975bp fragment resulted in decreased expression of the construct over the shorter -462bp fragment, which suggests that a putative repressor is located between -1800bp and -500bp. The specific aim of this project has been to evaluate a putative repressor region between -462bp and -1896bp of the N-cadherin promoter in detail. This publication was made possible by the NIH Grant Number P20 RR16469 from the INBRE Program of the National Center for Research Resources.

THE ROLE OF METHYLMALONATE SEMIALDEHYDE DEHYDROGENASE IN *ARABIDOPSIS THALIANA* DURING GERMINATION

Kyla J. Ronhovde and Kerry Lucas, Department of Biology, Doane College, Crete, NE 68333

Little is known about the characterization of methylmalonate semialdehyde dehydrogenase (MMSDH) in *Arabidopsis thaliana*. MMSDH catalyzes the last step in the valine degradation pathway converting (methyl)malonate semialdehyde into propionyl- or acetyl -CoA, respectfully, in all organisms. Previous studies have looked at the function of MMSDH in mammalian systems and in rice. Both studies confirmed that MMSDH is important for key metabolic pathways such as branched-chain amino acid degradation and the TCA cycle. In this study it was found that *A. thaliana* seeds lacking MMSDH expression exhibit poor germination rates compared to wild-type seeds and become wrinkled following desiccation. Germination studies between knockout and wild-type seedlings on varying concentrations of sucrose and glucose showed that MMSDH knockout seeds germinate at lower rates compared to wild-type. However, the knockout seeds germinated at a higher rate on plates containing

glucose compared to being placed on the more commonly used carbon source, sucrose. This study also supports a preliminary relationship between MMSDH and isoprenoid syntheses, since acetyl-CoA is a key metabolic precursor for these pathways. Experiments with the MMSDH knockout seeds grown in the presence of the isoprenoid and phytohormone, abscisic acid, germinated before wild-type seeds. These data combined suggests that MMSDH may play a more critical metabolic role throughout germination, possibly due to its relationship with isoprenoid syntheses.

EVALUATION OF THE EFFICACY OF A COMMERCIAL PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS (PRRSV) SERUM BASED ON MEASUREMENT OF SEROLOGIC RESPONSE AND PROTECTION UPON CHALLENGE

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The efficacy of a serum prophylaxis for PRRSV (97-7895) was assessed based on viremia upon challenge. To determine if there was any correlation with protective immunity against PRRSV, serologic responses (neutralizing antibodies) were measured as it is generally agreed upon as predictor of immunity. The egg yolk serum tested contains neutralizing antibodies for PRRSV and is manufactured and commercially available in Mexico. The results found suggest that the serum produced no measurable protective immunity against challenge.

CHLORELLA VIRUS PBCV-1 INFECTION OF ALGA CHLORELLA NC64A CELLS CAUSES AN INITIAL INCREASE, FOLLOWED BY A DRASTIC REDUCTION IN SUPEROXIDE PRODUCTION IN CHLORELLA CELLS

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In this study, certain aspects of the relationship between *Paramecium bursaria* [Ehrenberg] *Chlorella* virus 1 [Van Etten and Meints] (PBCV-1) and *Chlorella* NC64A algae were examined. The main objective was to see if there was an increase in superoxide production by the *Chlorella* algae after PBCV-1 infection, and how PBCV-1's superoxide dismutase (SOD) affected superoxide production in the cell after infection because of the fact that *Chlorella* algae lack SOD. Flow cytometry was the main technique used to examine the *Chlorella* cells using fluorescent dihydroethidium dye, an indicator of superoxide production. It was shown that in the initial stages of infection, superoxide production increased dramatically inside the *Chlorella* cells. In addition, PBCV-1's SOD reduced or counteracted superoxide production in the *Chlorella* cells after a brief period of accumulation because the SOD is able to metabolize the superoxide to another product. It was shown also that the dye (dihydroethidium) used in the experiment to detect superoxide could enter the cell by itself, but it entered in a much lower concentration without the assistance of PBCV-1.

TRANSLOCATION OF TLR-3 IN RESPIRATORY EPITHELIUM VIEWED THROUGH CONFOCAL MICROSCOPY

Michael L. Dvorak and T. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

Toll-like receptors (TLR's) are a class of proteins utilized by the innate immune system to protect the host from invading pathogens. The TLR mechanism is less specific than those of the adaptive immune system; however this reduction in specificity allows the TLR's to provide a broader and more immediate protection against infection. Once the receptor has been activated, it triggers a cascade through the activation of NF-kappaB and the production of interferons which result in inflammatory responses. This inflammatory response can become a detriment to the host when activated within the respiratory epithelium. In order to further study the TLR's role within the cells of the respiratory epithelium, it is important that the location of the mechanism within the cell be accurately determined. Through the use of fluorescent staining and confocal microscopy, a three dimensional image of the cell can be produced and the location of the mechanism determined.

