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PROGRAM and PROCEEDINGS, THE NEBRASKA ACADEMY OF SCIENCES (1880-2016) including the Nebraska Association of Teachers of Science (NATS) Division, Nebraska Junior Academy of Sciences (NJAS) Division, and Affiliated Societies: 136th Anniversary Year, One Hundred-Twenty-sixth Annual Meeting.

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**PROGRAM
and
PROCEEDINGS**

**THE NEBRASKA ACADEMY
OF
SCIENCES**

1880-2016

including the

**Nebraska Association of Teachers of Science
(NATS) Division**

**Nebraska Junior Academy of Sciences
(NJAS) Division**

**and
Affiliated Societies**



136th Anniversary Year

One Hundred-Twenty-sixth Annual Meeting

April 22, 2016

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

NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The 2016 Fall Conference of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, September 22 - September 24 (Thursday, Friday, and Saturday).

President: Lee Brogie, Wayne Junior/Senior High School, NE

President-Elect: Shauna Roberson, Garden County Schools, Oshkosh, NE

AFFILIATED SOCIETIES OF THE NEBRASKA ACADEMY OF SCIENCES, INC.

1. American Association of Physics Teachers, Nebraska Section

Web site: <http://www.aapt.org/sections/officers.cfm?section=Nebraska>

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 /Nebraska Chapter, Nat'l Council Sections

6. Nebraska Graduate Women in Science

7. Nebraska Ornithologists' Union

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

Publishers of the quarterly, *The Nebraska Bird Review*

Spring Meeting, May 16, 2016, Kimball, NE

Fall Meeting, September Dates and Location to be Announced

8. Nebraska Psychological Association

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

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

Web site: <http://sections.maa.org/nesesd/>

10. Nebraska Space Grant Consortium

Web site: <http://www.ne.spacegrant.org/>

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

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 \$70.00 for General Registrants which includes dues. Student registration is \$15.00, student dues are an additional \$10.00 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 \$5.00/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 periodically by the Academy for 44 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* has moved to a digital format and is available to anyone through the Digital Commons at the University of Nebraska–Lincoln. It is abstracted by major abstracting services as well. Manuscripts should be submitted via the online submission system at <http://digitalcommons.unl.edu/tnas/guidelines.html> using the Submit your paper or article link

Our website address is <www.nebraskaacademyofsciences.wildapricot.org>.

PROGRAM

FRIDAY, APRIL 22, 2016

- 7:30 a.m. REGISTRATION FOR ACADEMY, Lobby of Lecture wing, Olin Hall
- 8:00 Aeronautics and Space Science, Session A, Olin 249
Aeronautics and Space Science, Session B, Olin 224
Chemistry and Physics, Section A, Chemistry, Olin A
Collegiate Academy, Biology Session A, Olin B
- 8:10 Earth Science, Olin 325
- 8:15 Chemistry and Physics, Section B, Physics, Planetarium
- 8:30 Biological and Medical Sciences, Session A, Olin 112
Biological and Medical Sciences, Session B, Smith Callen Conference Center
- 9:00 Anthropology, Olin 111
Collegiate Academy, Chemistry and Physics, Session A, Olin 324
Environmental Sciences, Olin 325
- 9:10 Aeronautics and Space Science, Poster Session, Olin 249
- 10:30 Aeronautics and Space Science, Poster Session, Olin 249
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN B – Dr. Juliane Soukup, “Riboswitches Turn Students
Onto Research”. Scholarship and Friend of Science Recipients also announced.
- 12:00 LUNCH, PATIO ROOM, STORY STUDENT CENTER
(Pay and carry tray through cafeteria line, or pay at NAS registration desk)
Aeronautics Group, Sunflower 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
Collegiate Academy, Biology Session A, Olin B
Collegiate Academy, Chemistry and Physics, Session B, Olin 324
Teaching of Science and Math, Olin 325
- 1:25 Applied Science and Technology, Olin 224
- 3:15 History and Philosophy of Science, Olin 224
- 4:30 BUSINESS MEETING, OLIN B

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

AERONAUTICS AND SPACE SCIENCE

Chairperson: Scott E. Tarry

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

SESSION A

Olin Hall Room 249

- 8:00 1. TARGETING THE PHOSPHORYLATED RPA:RAD52 COMPLEX FOR CANCER THERAPEUTICS. Mona Al-Mugotir*, Lucas Struble, and Krysten E. Vance, Department of Biochemistry and Molecular Biology, Gloria E. O. Borgstahl, Jacob Remsza, and Carol Kolar, Eppley Institute, Fred and Pamela Buffett Cancer Center, University of Nebraska Medical Center, Omaha.
- 8:10 2. HUMAN RAD52, RPA, AND DNA: STRUCTURE AND COMPLEX INTERACTION. Lucas Struble, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.
- 8:20 3. LARGE VOLUME CRYSTAL GROWTH OF SUPEROXIDE DISMUTASE IN MICROGRAVITY FOR NEUTRON DIFFRACTION STUDIES. Jahaun Azadmanesh*, Department of Biochemistry and Molecular Biology; and Scott Trickel, Carol Kolar, and Gloria E. O. Borgstahl, Eppley Institute for Research in Cancer and Allied Diseases, University of Nebraska Medical Center, Omaha.
- 8:30 4. MECHANICALLY-INDUCED OSTEOCYTE/TH17 CELL SIGNALING AND SUBSEQUENT OSTEOCLAST RECRUITMENT. Travis McCumber* and Diane Cullen, Department of Biomedical Sciences, Creighton University, Omaha.
- 8:40 5. EFFECTS OF VIRTUAL UPHILL WALKING ON LOCOMOTOR-RESPIRATORY COUPLING. William Denton* and Jennifer Yentes, Biomechanics, University of Nebraska at Omaha.
- 8:50 6. LOCOMOTOR ADAPTATION THROUGH MULTIPLE SENSORY MODALITY AUGMENTATION IN ASTRONAUTS. Jessica Fujan-Hansen, Biomechanics, University of Nebraska at Omaha.
- 9:00 7. DEVELOPMENT OF A TREADMILL WITH A DYNAMICALLY ADAPTIVE SURFACE. Travis Vanderheyden* and Kota Takahashi, Biomechanics, University of Nebraska at Omaha.
- 9:10 BREAK/POSTER PRESENTATIONS
- 9:30 8. THE ROLE OF VESTIBULAR PERCEPTION IN LEARNING A NOVEL LOCOMOTOR TASK. Allison Hoover* and Mukul Mukherjee, Biomechanics, University of Nebraska at Omaha.

- 9:40 9. VALIDITY OF WEARABLE FITNESS TRACKERS ON SLEEP MEASURE. Alyssa K. Keill* and Jung-Min Lee, Health, Physical Education and Recreation, University of Nebraska at Omaha.
- 9:50 10. EFFECTS OF ENVIRONMENTAL STRESS ON TELESURGICAL SKILLS LEARNING. Moshen Zahiri and Carl A. Nelson, Mechanical and Materials Engineering, University of Nebraska–Lincoln, and Ka-Chun Siu*, Physical Therapy Education, University of Nebraska Medical Center, Omaha.
- 10:00 11. EFFECTS OF HAND DOMINANCE ON POSTURAL CONTROL DURING LAPAROSCOPIC SKILLS PRACTICE USING VIRTUAL REALITY SIMULATION. Anthony White*, College of Medicine, Chun-Kai Huang and Ka-Chun Siu, Physical Therapy Education, and Dmitry Oleynikov, Department of Surgery, University of Nebraska Medical Center, Omaha.
- 10:10 12. EFFECTS OF A TRANSITIONAL 3D-PRINTED PROSTHETIC HAND ON CO-CONTRACTION IN CHILDREN WITH UPPER LIMB DIFFERENCES. Jorge M. Zuniga, Dimitrios Katsavelis, and Ryan Smith*, Exercise Science and Pre-Health Professions, Creighton University, Omaha.
- 10:20 13. CASE STUDY: ULTRASOUND ANALYSIS OF ECHOINTENSITY AND ORPHOLOGY IN FOREARMS OF A TRANSRADIAL AMPUTEE. Maggie Fleita* and Maggie Griffin*, Exercise Science and Pre-Health Professions, and Joey Bowens*, School of Medicine, Creighton University, Omaha.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. THE NEIGHBORHOOD OF LOW-Z LOBAL QSOS. Wyatt Behn, Department of Physics and Astronomy, University of Nebraska at Kearney.
- 11:00 15. TOWARDS ULTRA-FAST SOLVENT EVAPORATION, THE DEVELOPMENT OF A COMPUTER CONTROLLED SOLVENT VAPOR ANNEALING CHAMBER. Gunnar Nelson*, Chloe Drapes, Meagan Grant, Jeffrey Wong, and Andrew Baruth, Department of Physics, Creighton University, Omaha.
- 11:10 16. DEVELOPMENT OF AUTOMATION AND ANALYSIS SOFTWARE FOR AN ARRAY OF COMMERCIAL RADIO DISHES. Matthew Hormandl, Department of Physics and Astronomy, University of Nebraska–Lincoln.
- 11:20 17. STATUS AND UPGRADES TO THE BEHLEN OBSERVATORY 30-INCH TELESCOPE AT THE UNIVERSITY OF NEBRASKA–LINCOLN. Shelby Clausen* and Celeste Labeledz, Department of Physics and Astronomy, and Emma Schneider, Department of Mathematics, University of Nebraska–Lincoln.
- 11:30 18. UNL RADIO TELESCOPE ARRAY PROJECT, AUTOMATED TRACKING MOUNTS. Nicole Benker, Department of Physics and Astronomy, University of Nebraska–Lincoln.

- 11:40 19. CONTROL SYSTEM DESIGN FOR THE RADIO ARRAY PROJECT AT THE UNIVERSITY OF NEBRASKA–LINCOLN. Jennifer Hamblin* and Savanna McDonald, Department of Physics and Astronomy, University of Nebraska–Lincoln.
- 11:50 20. PECVD OF BORON CARBIDE FOR NEUTRON VOLTAICS. N. J. Ianno*, Department of Electrical and Computer Engineering, A. Enders and P.A. Dowben, Department of Physics and Astronomy, University of Nebraska–Lincoln.

AERONAUTICS AND SPACE SCIENCE

Chairperson: Michaela Lucas

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

SESSION B

Olin Hall Room 224

- 8:00 1. COLLEGE OF SAINT MARY ELEMENTARY SCIENCE OUTREACH PROGRAM: GROWING INTERACTIONS WITH SCHOOLS AND STUDENTS. Colleen Bernal* and Hannah Pauley*, Department of Biology, College of Saint Mary, Omaha.
- 8:10 2. REACH FOR THE SKIES SATURDAY SPACE SCIENCE. Kayla Daniels*, Meghan Krajcek*, Leah Uhlir, Jennifer Balmat, Ann Buchmann, and Mike Leite, Department of Physical and Life Sciences; and Tatum Renken*, Department of Education (Elementary Endorsement); and Mikayla Bower and Lane Swedberg, Department of Education (Secondary Science Endorsement); and Douglas Poole and Beth Wentworth, Department of Mathematics, Chadron State College, Chadron.
- 8:20 3. DESIGNING ECOSYSTEM ANALYSIS FOR EDUCATORS, A UNO GRADUATE BIOLOGY COURSE, WITH SUPPORT FROM A NASA COURSE DEVELOPMENT MINI-GRANT. Carol Engelmann*, Department of Biology, and Ashlee Dere*, Department of Geology/Geography, University of Nebraska at Omaha.
- 8:30 4. ARDUINO TEACHING MODULES. Chase Cushman* and William Spurgeon, Department of Business and Information Technology, Western Nebraska Community College, Scottsbluff.
- 8:40 5. 3D PRINTING STEM RESOURCE MANUAL. Marc Petrykowski* and Jorge Zuniga, Department of Exercise Science and Pre Health Professions, Creighton University, Omaha.
- 8:50 6. P-ROBOTS (PROGRAMMING ROBOTS SUITE). Jose Baca* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 9:00 7. AUTONOMOUS UAV NAVIGATION IN GPS-DENIED ENVIRONMENTS USING APRILTAGS. Sonum Chowdary Vuppuluri* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 9:10 BREAK/POSTER PRESENTATIONS

- 9:30 8. AUTONOMOUS UAV NAVIGATION IN AN INDOOR ENVIRONMENT. Venkat Ramana Reddy Garlapati* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 9:40 9. SIMULTANEOUS CONFIGURATION FORMATION AND INFORMATION COLLECTION BY MODULAR ROBOTIC SYSTEMS. Ayan Dutta* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 9:50 10. FAST PATH PLANNING USING EXPERIENCE LEARNING FROM OBSTACLE PATTERNS. Olimpiya Saha* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 10:00 11. MULTI-ROBOT INFORMED PATH PLANNING UNDER COMMUNICATION CONSTRAINTS. Brad Woosley* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 10:10 12. ROUTING OPTIMIZATION IN INTERPLANETARY NETWORKS. Sara El Alaoui* and Byrav Ramamurthy, Department of Computer Science and Engineering, University of Nebraska–Lincoln.
- 10:20 13. PRELIMINARY CONCEPT FOR USING MANUFACTURING ROBOTS AS SURGICAL ASSISTANTS. Alex Drozda* and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. AUTONOMOUS VEHICLE NAVIGATION. Bailey Roth* and William E. Spurgeon, Department of Business and Information Technology, Western Nebraska Community College, Scottsbluff.
- 11:00 15. DEPLOYABLE AND RETRACTABLE BOOM SYSTEMS FOR MICROGRAVITY PAYLOADS. Taylor Kerl* and Christopher Volle, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 11:10 16A. 2015-16 UNL UAV- INTERNATIONAL AERIAL ROBOTICS COMPETITION. Alex Drozda, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 11:15 16B. 2015-16 UNL ROCKETRY- MIDWEST HIGH POWER ROCKETRY COMPETITION. Alex Drozda, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 11:20 17. UNIVERSITY OF NEBRASKA–LINCOLN DESIGN/BUILD/FLY. Jacob Quint, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 11:30 18. ASTEROID SAMPLE COLLECTION DEVICE. Maggie Clay*, Carl Nelson, Ethan Monhollon, Luke Monhollon, Blake Stewart, and Kellon Ronspies, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.

- 11:40 19. STRATIGRAPHIC POSITION AND AREAL DISTRIBUTION OF CONGLOMERATES IN THE SPOTTED TAIL RANGE OF DAWES COUNTY, NEBRASKA. Miles D. Chasek*, Jennifer L. Balmat, Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron; and Hannan E. LaGarry, Department of Math, Science, and Technology, Oglala Lakota College, Kyle, SD.
- 11:50 20. ROLE OF HYDROPONIC MEDIA IN THE EPIDEMIOLOGY OF PYTHIUM ROOT ROT OF LETTUCE. Karen Saavedra* and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha.

AERONAUTICS AND SPACE SCIENCE

Chairperson: Scott E. Tarry
NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

POSTER SESSION

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

ANALYSIS OF QUASAR OUTFLOW ABSORPTION LINES. Sean Lindgren* and Jack Gabel, Department of Physics, Creighton University, Omaha.

FUNCTIONAL CHARACTERIZATION OF ANTIOXIDATION SIGNALING AND CELL-CYCLE REGULATION IN THE RICE BLAST FUNGUS MAGNAPORTHE ORYZAE. Lauren Segal* and Richard A. Wilson, Department of Plant Pathology, University of Nebraska–Lincoln.

EFFECTS OF AUDITORY STIMULUS NOISE LEVELS ON THE LOCOMOTOR-RESPIRATORY COUPLING. Casey Wiens, Biomechanics, University of Nebraska at Omaha.

HUMAN SKELETAL MUSCLE RESPONSE TO TEMPERATURE. Roksana B. Zak*, Robert J. Shute, and Dustin R. Slivka, Health, Physical Education, and Recreation, University of Nebraska at Omaha.

DEVELOPING ANDROID BASED MOBILE APP TO STUDY HOUSEHOLD EMISSIONS OF CARBON DIOXIDE GAS BY MONITORING INDIVIDUAL UTILITY BILLS. Megan Kyle* and Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha.

CLIMATE CHANGE AND WEATHER DATA COMPARISONS: A COMPARATIVE STUDY OF LOCAL, STATE, NATIONAL AND GLOBAL WEATHER INFORMATION. Christina Coffman*, Falon Torez*, Lorrain Smith*, and Thomasina Whipple*, Department of Math and Science, Nebraska Indian Community College, Niobrara.

PRODUCTION OF PYTHIUM INOCULA FOR EPIDEMIOLOGICAL STUDIES IN HYDROPONICS. Demi Eble* and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha.