COMPARISON OF POTENTIALLY ONCOGENIC PROTEINS THAT CAUSE AURORA A KINASE ACTIVATION AND ANALYSIS OF PHOSPHOSPECIFIC MONOCLONAL ANTIBODIES TO SHOW AURORA A'S ROLE IN MITOTIC SPINDLE FORMATION IN HELA CELLS

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Aurora A Kinase is overexpressed in a variety of cancers including pancreatic, breast, colorectal and others. Previously, HURP, TPX2 and Protein X have been studied as potentially oncogenic proteins that cause Aurora A phosphorylation, and therefore, activation of this kinase. It was seen that Aurora A was significantly less phosphorylated by HURP than by TPX2 or Protein X, meaning that it does not directly activate Aurora A. In our Western blots, we have shown that phosphospecific monoclonal primary antibodies reacted only with the wild type, phosphorylated form of Aurora A as opposed to the unphosphorylated mutant. In immunofluorescent-stained HeLa cells, the 3H8 primary antibody showed that cells in both mitotic metaphase and anaphase exhibited Aurora A localization at the cell's midzone rather than simply at the spindle poles and centrosomes. Knowledge about Aurora A activators and localization will hopefully lead to effective Aurora A inhibitors that will lessen or eliminate tumors.

FILTER AND PARAMETER OPTIMIZATION FOR REMOVAL OF 1% BOVINE SERUM ALBUMIN FROM EMJH MEDIA USING TANGENTIAL FLOW FILTRATION

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Downstream processing in vaccine production requires the addition and removal of many biological components. Before entering pilot scale production, these processes must be done at laboratory scale to optimize parameters for maximum efficiency. In this study bovine serum albumin (BSA) was separated from EMJH media using tangential flow filtration at laboratory scale to determine optimal parameters and filter porosity for pilot size up-scale. Four filters of different porosities were tested to determine the largest porosity that would retain the BSA and the smallest porosity that would allow passage of the BSA molecules. Concentration of samples was tested via a spectrophotometer. BSA, a molecular weight of approximately 66kDa, was passed sufficiently through a filter porosity of 300kDa (87%), and a porosity of 30kDa was able to remove most (92%) of the BSA. These preliminary results suggest that these filter porosities are the most efficient for BSA filtration. Further study is

needed to determine the most effective parameters for BSA filtration and ways to increase filter integrity throughout these extensive processes.

OPTIMIZATION OF A LYOPHILIZATION CYCLE OF A SWINE VACCIN

Lauren Brooks, Department of Biology, Dana College, Blair, NE 68008

Optimization of a swine vaccine lyophilization cycle and formulation was achieved for both 50 dose and 250 dose presentations. The time required for lyophilization was decreased significantly while increasing the quality of the resulting cake. This was accomplished through reduction of fill volume, increasing stabilizer concentration, and implementing temperature data obtained through freeze dry microscopy. The lyophilization parameters were validated through small process validation, and will be transferred to manufacturing scale with expected reduction of manufacturing costs and improved quality of the swine vaccine.

EFFECTS OF DESMOSOMES ON THE ACTIVATION OF EPIDERMAL GROWTH FACTOR RECEPTORS

Erin Bazata, Biology Department, Dana College, Blair, NE 68008, and J.K. Wahl, University of Nebraska Medical Center, College of Dentistry, Lincoln, NE 68583

The goal of this project was to determine if the assembly of desmosomes causes epidermal growth factor receptors (EGFR) to become activated. By understanding the relationship between desmosome assembly and EGFR activation, we may be able to regulate cancer cells by destroying desmosomes and thus stop tumors from growing. During the study, cells that do and do not contain desmosomes were grown, protein was extracted, and a Western blot was conducted using an antibody against EGFR. It was seen that desmosome assembly may activate EGFR.

COLLEGIATE ACADEMY

CHEMISTRY AND PHYSICS

ENANTIO-DISCRIMINATION OF METHAMPHETAMINE BY CIRCULAR DICHROISM USING PORPHYRIN TWEEZERS

Marcus Anderson, Mark V. Wilson, Kerry Lucas, and Andrea E. Holmes, Department of Chemistry, Doane College, Crete, NE 68333

Using exciton-coupled circular dichroism (CD) spectroscopy, our lab was able to differentiate between the two enantiomers of methamphetamine using commercially available porphyrin tweezers as achiral hosts. The host-guest complex formed with (+)-(S)-methamphetamine produced a negative bisignate shaped exciton-coupled CD spectrum, while the complex formed with (-)-(R)-methamphetamine produced a positive one. This sensitive technique could serve as an alternative method for the detection and enantio-discrimination of chiral methamphetamine.