ACTIVE GALACTIC NUCLEI CONTINUUM AND BROAD ABSORPTION LINE
VARIABILITY. Jack Widmer* and Jack Gabel, Department of Physics, Creighton
University, Omaha.

ANTHROPOLOGY

Co-chairs: Aaron Pattee and Wayne Babchuk
Department of Anthropology
University of Nebraska–Lincoln
Olin Hall 111

- 9:00 WELCOME AND INTRODUCTION TO MORNING SESSIONS. Aaron Pattee,
President, AnthroGroup, Department of Anthropology, University of Nebraska–Lincoln
- 9:10 1. LINGUISTIC ANTHROPOLOGY: HIGH GERMAN AS A CASE STUDY OF THE
SIGNIFICANCE OF HISTORICAL LINGUISTICS. Aaron Pattee, Department of
Anthropology, University of Nebraska–Lincoln
- 9:30 2. HISTORICAL AND PRESENT-DAY CHALLENGES OF PRESERVING THE
LIVONIAN LANGUAGE IN THE BALTICS. Enia Kiusals, Department of
Anthropology, University of Nebraska–Lincoln.
- 9:50 3. BIG BRAINS: WHY ONE DEFINING TRAIT OF “HUMAN-NESS” IS SO UNIQUE.
Sean Field, Department of Anthropology, University of Nebraska–Lincoln.
- 10:10 4. A COMPARISON OF CRANIOMETRIC METHODS: RELIABILITY OF
THREE-DIMENSIONAL SCANNING METHODS TO DIRECT HAND-HELD
MEASUREMENTS. Megan Hoffman* and Emily Hammerl, Department of
Anthropology, University of Nebraska–Lincoln.
- 10:30 BREAK
- 10:40 5. AN OVERVIEW OF THE ETIOLOGY OF FOOD ALLERGIES AND THEIR
PREVALENCE IN DIFFERENT ETHNIC GROUPS. John Wagoner, Department of
Anthropology, University of Nebraska–Lincoln.
- 11:00 6. ARCHAEOPARASITOLOGICAL AND DIETARY ANALYSES OF DOG (CANIS
FAMILIARIS) COPROLITES FROM LA CUEVA DE LOS MUERTOS CHIQUITOS
(600-800 CE), RIO ZAPE VALLEY, DURANGO, MEXICO. Ruth E. Grady*, Johnica
J. Morrow, and Karl J. Reinhard, School of Natural Resources, University of Nebraska–
Lincoln.
- 11:20 7. ACCESS TO RESOURCES AND SERVICES FOR MALE SURVIVORS OF
INTIMATE PARTNER VIOLENCE: A HOLISTIC AND INTERDISCIPLINARY
PERSPECTIVE. Alexandra Martin, Department of Children, Youth, and Family Studies,
University of Nebraska–Lincoln.
- 11:40 8. SEX WORK, PUBLIC POLICY, AND STIGMA. Abby Wild, Department of
Anthropology, University of Nebraska–Lincoln.

- 12:00-1:00 LUNCH
- 1:00 p.m. WELCOME AND INTRODUCTION TO AFTERNOON SESSIONS. Chelsey Pounds, Vice- President, AnthroGroup, Department of Anthropology, University of Nebraska–Lincoln.
- 1:10 9. NICHE MARKETPLACE INFLUENCES ON POST-HARVEST COFFEE PROCESSING DECISIONS. Jonathan E. Ferguson, Department of Anthropology, University of Nebraska–Lincoln.
- 1:30 10. A RESILIENT POMPEII: APPLYING RESILIENCY THEORY TO POST-EARTHQUAKE OF 62 CE POMPEII. Rebecca Salem, Department of Anthropology, University of Nebraska–Lincoln.
- 1:50 11. USING GRAVESTONE PATTERNS AS A FORM OF NON-INVASIVE ARCHAEOLOGICAL RESEARCH. Erik Schulz, Department of Anthropology, University of Nebraska–Lincoln.
- 2:10 12. THE BIOARCHAEOLOGY OF VIOLENCE: SKELETAL ANALYSIS ON VICTIMS OF TORTURE AND BRUTAL EXECUTION IN MEDIEVAL AND EARLY MODERN EUROPE. Lindsey Peterson, Department of Anthropology, University of Nebraska–Lincoln.
- 2:30 13. EMERGING IN CONTROVERSY AND FUELED BY NEW TECHNOLOGIES: BIOARCHAEOLOGY REVEALS A STORIED PAST. Maia Behrendt, Department of Anthropology, University of Nebraska–Lincoln.
- 2:50 14. USDA/UNL ARTIFACT ROADSHOWS: THE DEVELOPMENT OF A 2D ARCHIVE OF GREAT PLAINS PROJECTILE POINTS FROM PRIVATE LANDS. Maia Behrendt, Department of Anthropology, University of Nebraska–Lincoln.
- 3:10 BREAK
- 3:20 15. USDA-UNL ARTIFACTS ROADSHOW DIGITAL ARCHIVE: REDUCING PROCESSING TIME AND INCREASING MODEL SUCCESS RATES IN 3D PHOTOGRAMMETRY. Amos Sobotka, Department of Anthropology, University of Nebraska–Lincoln.
- 3:40 16. VICTORIAN DOMESTICITY ON THE FRONTIER: AN EXAMINATION OF NINETEENTH CENTURY ARCHAEOLOGICAL MATERIALS FROM A LINCOLN CISTERN. Kami Ahrens, Department of Anthropology, University of Nebraska–Lincoln.
- 4:00 17. RETRACING NEBRASKA’S EUROPEAN PAST THROUGH DIGITAL RESEARCH METHODS OF PRESERVATION. Chelsey Pounds, Department of Anthropology, University of Nebraska–Lincoln.
- 4:20 18. DIGITAL HERITAGE AND PUBLIC OUTREACH: THE CREATION OF ‘YOUR NATIONAL GRASSLANDS STORY’ WEBSITE. Lexus Wellman* and Luke Hittner, Department of Anthropology, University of Nebraska–Lincoln.

APPLIED SCIENCE AND TECHNOLOGY

Chairperson: Mary Ettel
Wayne State College, Wayne
Olin Hall 224

- 1:25 OPENING REMARKS
- 1:30 1. IMPROVING BORON CARBIDE NEUTRON VOLTAICS. Ethiyaj Raj Wilson*, Elena Escheverria, George Petersen, Michael Nastasi, Sean King, Tino Hofmann, Axel Enders and Peter A. Dowben, University of Nebraska–Lincoln; and Bing Dong and Jeffrey Kelber, University of North Texas, Denton, TX.
- 1:45 2. HOLLAND COMPUTING CENTER: COMPUTATIONAL RESOURCES FOR COLLABORATIVE NEBRASKA SCIENCE. David R. Swanson, Holland Computing Center, University of Nebraska–Lincoln.
- 2:15 BREAK
- 2:20 3. DETERMINING SUSCEPTIBILITY GENE EBE VARIATION ACROSS 3,000 SEQUENCED RICE GENOMES. Dalton Bichlmeier*, Blake Kostal, Michael Shavlik, and Erin Doyle, Department of Biology, Doane College, Crete.
- 2:35 4. NORTHWESTCHEM: A HIGH-PERFORMANCE COMPUTATIONAL CHEMISTRY SOFTWARE SUITE. Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 2:50 5. IDENTIFYING GENETIC LOCI ASSOCIATED WITH MORPHOLOGICAL PHENOTYPES FROM MOUSE BRAIN IMAGE DATA AS AN UNDERGRADUATE COURSE PROJECT. Tyler Brookshire*, Hunter Creglow, Nolan Field, Qing Li, Michael Shavlik, Jessica Swanger, Erin Doyle, and Tessa Durham Brooks, Department of Biology, Doane College, Crete.

BIOLOGICAL AND MEDICAL SCIENCES

Chairperson: Annemarie Shibata
Department of Biology, Creighton University

SESSION A

Session Chairperson: Brandon Luedtke University of Nebraska Kearney
Olin 112

- 8:30 1. UNDERSTANDING THE ROLE OF OXYGEN IN THE STABILITY OF A PUTATIVE NICKEL BINDING SITE IN A NICKEL. Melissa Davison* and Amanda Glass, Department of Chemistry, University of Nebraska at Kearney.
- 8:41 2. PATTERNS OF ANTIMICROBIAL RESISTANT E. COLI ISOLATED FROM DOMESTIC AND WILD DOGS IN NORTHERN NEBRASKA. Megan McLean*, Brianna Butler, and Ann Buchmann, Chadron State College, Chadron.

- 8:52 3. PREDICTED GLUTAMIC ACID-RICH PROTEIN GENE KNOCKOUT CRITICALLY IMPAIRS THE ABILITY OF TOXOPLASMA GONDII TO FORM CYSTS. Maggie Bartlett*, Prasad Potluri, and Paul Davis, University of Nebraska at Omaha.
- 9:03 4. EXPLORATION OF CELL WALL PERMEABILITY TO ANTIBIOTIC GLMS RIBOSWITCH ANALOGS. Nick Bartschat* and Juliane K. Soukup, Department of Chemistry, Creighton University, Omaha.
- 9:14 5. CIRCULAR DICHROISM AS A TOOL TO DEFINE THE ELECTRONIC STRUCTURE OF METAL-BINDING PEPTIDES. Ellie Lesiak* and Amanda Glass, Department of Chemistry, University of Nebraska at Kearney.
- 9:25 BREAK
- 9:40 6. COMPARISON OF SELF-ETCH ADHESIVES WITH ATOMIC FORCE MICROSCOPY AND OPTICAL PROFILOMETRY AND ITS IMPLICATIONS. Nicholas G. Fischer* and Andrew Baruth, Department of Physics; and Wayne W. Barkmeier, School of Dentistry, Creighton University, Omaha, NE; and Toshiki Takamizawa, School of Dentistry, Nihon University, Tokyo, Japan.
- 9:51 7. PREVALENCE OF PATHOGENIC BACTERIA IN THE AMERICAN DOG TICK (*DERMACENTOR VARIBILIS*) IN DAWSON COUNTY, NEBRASKA. Nathan Harms*, Parth Chaudhari, Brandon Luedtke, and Julie Shaffer, Department of Biology, University of Nebraska at Kearney; and Travis Bourret, Medical Microbiology and Immunology, Creighton University School of Medicine, Omaha.
- 10:02 8. MOLECULAR PHYLOGENY AND BIOGEOGRAPHICAL HISTORY OF SUBTRIBE NEPETINAE (LAMIACEAE): AN EXAMINATION OF THE EAST ASIAN AND NORTH AMERICAN DISJUNCTION WITHIN THE GENUS AGASTACHE. Joshua Wiese* and Bryan Drew, Department of Biology, University of Nebraska at Kearney.
- 10:13 9. BUGGY CREEK VIRUS DISTRIBUTION AND DYNAMICS IN SWALLOW BUGS (*OECIACUS VICARIUS*) IN CLIFF SWALLOW (*PETROCHELIDON PYRRHONOTA*) COLONIES IN SOUTHEAST NEBRASKA AND SOUTHWEST IOWA. Troy Rowan* and Carol Fassbinder-Orth, Department of Biology, Creighton University Omaha.
- 10:24 10. PHOSPHATIDYLINOSITOL-4-PHOSPHATE AND OXYSTEROL BINDING PROTEINS ARE NECESSARY FOR LYSOPHOSPHOLIPID TRANSPORT IN *SACCHAROMYCES CEREVISIAE*. Jaquelin Garcia*, Surabhi Naik, Michael Schwabe, and Wayne Riekhof, Department of Biology, University of Nebraska–Lincoln.
- 10:35 11. PARASITES AS AN ECOLOGICAL BAROMETER. Allison Hanser*, Samuel Hagen* and John Shea, Department of Biology; and Rebecca Gasper, Department of Math, Creighton University, Omaha; and Requa West, Oglala Lakota College, SD.
- 11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

Session Chairperson: Kim Carlson, University of Nebraska Kearney
Smith Callen Conference Center

- 8:30 1. MUTANT BVDV WITH MODIFIED NPRO INDUCES TYPE I INTERFERON PRODUCTION VIA RLR-DEPENDENT PATHWAYS (INCLUDING: MAVS, TBK-1, PKR, IRF-3 AND IRF-7). Abdulrahman Alkheraif*, Christina Topliff, Jayagopala Reddy, and Clayton Kelling, School of Veterinary Medicine and Biomedical Sciences, University of Nebraska–Lincoln.
- 8:41 2. CHARACTERIZING METAL BINDING IN PEPTIDES DERIVED FROM THE SLYD METALLOCHAPERONE USING ISOTHERMAL TITRATION CALIBRATION. Nicholas Hinz*, Keegan McGill*, and Amanda Glass, Department of Chemistry, University of Nebraska at Kearney.
- 8:52 3. INFLUENCE OF SIR-2 ON PHYSIOLOGICAL DNA BREAKS IN ALZHEIMER’S DISEASE MODEL *DROSOPHILA MELANOGASTER*. Erica Ragatz* and Ann Buchmann, Chadron State College, Chadron.
- 9:03 4. MOLECULAR AND PHYSIOLOGICAL RESPONSE OF *MEDICAGO SATIVA L.* (ALFALFA) TO SALINITY STRESS. Casey Sutton* and Paul Twigg, Department of Biology, University of Nebraska at Kearney.
- 9:14 5. A REVIEW OF EXPERIMENTAL COMPOUNDS DEMONSTRATING ANTI-TOXOPLASMA ACTIVITY. Madalyn M. McFarland*, Sydney J. Zach*, Andrew J. Neville, Xiaofang Wang, Jonathan L. Vennerstrom, and Paul H. Davis, Department of Biology at the University of Nebraska at Omaha.
- 9:25 BREAK
- 9:40 6. CHARACTERIZING NORTHERN GOSHAWK HABITAT AND PREDICTING POTENTIAL LOSSES TO CLIMATE CHANGE. Marilyn Wright*, Jenelle Jackson, Victor Murphy, Erika Higa, Sean McCartney, Amanda Clayton, Ross Nelson, John Bolten, and Nate Bickford, Department of Biology, University of Nebraska at Kearney.
- 9:51 7. FLOWER VISITS BY MONARCH BUTTERFLIES AT FOUR EASTERN NEBRASKA PRAIRIES. Robert T. Wankmuller* and Theodore Burk, Department of Biology, Creighton University, Omaha.
- 10:02 8. ORANGE SULPHUR BUTTERFLIES, *COLIAS EURYTHEME*, ACQUIRE SUBSTANTIAL AMOUNTS OF POLLEN WHEN VISITING PRAIRIE FLOWERS. Hannah L. Mullally*, Theodore Burk, and Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha.

- 10:13 9. REPRODUCTIVE DEVELOPMENT IN THE AQUATIC SPECIES *RUPPIA MARITIMA*. Christie L. Dang, Bridget L. Giffei, Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha.
- 10:24 10. CHARACTERIZATION OF THE PROGAMIC PHASE IN *RUPPIA MARITIMA*. Bridget L. Giffei*, Christie L. Dang and Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha.
- 10:35 11. CLONING, EXPRESSION AND CHARACTERIZATION OF 5-AMINOLAEVULINIC ACID DEHYDRATASE FROM *ESCHERICHIA COLI*. Jordan Ingersoll*, Department of Biology; and Frank Kovacs, Department of Chemistry, University of Nebraska at Kearney.
- 11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

BIOLOGICAL AND MEDICAL SCIENCE

SESSION C

Session Chairperson: Annemarie Shibata, Creighton University
Olin 112

- 1:00 1. QUANTIFYING *PSEUDOMONAS AERUGINOSA* USING FLUORESCENCE SPECTROSCOPY. Macduff O. Okuom*, Jasmin Sandoval, Derek Sabatka, and Andrea E. Holmes, Department of Chemistry, Doane College, Crete.
- 1:11 2. INVESTIGATING THE POTENTIAL ROLE OF LONG NON-CODING RNA IN MICROGLIAL POLARITY. Manaswita Tappata* and Annemarie Shibata, Department of Biology, Creighton University, Omaha.
- 1:22 3. TRANSLOCATION OF DOLUTEGRAVIR-PLGA-NP AND DOLUTEGRAVIR-CELLULOSE ACETATE PHTALATE-NP INTO HUMAN CELLS. Marisa Varghese*, Charlton Meyer, and Annemarie Shibata, Department of Biology; and Subhra Mandal and Christopher Destache, School of Pharmacy and Health Professions, Creighton University, Omaha.
- 1:33 4. INVESTIGATION OF THE TRANSMISSIBLE MINK ENCEPHALOPATHY SPECIES BARRIER EFFECT VIA AGGREGATION AND SOLUBILITY SCREENING ALGORITHMS. William Graft *, Department of Mathematics; and Jason C. Bartz, Department of Medical Microbiology and Immunology; and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 1:44 5. INTERACTIONS AND ORIENTATION OF THE PRION PROTEIN AT THE MEMBRANE INTERFACE. Jesse Woo*, Department of Mathematics; and Jason C. Bartz, Department of Medical Microbiology and Immunology; and Patricia Soto, Department of Physics, Creighton University, Omaha.