WILD PLUM®: DYES OF IMPROVED OPTICAL BRIGHTNESS AND FLUORESCENCE

Jordan Groathouse, Casey Gustafson, Kerry Lucas, and Andrea Holmes, Department of Chemistry, Doane College, Crete, NE 68333

We have developed blue fluorescent dyes that impact optical brightness, color purity, and fluorescence to camouflage skin imperfections in cosmetic applications. The new dyes have controlled

solubility and stability which are important for cosmetic formulations, such as make up, lotions, etc. The syntheses, characterization, and optical properties will be reported. US Patent No. 61/080,711

NUTRITIONAL EFFECTS ON PROTEIN EXPRESSION IN HZAM1 CELLS

J. Warchol, C. Collins, and E.J. Haas, Department of Chemistry, Creighton University, Omaha, NE 68178

Insect cells are a less expensive and easier to maintain alternative to mammalian cell culture for the investigation of cellular processes in eukaryotes. A challenge to the successful culture of insect cells is development of a chemically defined medium that supports growth at the same level as medium supplemented with the chemically undefined component Fetal Bovine Serum (FBS). Previous studies have qualitatively assessed the effect of various nutritional factors on growth of insect cells in chemically defined media. This project represents the first quantitative study, as measured by protein expression levels, of the effects of nutritional components in chemically defined insect cell culture media. Here we report the effect on protein expression levels in HzAM1 cells, an ovarian cell line from the moth *Helicoverpa zea*, exposed to massive doses of ascorbic acid (vitamin C).

EFFECTS OF HEAT-SHOCK ON PROTEIN EXPRESSION IN HZAM1 CELLS

M. McDevitt and E.J. Haas, Department of Chemistry, Creighton University, Omaha, NE 68178

Insect cells provide a convenient system for the study of signal transduction pathways in eukaryotic cells. As an example, the Toll Receptors that play a role in innate immunity were discovered in *Drosophila*. The project described here utilizes 2-dimensional polyacrylamide gel electrophoresis to determine changes in protein expression in cells exposed to external stimuli. The goals include discovery of common regulatory pathways for proteins involved in cellular responses. Here we report the effect on protein expression levels in HzAM1 cells, an ovarian cell line from the moth *Helicoverpa zea*, after being subjected to 15 minutes of 42°C heat shock stress.

NMR ANALYSIS OF TWO NOVEL EUGENOL DERIVATIVES

Austin Lucht, Travis Reed, Troy Beck, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

The Diels-Alder reaction was carried out under various conditions with two main approaches: 1. solvent free refluxing of eugenol and cyclopentadiene and 2. the use of Lewis acid catalyst in THF solvent. The best results are with solvent free reflux at 150 °C for 24 hrs to give a relative yield, by GC/MS, of 30% of the Diels-Alder product, 4-(bicyclo[2.2.1]hept-5-en-2-ylmethyl)-2-methoxyphenol. The reaction transition states and products (4/8 possible stereoisomers) were modeled Spartan '06 DFT computational method B3LYP/6-31G*. Theory predicted the endo (RRR/SSS stereoisomers) transition state and product energies to be lower in energy than the exo isomers (RSS/SRR), however in all instances the energy differences are less than 6 kJ/mol.

Hydration of eugenol yielded the Markovnikov, non-rearranged product as the primary product. Surprisingly, this also correlates to the theoretical product predicted by using Spartan '06 DFT computational method B3LYP/6-31G*. Both products were purified by partitioning and column chromatography conditions using a 30% (v/v) mixture of acetone/hexane on silica gel, fractions collected and characterized by ¹H and ¹³C NMR, FT-IR spectroscopy and GC/MS.

INVESTIGATING THE MATRIX STRUCTURE REQUIRED FOR MINERALIZATION BY SERUM CALCIFICATION FACTOR

Brittini N. Likes, Blair K. Popple, Frank Miller, Mark V. Wilson, and Erin E. Wilson, Department of Chemistry, Doane College, Crete, NE 68333

Serum calcification factor (SCF) is a blood serum protein that has been found to cause mineralization in a wide variety of collagen matrices from demineralized bone matrix to artificial human bone matrix. We have previously reported that isolated type I and type II collagen are both mineralized by SCF in bovine blood serum. In this study the limits of chemical and three-dimensional structure on which SCF can act have been explored. Chitosan, a carbohydrate derivative used as a bone replacement scaffold, and a synthetic collagen-like self-assembling peptide (Pro-Hyp-Gly)₁₀, were tested in order to determine if they possess an appropriate chemical structure and adopt a close enough 3-D structure to native collagen to allow SCF-induced mineralization. Positive mineralization results for chitosan imply that the collagen triple helix is unnecessary for SCF function. Self-assembly of the synthetic collagen and characterization of the resulting structure will be presented, as well as results of the SCF-mineralization assays.