- 1:55 BREAK
- 2:10 6. GROWTH SUPPRESSIVE EFFECTS OF INHIBITORS OF STAT3, SYK, AND BRAF ON CHRONIC LYMPHOCYTIC LEUKEMIA: SUPERIOR EFFICACY OF STAT3 INHIBITOR. Melissa Shadoin*, Ashima Shukla, and Shantaram Joshi, Genetics, Cell Biology, and Anatomy Department, University of Nebraska Medical Center in Omaha.
- 2:21 7. THE TWO MICROELECTRODE VOLTAGE CLAMP: TALKING WITH PROTEINS ELECTRICALLY. Kari Heck*, Biological Systems Engineering; and Hideaki Moriyama, Biological Sciences, University of Nebraska–Lincoln.
- 2:32 8. INTRON DEGENERATION AND HETEROGENIETY IN THE LICHEN FUNGI *TELOSCHISTES*. Dawson Johnson*, Derek Kleier, and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney.
- 2:43 9. GENETIC AND PHYSIOLOGICAL RESPONSES TO DROUGHT STRESS IN ALFALFA. Karolina Kodin*, Natasha Anderson, and Paul Twigg, Department of Biology, University of Nebraska at Kearney.
- 2:54 10. USING COMPUTATIONS TO DEFINE POSSIBLE GEOMETRIES FOR NICKEL-PEPTIDE COMPLEXES TO UNDERSTAND NICKEL BINDING IN A NICKEL METALLOCHAPERONE. Seth D. Springer* and Amanda M. Glass, Department of Chemistry, University of Nebraska at Kearney.
- 3:05 11. GENERATION OF A FLUOROGEN-ACTIVATING TAG FOR *CANDIDA ALBICANS* PROTEIN LOCALIZATION. Christopher M. Dziatkowski* and Jill R. Blankenship, University of Nebraska at Omaha.
- 3:16 12. STRUCTURES RELATING TO VIRULENCE CHARACTERIZED BY SHAPE ANALYSIS OF CHIMERIC COXSACKIEVIRUS 5' UNTRANSLATED REGION RNA. Emily Keit* and William Tappich, Department of Biology, University of Nebraska at Omaha.
- 3:27 13. VITAMIN D DEFICIENCY IN KERATINOCYTES INDUCES DNA DAMAGE MEDIATED PRO-APOPTOTIC FUNCTIONS THROUGH PHOSPHORYLATION OF RB. Jonathan P. Fleegel*, Chandra S. Boosani, and Devendra K. Agrawal, Department of Clinical and Translational Science, Creighton University School of Medicine, Omaha.
- 3:38 14. CORRELATION BETWEEN CARDIAC ARRHYTHMIA AND BALANCE. Emily Thraillkill, Mohammed Alwatban, Benjamin Hage, Julie Honaker, and Gregory Bashford, Biological Systems Engineering, University of Nebraska–Lincoln.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

Session Chairperson: Julie Shaffer, University of Nebraska Kearney
Smith Callen Conference Center

- 1:00 1. POSSIBLE DETECTION OF QUORUM SENSING MOLECULES RELEASED DURING *PSEUDOMONAS AERUGINOSA* BIOFILM FORMATION WITH A UNIQUE COLORIMETRIC SENSING ARRAY, DETECHIP®. Rachel Lukowicz*, Andrea Holmes, Michael Kangas, and Jordyn Atwater, Department of Chemistry, Doane College, Crete.
- 1:11 2. THE YEAST QUORUM-SENSING MOLECULE, FARNESOL, PROMOTES INNATE INFLAMMATORY RESPONSES. Riley Jones*, Jessica Hargarten, and Deborah Brown, Department of Biological Sciences, University of Nebraska–Lincoln.
- 1:22 3. GEOTAXIS ANALYSIS OF NORA VIRUS INFECTED DROSOPHILA MELANOGASTER. Abigail Benz*, Amanda McCown, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.
- 1:33 4. EVOLUTION OF AN rRNA INTRON AT ONE POSITION IN TELOSCHISTALES. Jacob A. Burklund* and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney.
- 1:44 5. PROLIFERATION OF BREAST CANCER CELLS IN TYPE 2 DIABETES. Melody Jane Morwitzer*, and Surabhi Chandra, Department of Biology, University of Nebraska at Kearney.
- 1:55 BREAK
- 2:10 6. DISTRIBUTION OF TARDIGARDES IN SOUTH DAKOTA. Megan Burma*, Department of Biology, Concordia University, Seward.
- 2:21 7. PRODUCTION OF MONOSPECIFIC ANTISERA FOR VAGO & VIRUS INDUCED RNA-1 (VIR-1). Wilfredo Lopez*, Brad L. Ericson, Darby J. Carlson, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.
- 2:32 8. MICROGLIA POLARIZED TO AN M2-LIKE STATE BY NEURONAL DAMAGE ENHANCE NEUROGENESIS. Erin Whiteford*, Steven Yackley, Charlton Myer, and Annemarie Shibata, Department of Biology, Creighton University, Omaha.
- 2:43 9. INVESTIGATION OF INTRACELLULAR SIGNALING PATHWAYS UNDERLYING THE POLARITY OF MICROGLIA. Steven V. Yackley*, Erin Whiteford, Charlton Myer, John Leong, and Annemarie Shibata, Department of Biology, Creighton University, Omaha.

- 2:54 10. CHARACTERIZATION OF A POSSIBLE IRES SITE IN THE NORA VIRUS GENOME. Alexis Page*, Brad L. Ericson, Darby J. Carlson, and Kimberly A. Carlson, Department of Biology, University of Nebraska at Kearney.
- 3:05 11. THE EFFECTS OF A PPARGAMMA AGONIST ON THE STEREOLOGICAL ANALYSIS OF THE HIPPOCAMPUS AND HYPHTHALAMUS IN AN EPILEPTIC MODEL. Sara Knowles*, Department of Biology; and Brianna Zieba, Harrison Roundtree, Kristina Simeone, and Tim Simeone, Department of Pharmacology, Creighton University, Omaha.
- 3:16 12. FABRICATION AND CHARACTERIZATION OF DOLUTEGRAVIR-LOADED CELLULOSE ACETATE PHTHALATE NANOPARTICLES IN THERMOSENSITIVE GEL. Rachel Pham*, Patrick Bruck, Annemarie Shibata, Department of Biology; and Subhra Mandal and Chris Destache, School of Pharmacy and Health Professions, Creighton University, Omaha.
- 3:27 13. *IN VIVO* AND *EX VIVO* ANALYSIS OF DOLUTEGRAVIR-LOADED NANOPARTICLES FOR HIV-1 PROPHYLAXIS. Patrick Bruck*, Rachel Pham, Michael Rezich, and Annemarie Shibata, Department of Biology; and Subhra Mandal and Chris Destache, School of Pharmacy and Health Professions, Creighton University, Omaha.
- 3:38 14. AN ASSESSMENT OF THE DISTRIBUTION OF THE CYP2D6 ALLELE FREQUENCIES WITHIN THE (SUDANESE OR KAREN) POPULATIONS IN NEBRASKA. Michele Vietz, Brad Carlson*, Bryce Ashton, Brigitte Chavez, Luis Olmedo, Victoria Leddy, and Frankie Rose, Department of Biology, Union College, Lincoln.
- 3:49 15. EFFECTIVENESS AND TOXICITY OF EXPERIMENTAL COMPOUNDS AGAINST *TOXOPLASMA GONDI*. Austin Sanford*, Ryan Hemsley, Sydney Zach, and Paul Davis, Department of Biology, University of Nebraska at Omaha.