PREDICTION OF THE PKA OF WEAK ACIDS FROM DFT STUDIES

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

The determination of the pK_a of acids via experimental procedures can be very challenging. The experimental procedure involves obtaining pure samples and the proper determination of end points, which becomes more difficult for the weaker acids. A related problem is the determination of the protonation/deprotonation site for acids with multiple protonation sites. Recently, a procedure was devised in our laboratories to predict the pK_a of protonated nitrogenous bases using HF methods and Cramer-Truhlar solvation schemes utilizing commercially available computational programs. We have extended this procedure to an analysis of acids by employing ten model chemistries such as B3LYP/6-31+G(d, p), B3LYP/6-31+G(2d, 2p), B3LYP/6-31+G(df, pd), and B3LYP/6-31+G(2df, 2dp), and B3LYP/6-31+G(3df, 3pd), in an attempt to determine the most efficient model chemistry/resource consumption ratio. The selected acids and their conjugate bases were completely optimized to a stationary point on the Born-Oppenheimer surface. The difference in the computed energies of the acid and its conjugate base was graphed against experimental pK_a in an effort to identify a trend in which computed dissociation energy closely correlates with experimental pK_a.

EFFECTS OF PH ON THE GROWTH OF GREEN ALGA CHLORELLA

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Chlorella is a type of green algae that is generally acid tolerant. Culturing of Chlorella at different pH values was done to find the optimum pH for maximum growth. The experiment included the use of six different pH mediums, three sets of each, all with different pHs ranging from 4-9. An Alga-Gro concentrated medium, which is a sterile enriched medium for short term algal growth was used as the growth medium. KOH and HCl and a pH meter were used in adjusting the pH mediums. Cool white

fluorescent tubes were used as the light source because direct sunlight or incandescent bulbs generate excessive heat. As expected, experiment results showed maximum growth in weakly acidic and neutral conditions, that is, between the pH of 5 and 7. Strong acidic, pH 3 and 4, and strong alkaline conditions, pH 8 and 9, did not show any remarkable growth making these conditions inhibitors to growth.

BINDING STUDY OF B- AND Z-POLY(DG-DC)₂ WITH ORGANIC DYES

Adrian Draney, Han Chu, Michael A. Guericke, Kerry Lucas, and Andrea E. Holmes, Department of Chemistry, Doane College, Crete, NE 68333

Poly(dG-dC)₂, a long stranded nucleic acid, binds various molecules such as organic dyes to its minor groove. We studied the binding of 3-3'-diethylthiatricarbocyanine iodide to both the B and the Z form of Poly(dG-dC)₂. These binding events were able to be observed using absorbance spectroscopy, circular dichroism, and fluorescence spectroscopy. The stability of the DNA-dye complex was then evaluated for resistance to heat, light exposure, and time. There is evidence to show that both B and Z forms of Poly(dG-dC)₂ protect the dye from photobleaching due to the dye binding into the minor groove of the DNA.

The project is supported by the NIH grant number P20 RR016469 from the INBRE Program of the National Center for Research Resources and by the NSF (DUE-0633462) and CHE-0747949.

DESIGN OF POTENT GALECTIN INHIBITORS

T. Nguyen and E.J. Haas, Department of Chemistry, Creighton University, Omaha, NE 68178; and W.G. Chaney, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha, NE 68198-5870

Galectins are important carbohydrate binding proteins, implicated in a number of processes including inflammation, immunity, tumor growth and metastasis. Inhibitors of galectins are therefore valuable research tools as well as potential leads for pharmaceutical development. The goal of this research is to identify potent and highly specific inhibitors of these important proteins through a combination of computation and synthesis. Docking computations with AutoDock 3 software and a set of parameters developed for carbohydrate binding proteins were found not to be generally predictive of the affinity of known galectin-3 inhibitors. Progress attempting to improve the usefulness of these computations with AutoDock version 4 will be reported. It has been noted that careful assignment of atomic charges on the ligand with the semi-empirical molecular orbital calculation program MOPAC results in prediction of energetically more favorable binding.

COMPARISON OF TWO-PHOTON NADH INTENSITY IMAGING AND FLUORESCENCE LIFETIME IMAGING TO QUANTIFY CELLULAR ENERGETICS

Jorge Vergen, Clifford Hecht, Michael Nichols, Department of Physics, Creighton University, Omaha, NE 68178; and LeAnn Tiede, Department of Biomedical Science, Creighton University School of Medicine, Omaha, NE 68178

Matching specific cellular energy requirements with demand is a fundamental health determinant of individual cells, tissues, and organs. Two-photon excitation is currently an accepted method of quantifying cellular energetics however intensity based imaging alone cannot account for intracellular

factors such as the lifetime differences in free and enzyme-bound NADH. As an alternative method to intensity based optical imaging, studies by Blinova *et al.* 2004¹, and Vishwasrao *et al.* 2005², suggest that time-resolved fluorescence lifetime imaging (FLIM) may provide a more accurate assessment of cellular metabolic function. We are currently in the process of comparing the capabilities of intensity and FLIM imaging as a means of assessing cellular metabolism. By using metabolic inhibitors and uncouplers to modify the metabolic state, we have observed six distinct lifetime populations of NADH in osteoblast-like 2T3 cells that represent free and enzyme bound forms of NADH. We are now characterizing multicell tumor spheroids, in vitro tumors which generate cell populations with varying metabolic rates in a spherically symmetric system. By studying the various metabolic states located at different radii within the spheroid, we will compare NADH intensity imaging and FLIM in a realistic tumor environment.

¹Blinova, K, Combs, C, Kellman, P and Balaban, R S 2004 Fluctuation analysis of mitochondrial NADH fluorescence signals in confocal and two-photon microscopy images of living cardiac myocytes *J Microsc* 213 Pt 1 70-5.

²Vishwasrao, H D, Heikal, A A, Kasischke, K A and Webb, W W 2005 Conformational dependence of intracellular NADH on metabolic state revealed by associated fluorescence anisotropy *J Biol Chem* 280 26 25119-26.

DEVELOPMENT OF A MONOLITHIC HPLC COLUMN CAPABLE OF SEPARATING AND QUANTIFYING TAURINE, A COMMON COMPOUND FOUND IN ENERGY DRINKS

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High performance liquid chromatography (HPLC) is a common technique used to separate various components in samples. In this project we synthesized a chromatography column capable of separating the various components found in energy drinks and developed a laboratory procedure which could be implemented in either an undergraduate analytical or organic chemistry laboratory.

The most common type of monolithic support used in chromatographic applications is a methacrylate monolith. The methacrylate support is formed by polymerizing a mixture of monomer (glycidyl methacrylate), cross-linker (ethylene glycol dimethacrylate) and porogen (cyclohexanol and dodecanol). Although the porogen does not actually polymerize, it is necessary for the creation of pores that allow for the solvent to flow through the monolith. This monolith can then be used as a chromatographic support capable of separating organic compounds.

The monolith that was synthesized was modified slightly to accommodate the separation of taurine from the other components in the energy drink. This was performed by modifying the functional groups on the monomer to allow for ion-exchange. Once the ion-exchange column was synthesized, we developed a method which allowed for the separation and quantification of taurine. This was performed by changing the composition of the eluent (mobile phase).

APTAMER-BASED COLORIMETRIC SENSOR FOR NARCOTICS

Jordan Beaber, Jordan Groathouse, Kerry Lucas, and Andrea E. Holmes, Department of Chemistry, Doane College, Crete, NE 68333

Using specific aptamer sequences selected by SELEX and cocaine, our lab attempted to make a colorimetric sensor for narcotics. The aptamers form a three way junction, creating a hydrophobic pocket, which allows the dye and drugs to bind with the aptamer. Using a 96 well-plate assay, cyanine dye, and UV-Vis spectroscopy, we tested 42 aptamers with cocaine, methamphetamine, and ketamine. Results will be reported.

DETECHIP®: HIGHLY SELECTIVE MOLECULAR SENSORS FOR SMALL MOLECULES SUCH AS ILLICIT DRUGS

Jacob Francis, Shari Pacquette, Casey Gustafson, Kerry Lucas, and Andrea Holmes, Department of Chemistry, Doane College, Crete, NE 68333

We found novel, highly selective molecular sensors that show fluorescent and / or color change in the presence of small molecules such as illicit drugs. From the sensors we have developed an “on-site” illicit drug detection test kit called DETECHIP®. DETECHIP® creates a binary sequence numbers that is used to identify the unknown drug being tested.

ULTRA PERIPHERAL COLLISIONS AT RHIC

Jamison S. Duckworth and J. Seger, Department of Physics, Creighton University, Omaha, NE 68178

At RHIC (the Relativistic Heavy Ion Collider) two atomic nuclei move toward each other at near the speed of light. The atomic nuclei that have been collided include gold, deuterium, copper, and free protons. Creighton is a member of the collaboration that works on a detector called STAR, the Solenoidal Tracker At RHIC. The STAR detector is used to detect Ultra Peripheral Collisions, (UPCs). These collisions occur when the nuclei physically miss but still interact with each other electromagnetically. This electromagnetic interaction of atomic nuclei leaves both nuclei intact but can give off other particles. The presentation will explain the STAR detector and the physics of UPC's focusing on the production of rho mesons.