CHEMISTRY & PHYSICS

Chairperson: Joshua Darr, Chemistry Department
University of Nebraska at Omaha

SECTION A, CHEMISTRY

Olin LH-A

- 8:00 WELCOME
- 8:05 1. OPTIMIZATION OF ON-COLUMN ENTRAPMENT CONTAINING HUMAN SERUM ALBUMIN FOR THE STUDY OF DRUG-PROTEIN BINDING BY HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. Shiden Azaria* and John Vargas, Department of Chemistry, University of Nebraska–Lincoln.
- 8:20 2. THE DEVELOPMENT OF HIGHLY-ORIENTED 3D NANOSTRUCTURES FOR USE WITH ULTRA-THIN LAYER CHROMATOGRAPHY AND ELLIPSOMETRY. Sandya R. Beeram*, D. Peev, E. Rodriguez, E. Pfaunmiller, D. Sekora, N. Kananizadeh, E. Schubert, Y. Li, T. Hofmann, M. Schubert and D.S. Hage, Departments of Chemistry and Electrical and Computer Engineering, University of Nebraska–Lincoln.
- 8:35 3. METHOD DEVELOPMENT FOR SEPARATING LITHIUM ION ELECTROLYTE CARBONATES USING ION-MODERATED PARTITION HIGH PERFORMANCE LIQUID CHROMATOGRAPHY. Anuja Bhalkikar*, Chris M. Marin and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln.
- 8:50 4. DETERMINATION OF LEAD CONCENTRATION IN SOIL AT EPA SUPERFUND SITE ACROSS NORTHEASTERN OMAHA. Kaiguo Chang*, Jose Conceicao, Bernadette Corbett, Deidra E. Broderick, Richard E. Amoussou, Andrew Sheridan, Department of Chemistry, College of Math and Sciences, Metropolitan Community College, Omaha.
- 9:10 BREAK
- 9:25 5. BIOORTHOGONAL REACTION OF AMPHIPHILIC CYCLOBUTENES AND 1,2,4,5-TETRAZINES. Boone W. Evans*, William Lambert, and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln.
- 9:40 6. NITRATE EFFECT ON MICROWAVE-ASSISTED SYNTHESIS OF CERIA NANOCUBES. Tamra Fisher*, Yousif Ibrahim, Benjamin Steffensmeier, and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln.
- 9:55 7. METHOD AND ANALYSIS OF THE HYGROSCOPICITY OF AMINO ACID AEROSOLS. Salvatore Gottuso*, Paul Morales, Amissabah Johnson, and Joshua P. Darr, Department of Chemistry, University of Nebraska at Omaha.

- 10:10 8. SOLVENT VAPOR ANNEALING. Meagan Grant*, Department of Physics, University of Creighton, Omaha.
- 10:20 9. SUBSTITUTED AMINO ACIDS AS LARGE-NEUTRAL AMINO ACID TRANSPORTER 1 (LAT-1) SUBSTRATES FOR DRUG DELIVERY. Logan M. Hansen*, Evan Augustyn, Karissa Finke, Nathan Heeren, and Allen A. Thomas, University of Nebraska at Kearney; and Arik A. Zur, Huan-Chieh Chien, Lawrence Lin, and Kathleen Giacomini, University of California at San Francisco, San Francisco, CA; and Claire Colas and Avner Schlessinger, Icahn School of Medicine at Mount Sinai, New York, NY.
- 10:40 BREAK
- 11:00 MAIBEN LECTURE
- 1:00 10. PROGRESS TOWARDS A UNIVERSAL CHEMICAL DETECTOR: COLORIMETRIC SENSOR ARRAY FOR THE IDENTIFICATION OF ACIDS AND BASES AND DETERMINATION OF THEIR CONCENTRATIONS. Michael J. Kangas*, Jordyn Atwater, Rachel M. Lukowicz, Raychelle M. Burks, Andrea E. Holmes, Department of Chemistry, Doane College, Crete.
- 1:20 11. ANALYSIS OF INTERACTIONS BETWEEN PLATINUM-CONTAINING DRUGS AND HUMAN SERUM ALBUMIN BY USING IMMUNOEXTRACTION AND AFFINITY MICROCOLUMNS. Jeff Post*, Xiwei Zheng, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 1:35 12. DIRECTING REGIOSELECTIVE 2+2 PHOTOCYCLOADDITION WITHIN A MACROCYCLIC CAVITAND. Mahesh Pattabiraman, Ph.D. and Nga Nguyen*, Department of Chemistry, University of Nebraska at Kearney.
- 1:45 13. CAVITAND-MEDIATION APPROACH TO CONTROLLING CHEMICAL REACTIONS. Mahesh Pattabiraman, Ph.D.* and Nga Nguyen, Department of Chemistry, University of Nebraska at Kearney.
- 2:00 BREAK
- 2:15 14. METABOLIC DYSFUNCTION INDUCED AND POTENTIATED BY GENE-ENVIRONMENT INTERACTIONS LINKED TO PD. Shulei Lei*,¹ Annadurai Anandhan^{2,3}, Ronald L. Cerny¹, Rodrigo Franco^{2,3}, and Robert Powers^{1,3}, ¹Department of Chemistry, ²School of Veterinary Medicine and Biomedical Sciences, ³Redox Biology Center, University of Nebraska–Lincoln.
- 2:35 15. DEVELOPMENT OF A SCANNING MICROFLUIDIC SYSTEM FOR CHROMATOGRAPHIC-BASED BINDING ASSAYS. Elliott Rodriguez*, John Vargas, Ryan Matsuda, Benjamin Hage, Michael Stoller, Stephen A. Morin, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

- 2:50 16. NANOLUCIFERASE FRAGMENTS AS SENSITIVE PROBES FOR PROTEIN SOLUBILITY IN LIVING CELLS. Jia Zhao*, Travis J. Nelson Quyen Vu, Tiffany Truong, and Cliff I. Stains, Department of Chemistry, University of Nebraska–Lincoln.
- 3:10 17. GLYCOFORM ANALYSIS OF ALPHA₁-ACID GLYCOPROTEIN BY CAPILLARY ELECTROPHORESIS. Chenhua Zhang*, Cong Bi, William Clarke, and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.

CHEMISTRY AND PHYSICS

Chairperson: Adam N. Davis
Wayne State College, Wayne
Planetarium

SECTION B, PHYSICS

- 8:15 WELCOME
- 8:20 1. THE ROLE OF ULTRA-FAST SOLVENT EVAPORATION ON THE DIRECTED SELF ASSEMBLY OF BLOCK POLYMER THIN FILMS. Chloe Drapes*, Gunnar Nelson, Meagan Grant, Jeffrey Wong, and A. Baruth, Department of Physics, Creighton University, Omaha.
- 8:40 2. EFFECTS OF CHEMOTHERAPY-INDUCED ALTERATIONS IN CELL MECHANICAL PROPERTIES ON CANCER METASTASIS. Sruti Prathivadhi*, Carolyn Taylor, Michael Nichols, and Andrew Ekpenyong, Department of Physics, and Jianhao Ning*, Department of Chemistry, Creighton University, Omaha.
- 8:50 3. ANALYSIS OF ELECTRON-POSITRON PAIR PRODUCTION IN SIMULATED ULTRA-PERIPHERAL AUAU COLLISIONS. Matthew Rehbein, Department of Physics, Creighton University, Omaha.
- 9:05 4. BACKGROUND STUDIES FOR FOUR-TRACK EVENTS WITH CHARM AT ALICE. Jordan Roth, Department of Physics, Creighton University, Omaha.
- 9:15 5. IMPLEMENTATION OF AN ALARM SYSTEM FOR HARDWARE CONTROLS AT THE STAR EXPERIMENT. Sam Ruiz, Physics Department, Creighton University, Omaha.
- 9:25 6. ELECTRON-POSITRON PAIR PRODUCTION IN ULTRA-PERIPHERAL COLLISIONS AT STAR. Jacob Shearer, Department of Physics, Creighton University, Omaha.
- 9:40 7. ON THE VIABILITY OF TWO DIFFERENT SPEEDS OF LIGHT IN LORENTZ TRANSFORMATIONS AND CAUSALITY. Adam N. Davis, Department of Physical Sciences, Wayne State College, Wayne.

EARTH SCIENCE

Chairperson: Jennifer Balmat
Chadron State College
Olin 325

- 8:10 WELCOME
- 8:15 1. VALIDATING GROUND OZONE AT ULTRAVIOLET (UV) BAND WITH SATELLITE MEASUREMENTS FROM AURA OZONE MONITORING INSTRUMENT (OMI). Connor Dennhardt, and Dr. Jeng Zeng, Department and Earth and Atmospheric Sciences, University of Nebraska–Lincoln.
- 8:30 2. A GIS ANALYSIS FOR BASALTIC GREYWACKE AS A MARTIAN ANALOG. Joslynn VanDerslice, Department of Geoscience, Chadron State College, Chadron.