USE OF THE GENERALIZED EIKONAL APPROXIMATION METHOD TO TEST LIGHT SCATTERING BY A LEVITATED LARGE SPHERICAL DIELECTRIC

Jason Gerritsen, Department of Physics, Hastings College, Hastings, NE 68902

Light scattering is the redirection of light from its straight-line path. Light scattering occurs continuously in the Earth's atmosphere. Cloud droplets ranging from 20 to 150-micron in size scatter light via Mie scattering. An apparatus was designed to levitate droplets in this size range. Using a He-Ne laser, scattering from droplets was observed in the form of an interference pattern projected onto a CCD (Charge Coupled Device) array. Measurements of size parameter, refractive index and relative intensity as a function of scattering angle were made with the CCD. These measurements were then compared to the theoretical values predicted by the GEA (Generalized Eikonal Approximation).

CELL SIGNALLING AND THE OPTICAL STRETCHER

Timothy Smith and Michael Nichols, Department of Physics, Creighton University, Omaha, NE 68178

Although the macroscopic effects of osteoporosis are well known, the cellular cause of this disease has been intensely studied with no definitive results to indicate either the mechanism or cell type responsible for bone deficiencies. Our lab is currently characterizing the mechanical elasticity of bone cells and the method by which they communicate with the other bone cells by using the optical stretcher, a dual beam optical stretcher that allows for the study of individual living cells by controlling the pressure exerted along the major axis of the cell. We have spent the last several years characterizing the stretcher and refining the design to allow for higher throughput and ease of use. In addition, work has been done to measure the elasticity of osteoblast-like cells and red blood cells and members of the lab are now characterizing osteocyte-like cells. We have also developed an apparatus to perform high resolution fluorescence imaging of cells being stretched and have observed changes in Fluo-4 fluorescence, suggesting a change in cell calcium concentration as a result of the applied optical force. By monitoring the changing levels of calcium and other common signaling molecules, we hope to elucidate the mechanism by which bone mass is regulated.

SINGLE BUBBLE SONOLUMINESCENCE (SBSL) PRODUCTION IN A SPHERICAL RESONANT FIELD

Joe Jeanjaquet, Department of Physics, Hastings College, Hastings, NE 68902

Single Bubble Sonoluminescence (SBSL) consists of producing micrometer sized bubbles within a resonant acoustic field, resulting in the emission of light. The light is emitted when resonant sound waves cause the microscopic bubble to collapse and cavitate at supersonic speeds. This rapid and violent compression triggers the release of light and energy. Using an experimental set-up consisting of a spherical water-filled quartz flask, piezoelectric transducers and a power supply, SBSL was investigated. Bubble size was determined using Mie scattering techniques, while spectroscopic analysis allowed for measurements of light duration, composition and intensity.

INVESTIGATION OF THE SAFETY AND EFFICIENCY OF WIRELESS POWER TRANSFER USING COUPLED MAGNETIC RESONANCES

Jordan Neuhart, Department of Physics, Hastings College, Hastings, NE 68902

In 2007 a group of researchers at MIT developed and tested a method for wireless power transfer that used copper coils with strongly coupled magnetic resonances, achieving efficiencies between 40 and 50 percent when transferring 60 Watts over a distance of two meters. To verify their results, two helical copper coils with resonant frequencies of 10 MHz are constructed. The current in each coil is measured and used to determine the efficiency of a transfer of 60 Watts over several distances up to two meters. The results are compared to theory. A handheld spectral analyzer is used to measure the magnitude of the electric and magnetic fields and the Poynting vector at various distances from the source. The results were then compared with IEEE allowable radio frequency exposure guidelines to determine if the setup falls within the established guidelines.

TRACER DIFFUSION FOR A CONCENTRATED LATTICE GAS IN A REGULAR COMB STRUCTURE

P. M. Garcia, Department of Physics, Doane College, Crete, NE 68333

A regular comb lattice is composed of a long backbone of lattice sites with teeth, all having the same number of lattice sites, attached at equal intervals along the backbone. Such a structure is a simple example of a constrained geometry. Mass transport in such structures can often display anomalous features. In this investigation we study diffusion of a lattice gas in the comb structure. The model considered assumes a fixed concentration of non-interacting particles that can hop to nearest-neighbor sites. Double occupancy is not allowed. The system is simulated using a Monte Carlo procedure. The simulation shows normal diffusive behavior after a period of anomalous diffusion that increases as the tooth size increases. We also calculate the trap time distribution for tagged particles on a tooth as a function of concentration.

THE DESIGN, CONSTRUCTION AND TESTING OF A THERMOACOUSTIC REFRIGERATOR

Brian Steinert, Department of Physics, Hastings College, Hastings NE 68901

Many engines, heat pumps and refrigerators have multiple moving parts, which increases their complexity. A thermoacoustic refrigerator, on the other hand, has few moving parts. A thermoacoustic refrigerator was constructed using a loudspeaker, PVC pipe, Mylar sheeting, nylon line and thermocouples. This resulted in a refrigerator that is reliable, low cost and simple. The operational parameters of stack position, gas type and gas composition were changed to investigate their affects on overall performance and efficiency. This optimization was verified by the maximum temperature differences measured within the refrigerator.

CLUSTER GROWTH IN AQUEOUS MALTOSE SOLUTIONS MONITORED BY DYNAMIC LIGHT SCATTERING

Tri Tran and D. L. Sidebottom, Department of Physics, Creighton University, Omaha, NE 68178

Aqueous sugar solutions play a prominent role in the cryopreservation of biological tissues both in nature and in industry. However, the function of these sugars in protecting tissues during freezing and thawing is not fully understood. Some speculate that sugars function to promote vitrification of the solution as opposed to harmful crystalization. Others speculate that the sugar molecules preferentially coordinate with the tissue to produce a protective, hydrogen-bonded layer which serves to expel unwanted water. Here we report dynamic light scattering studies of aqueous maltose solutions which reveal that significant clustering of maltose occurs in these solutions. This cluster growth is shown to be consistent with the evolution towards an interconnected carbohydrate network forming at maltose concentrations near the percolation threshold observed in recent molecular dynamics simulations.

COMPUTATIONAL STUDIES OF NATURAL AND SYNTHETIC ESTROGEN

Rachel Faust, Rita Lindberg, and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

Synthetic estrogen, ethinyl estradiol, in combination with some synthetic form of progesterone, forms a pharmaceutical agent that is the most widely used form of oral contraceptives in the United States today. We began the present study with an examination of the history of drugs used as oral contraceptives. Next, we modeled (with the Gaussian software suite) 17-beta estradiol, estrone, ethinyl estradiol, and Tamoxifen. The species of interest were optimized to a stationary point on the Born-Oppenheimer surface using the B3LYP/6-31G(2df, pd) model chemistry. We examined the molecular geometry, location and energy differences of the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO), and the charge distribution in an attempt to understand the chemistry of the compounds.

A STUDY OF THE SOLAR CAPABILITIES OF THE NEBRASKA CLIMATE AND POSSIBLE PHOTOVOLTAIC SOLUTIONS

Eric J. Hauger, D.P. Blair, J. Brewer, and M.G. Cherney, Department of Physics, Creighton University, Omaha, NE 68178

Creighton University is in the design stage of a multi-million dollar alternative energy project. The University will invest in a solar cell array system to supplement some of the campus's energy needs. This study examines the varying energy yields of solar arrays due to changes in temperature, angle of light incidence, and surface reflectivity. In particular, we are looking into the climate variations in eastern Nebraska and how these variations would necessitate the selection of particular solar cell technologies. As this will serve as a prototype for commercial utility customers, design constraints include situating the array in a prominent location. The results of the design study will be presented.

BIOMECHANICAL MEASUREMENTS OF BONE CELLS USING THE OPTICAL STRETCHER

Anya Burkart, Physics Department, Creighton University, Omaha, NE 68178

The optical stretcher is a novel dual-beam trap capable of stretching individual living cells. Our ray-optics model accounts for focusing by the spherical interface and the effects of multiple internal reflections when computing the optical pressure on a thin spherical shell using exact ray-optics solutions, determined by numerical solution of Euler-Lagrange equations. Calibration studies with polystyrene spheres show excellent agreement between model predictions and experimental escape force measurements, and RBC elasticity measurements are consistent with literature values. We have used the stretcher to measure elasticity of murine 2T3 osteoblast-like cells, and find these cells are approximately 12 times stiffer than RBCs. We are currently investigating the possible correlation between mechanical stress-induced cell signaling and cellular elasticity by comparing the elasticity of murine 2T3 osteoblast-like cells and murine MLO-Y4 osteocyte-like cells. These investigations may improve our understanding of diseases such as osteoporosis and osteopetrosis, as well as skeletal structure changes in low gravity environments.