ENVIRONMENTAL SCIENCES

Chairperson: Barbara Hayford
Wayne State College
Olin 325

- 9:00 OPENING REMARKS
- 9:05 1. STUDIES OF NITRATE TOXICITY IN NON-BITING MIDGES. Jaelyn Lewis, Austyn Houser, Meghan Krajicek, Barbara Hayford, and Gustavo Zardeneta, Department of Life Sciences, Wayne State College, Wayne.
- 9:20 2. SUSTAINABLE GRASSLAND MANAGEMENT: AN EXPLORATORY STUDY OF PROGRESSIVE RANCHERS IN NEBRASKA. Stephanie Kennedy, School of Natural Resources, University of Nebraska–Lincoln.
- 9:40 3. DEFAULT OPTIONS' EFFECT ON GRID PARITY. Shannon L. Moncure, Mark E. Burbach, and Jacob Smith, School of Natural Resources, University of Nebraska–Lincoln.
- 10:00 4. UNDERSTANDING RANCHERS' PERCEPTIONS OF HETEROGENEITY IN THE NORTHERN GREAT PLAINS. Maggi Sliwinski, Mark Burbach, Larkin Powell and Walter Schacht, School of Natural Resources, University of Nebraska–Lincoln.
- 10:20 5. THE IMPACT OF PLACE ATTACHMENT ON FARMER LAND SUCCESSION PLANNING: A MIXED METHODS STUDY. Mark Burbach and Shari Kunert, School of Natural Resources, University of Nebraska–Lincoln.
- 10:35 6. NEW VOLUNTEER MONITORING PROTOCOLS FOR STREAMS AND WETLANDS OF NORTHEAST NEBRASKA. Barbara Hayford and Mark Hammer, Department of Life Sciences, Wayne State College, Wayne.

HISTORY AND PHILOSOPHY OF SCIENCE

Chairperson: Richard Webb
Union College, Lincoln
Olin 224

- 3:15 1. A "POOR MAN'S ATOMIC BOMB": ONE HUNDRED AND ONE YEARS OF CHEMICAL WARFARE. Martin Hulce, Department of Chemistry, Creighton University, Omaha.

TEACHING OF SCIENCE AND MATH

Chairperson: Josef Kren
Bryan College of Health Sciences, Lincoln
Olin 325

1:00 WELCOME

- 1:05 1. USING ASSESSMENTS BASED UPON PHYSICS EDUCATION RESEARCH (PER) TO INFORM CURRICULUM DESIGN. Michael M. Hull, Department of Physical Sciences and Mathematics, Wayne State College. Wayne.
- 1:20 2. A SIMPLE APPARATUS FOR DETERMINATING THE RELATIONSHIP BETWEEN PRESSURE AND TEMPERATURE OF GASES. Neil L. Heckman and Elizabeth D. Tidwell*, Chemistry Department, Hastings College, Hastings.
- 1:35 3. TEACHING THE SCIENTIFIC METHOD AS A MICROCOSM OF SCIENCE. Phyllis Higley, Department of Biology, College of Saint Mary, Omaha.
- 1:50 4. BRICKLAYER CODING AS A VEHICLE FOR LEARNING MATH. Betty Love*, Mathematics Department, Victor Winter, Computer Science Department, and Davina Faimon, Department of Mathematics, University of Nebraska at Omaha.
- 2:10 5. DOES COMPUTER SIMULATION OF CELL MEMBRANES WITH VIRUS-SPECIFIC RECEPTORS SHOW AN IMPROVED OUTCOME FOR VIRAL IMMUNE RESPONSES? Brigitte Corder, Bryan College of Health Sciences, Lincoln.
- 2:25 BREAK
- 2:40 6. COMPUTER SIMULATION OF THE PROGRESSION OF MACULAR DEGENERATION. Nicole Yosten*, Ali Stark and Josef Kren, Bryan College of Health Sciences, Lincoln.
- 2:55 7. COMPUTER SIMULATION OF THE EFFECTS OF NON-VACCINATION ON MEASLES INCIDENCE. Nancy Shook* and Trisha Kaup, Bryan College of Health Sciences, Lincoln.

- 3:10 8. MODELING OF GLUCOSE LEVELS OF TYPE II DIABETIC PATIENTS AND THE EFFECTS ON THE HOMEOSTASIS OF ORGAN SYSTEMS. Landi Peregrine* and Kayla Piper, Bryan College of Health Sciences, Lincoln.
- 3:25 9. CLINICAL APPLICATIONS OF DRUG IONIZATION. A COMPUTER MODEL. Laurel Ahlman* and Josef Kren, Bryan College of Health Sciences, Lincoln.

COLLEGIATE ACADEMY

BIOLOGY

Chairperson: Adrianne Prokupek-Pickett, Department of Biology
Nebraska Wesleyan University, Lincoln

SESSION A

Olin LH-B

- 8:00 1. CLIMATE CHANGE EFFECTS ON RESPIRATION RATES OF BLUE CRAB (*CALLINECTES SAPIDUS*) FROM THE PATUXENT RIVER, CHESAPEAKE BAY. Annie M. Nyffeler*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Thomas Miller, Chesapeake Biological Laboratory, Solomons.
- 8:12 2. INFLUENCE OF SUBSTRATE TYPE ON TERRESTRIAL LOCOMOTION IN THE ORNATE ROPEFISH (*POLYPTERUS ORNATIPINNIS*). Brandi Turner* and Gary W. Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:24 3. KINEMATICS OF SUCTION FEEDING IN THE AFRICAN LUNGFISH (*PROTOPTERUS ANNECTENS*). Emma D. Wass* and Gary W. Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:36 4. THE YEARLY DISTRIBUTION OF *PRATYLENCHUS* NEMATODES IN CORN PLANTS OF NEBRASKA. Jackson Kube, Department of Biology, Nebraska Wesleyan University, Lincoln
- 8:48 5. OCCUPANCY OF FROGS AND TOADS IN THE WETLANDS OF YORK AND SEWARD COUNTIES IN NEBRASKA. Taylor Epp*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Michelle Hellman, School of Natural Resources, University of Nebraska–Lincoln.
- 9:00 6. COMPARING THE TROPHIC STATE OF LAKES IN DIFFERENT ECOREGIONS OF NEBRASKA. Annalyssa Fountain, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 9:12 7. EVALUATION OF CAPSID PROTEIN GLYCOSYLATION FROM ANTIGENIC MUTANTS OF THE *CHLOROVIRUS* PBCV-1. Emily Hervert, Department of Biology, Nebraska Wesleyan University, Lincoln.

- 9:24 BREAK
- 9:36 8. ROLE OF SURFACE BACTERIA IN THE DECOMPOSITION OF MICE. Thanh Nguyen* and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha.
- 9:48 9. THE EFFECTS THAT COVER CROPS HAVE ON THE GENERAL POPULATION OF PARASITIC AND NON-PARASITIC NEMATODES IN NEBRASKA. Zac Keating*, and Glen Dappen, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 10:00 10. TRAUMATIC BRAIN INJURY ALTERS TAU PATHOLOGY IN AN ALZHEIMER'S DISEASE MOUSE MODEL. Ziomara Jurado*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Howard Fox, Kelly Stauch, Emily Harrison, and Lance Villeneuve, Department of Pharmacology and Experimental Sciences, University of Nebraska Medical Center, Omaha.
- 10:12 11. DOES INCREASING BODY LENGTH ENHANCE PERFORMANCE AND MINIMIZE TRADE-OFFS AMONG LOCOMOTOR MODES IN SNAKES? Alyssa Marian* and Gary Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 10:24 12. SITE-DIRECTED MUTAGENESIS OF THE *CHLAMYDIA TRACHOMATIS* A/HAR-13 SEROTYPE A MOMP GENE TO ALLOW FOR PROTEIN PURIFICATION OF POTENTIAL VACCINE. Nathan Hatch*, Kira Hannon, and Douglas Christensen, Department of Life Sciences; and Gustavo Zardeneta, Department of Physical Science, Wayne State College, Wayne.
- 10:36 13. PARTIAL PURIFICATION OF THE MAJOR OUTER MEMBRANE PROTEIN FROM *CHLAMYDIA MURIDARUM*. Cleofes Sarmiento* and Douglas Christensen, Department of Life Sciences; and Gustavo Zardeneta, Department of Physical Science, Wayne State College, Wayne.
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN LH-B
- 12:00 LUNCH
- 1:00 14. EPSTEIN-BARR VIRUS AND THE ROLE OF MDM2 IN VIRAL TRANSFORMATION. Carlie J. Pickrel*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Luwen Zhang, Nebraska Center for Virology, University of Nebraska–Lincoln.
- 1:12 15. EXOME SEQUENCING SCREENING FOR DOMINANT PROGRESSIVE HEARING LOSS CAUSES. Kira Hannon*, Department of Life Sciences, Wayne State College at Wayne; and Shelley Smith, James Askew, and Divya Nimmagadda, Munroe Meyer Institute, University of Nebraska Medical Center at Omaha.