MEASUREMENT THEORY

Nolan Aljaddou, University of Nebraska at Omaha, Omaha, NE 68182

This work is an analytic establishment of the proper underlying theoretical foundation of the science of physics, in terms of its most fundamental precept – measurement – in order to formulate the proper solution to some of its ultimate problems as well as to explain some of its greatest mysteries. It is grouped into two primary sections, the first covering the purely mathematical foundation, with the latter the application of the mathematical tools derived in order to construct the proper physical foundation. These two groups are further divided into subsections exemplifying a dual logic premise/implication structure of establishing necessary first principles alone, followed by the ultimate extent of the logical consequences of those principles. In the mathematical section this takes the form of first addressing the mathematical principle common to all physical measurement and then demonstrating the extent of its logical application in deriving the various branches of mathematics necessary for physics. In the following physical section, the nature of fundamental measures such as space and time and their exact interrelationship is established, followed by an examination of their consequential manifest properties in producing the existence of matter and its counterpart anti-matter, as well as the nature of their mutual interaction. The origin of fundamental particle variety is then established, following its effects through to the cosmological phenomena of black holes and the big bang, and the organization of subatomic structure. The exposition concludes in deducing the fundamental universal principle which governs all physical phenomena in their varied forms. Broadly speaking, the categories of foundation established are listed in order as follows: Foundations of Mathematics, Fundamental Branches of Mathematics, Quantum Physics, General Relativity, Classical Physics, Elementary Particle Physics, Cosmology, and Unification Physics – covering the spectrum of general mathematical physics classification. Fundamental problems solved include: the identity of the most fundamental axiom of mathematics, the proper axiomatic establishment of the calculus, the proper derivation and establishment of the correct framework of quantum physics – and clarification of quantum misunderstanding – the explanation for matter’s curvature of space-time, the reason for classical inertia and the form of the electromagnetic equations, the explanation for the divisions of fundamental particles and the fundamental forces, the mathematical proof of the existence of Yang-Mills theory of chromodynamics and its relation to producing the big bang and the internal effects of black holes, the identity of the unification principle of physics, and several others. Its reductionist nature establishes that it is the ultimate, unique foundation of all physical principles and by its nature the only means of solving and understanding the essential problems addressed therein.

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FRIEND OF SCIENCE AWARD TO LOIS MAYO



Lois Mayo is a native of Joliet, Illinois and has resided in Lincoln, Nebraska since 1972. She holds an A.A. degree in Liberal Arts from Joliet Junior College, B.S. degree in Biological Science and Education from Illinois State University and a M.S. degree in Natural Science from Oklahoma State University.

Lois has served as the K-12 Science Curriculum Specialist for Lincoln Public Schools since 1998. Prior to coming to LPS, she taught biology, advanced biology, and mathematics at Pius X High School for 26 years in addition to being the Science Department Chair. She also taught biology, chemistry, and mathematics in Illinois and Oklahoma before coming to Lincoln.

Lois has been actively involved in many scientific organizations. She served on the Nebraska Association of Teachers of Science (NATS) Board for six years as Secretary and President. She was elected to separate terms to the National Science Teachers Association (NSTA) Board of Directors as Division XI Director representing Nebraska, Kansas, and Missouri and as Division Director for Coordination and Supervision. Lois is also a member of the Nebraska Academy of Science, National Science Educational Leadership Association (NSELA), Association for Supervision and Curriculum Development (ASCD), National Association of Biology Teachers (NABT), and Delta Kappa Gamma. She has given over 70 presentations at national, regional, state, and local professional meetings and has co-authored five juried papers.

Lois has received many honors including the Presidential Award for Excellence in Science Teaching, Outstanding Biology Teacher Award in Nebraska, Sigma Xi Outstanding High School Science Teacher, and Nebraska Teacher Day Recognition. She was a Genentech Access Excellence Fellow, Tandy Technology Scholar, and GTE Growth Initiatives for Teachers (GIFT) Fellow.

FRIEND OF SCIENCE AWARD TO CAROL WIPF

Carol has been a professional assistant with the Nebraska Department of Education for 35 years. She was raised in Weeping Water, Nebraska and graduated from Weeping Water High School in 1969. She started her career at Mutual of Omaha as a file clerk. Four years later she took a job with the Nebraska Department of Education where she has been a professional assistant for four NDE Directors of Science. Over the 35 years she has seen her responsibilities change from typing and editing state science guides for Nebraska science educators to assisting in the development, and implementation of the State Science Standards and Assessments.

Carol is best known however for her excellent work and dedication to the Nebraska Junior Academy of Sciences and the Nebraska Association of Teachers of Science. In these roles, she has assisted with registration, editing the final programs, coordinating mailings, and answering the myriad of questions coming in from students and teachers throughout the state.

Carol has four brothers, a sister, six nieces, seven nephews, five great-nieces, and two great-nephews. Outside of work she enjoys collecting dolls, Santas, and faeries in addition to spending time with her nephew, Jordan, who attends Nebraska Wesleyan University.

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