- 1:24 16. PHYLOGENETIC ANALYSIS OF STREPTOMYCES AND RELATED BACTERIAL SPECIES. Nicholas Johnson*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Etsuko Moriyama and Julien Gradnigo, School of Biological Sciences, University of Nebraska–Lincoln.
- 1:36 17. CHARACTERIZATION OF ALKALINE PHOSPHATASE IN MICE LACKING THE HEPATOCYTE ASIALOGLYCOPROTEIN RECEPTOR DURING INFLAMMATORY LIVER INJURY. Rachel Kubik*, Sarah Hove, John Gould, Carol Casey and Benita McVicker, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:48 18. METHODS IN ASSESSING INSULIN AND GLUCOSE LEVELS IN FEMALE AFRICAN ELEPHANTS (*LOXODONTA AFRICANA*) IN ZOOS: A COMPARISON BETWEEN METABOLIC HORMONE LEVELS IN SERUM AND URINE. Chelsi Marolf, Department of Biology, University of Nebraska Wesleyan, Lincoln.
- 2:00 19. USDA-ARS, LINCOLN NE SORGHUM PROJECT: GENETIC IMPROVEMENT OF SORGHUM FOR NON-GRAIN ENERGY USES. Dylan Oates, Grain and Forage, USDA-ARS, University of Nebraska–Lincoln.
- 2:12 20. INFLUENCE OF PERCH DIAMETER AND INCLINE ON THE TRADEOFF BETWEEN SPEED AND BALANCE DURING ARBOREAL SNAKE LOCOMOTION. Amanda J. Schumacher* and Gary W. Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:24 BREAK
- 2:36 21. RELATIONSHIP BETWEEN HUMAN ACTIVITY AND HOME RANGE SIZES OF FOX SQUIRRELS (*SCIURUS NIGER*) ON THE NEBRASKA WESLEYAN UNIVERSITY CAMPUS. Katherine Ternent, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:48 22. PHYLOGENETIC ANALYSIS OF 16S rDNA GENE SEQUENCES OF BACTERIAL STRAINS FOUND IN THE MICROBIOME OF THE BELLY BUTTON. Erik Thompson* and Jerald S. Bricker, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:00 23. ASSESSMENT OF FUMIGANT TOXICITY OF ESSENTIAL OIL EXTRACTS AGAINST NORTHERN FOWL MITES. Lauren Ziegenbein* and Jerald S. Bricker, Department of Biology, Nebraska Wesleyan University, Lincoln; and Roberto Cortinas, Department of Veterinary Science, University of Nebraska–Lincoln.
- 3:12 24. DIFFERENTIAL EFFECTS OF LEG AUTOTOMY ON LOCOMOTOR PERFORMANCE AND KINEMATICS IN PHOLCID SPIDERS. Moriah Thompson*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Todd D. Levine, Department of Biology, Carroll University, Waukesha, WI; and Kerri M. Wrinn, Department of Biology, University of Wisconsin-Rock County, Janesville, WI; and Gary W. Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

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

SESSION A

Session Chairperson, David Treichel
Olin 324

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| 9:00 | 1. INVESTIGATIONS OF LEIDENFROST LIFETIMES AND PROPELLED-LEIDENFROST DROPLETS. Brendan Bramman, Department of Physics, Hastings College, Hastings. |
| 9:15 | 2. DEVELOPING METHODS OF DETECTING EXOPLANETS VIA TRANSIT OBSERVATION. Austin Bricker, Department of Physics, Nebraska Wesleyan University, Lincoln. |
| 9:30 | 3. FOCUSING SOUND WAVES IN A COMPARISON BETWEEN THE TIME REVERSAL PROCESS AND THE DELAY LAW METHOD TO ACHIEVE SUBWAVELENGTH FOCUSING. David Dobesh, Department of Physics, Hastings College, Hastings. |
| 9:45 | 4. MEASURING BINDING INTERACTIONS BETWEEN HSA AND DESETHYLATRAZINE USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. Alyssa Blair* and Annette Moser, Department of Chemistry, University of Nebraska at Kearney. |
| 10:00 | 5. STUDY OF THE EFFECT OF MAGNETIC FIELDS ON CYCLOADDITION REACTIONS. Mariah McAfoos* and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne. |
| 10:15 | 6. FERROMAGNETIC ACCELERATOR OPTIMIZATION. Jerrad McDermott, Department of Physics, Hastings College, Hastings. |
| 10:30 | 7. CHANGES IN THE UNOCCUPIED ELECTRONIC STRUCTURE OF THE SPIN CROSSOVER MOLECULE [Co(dpzca) ₂]. Yang Liu*, Xin Zhang, Axel Enders, and Peter Dowben, University of Nebraska–Lincoln. |
| 11:00 | MAIBEN LECTURE (Olin B) |

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS

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

SESSION B

Session Chairperson, Nathaniel Fackler
Olin 324

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| 1:00 | 8. SOLAR CELLS: CREATING CLEAN ENERGY USING SUNLIGHT. Brady Menke, Department of Physics, Hastings College, Hastings. |
| 1:15 | 9. AN INVESTIGATION OF INTERNAL FLUID FLOW USING NUMERICAL METHODS. Connor Bohlken, Department of Physics, Nebraska Wesleyan University, Lincoln. |
| 1:30 | 10. BLUETOOTH LOW-ENERGY WIRELESS SENSOR NETWORKING FOR PRECISION AGRICULTURE PURPOSES. Justin Pflug, Department of Physics, Hastings College, Hastings. |
| 1:45 | 11. USING LIQUID CARBON DIOXIDE AS A SOLVENT FOR AZO-DYE FORMATION. Zachary Reisen* and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne. |
| 2:00 | 12. PARABOLIC SOLAR COLLECTORY. Miranda Muhs, Department of Physics, Hastings College, Hastings. |
| 2:15 | 13. MEASURING BINDING INTERACTIONS BETWEEN HSA AND HYDROXYATRAZINE USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. Anthony Donovan* and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney. |
| 2:30 | 14. ANALYSIS OF A VIBRATING GUITAR STRING USING HIGH-SPEED PHOTOGRAPHY. Ian Tuttle, Department of Physics, Hastings College, Hastings. |
| 2:45 | 15. EFFECTS OF TREAD PATTERN ON SHOE FRICTION. Marco Fielder, Department of Physics, Hastings College, Hastings. |

PROCEEDINGS

AERONAUTICS AND SPACE SCIENCE

SESSION A

TARGETING THE PHOSPHORYLATED RPA:RAD52 COMPLEX FOR CANCER THERAPEUTICS

Mona Al-Mugotir, Lucas Struble, and Krysten E. Vance, Department of Biochemistry and Molecular Biology, Gloria E. O. Borgstahl, Jacob Remsza, and Carol Kolar, Eppley Institute, Fred & Pamela Buffett Cancer Center, University of Nebraska Medical Center, Omaha, NE 68198

Genomic integrity is challenged by intrinsic and extrinsic factors. Radiation is one example of the latter and has also been the main reason that NASA's lunar surface missions have been conducted in the shortest time possible over the past decades. Therefore, to meet the goal of a successful long-term mission, such limiting human biological factors must be considered. High levels of radiation challenge our DNA-damage repair mechanism by inducing excessive levels of DNA double strand breaks (DSBs), resulting in hazardous genome rearrangement, development of malignancies, and neurodegenerative diseases. Two main repair pathways are responsible for DNA damage repair: non-homologous end joining (NHEJ) and homologous recombination repair (HR). The former is an error-prone alignment and ligation of broken strands. HR repair, on the other hand, is an accurate repair mechanism that fundamentally involves the pairing of two homologous DNA sequences. HR repair works predominantly on broken replication forks and DSBs making HR repair a pathway of interest for targeted therapy. HR repair is initiated by resection of the broken strands and generation of exposed 3'-overhangs of single stranded DNA (ssDNA) that are immediately covered and protected by replication protein A (RPA). RAD51 protein is then recruited to the DSB site to form a helical nucleoprotein filament on the ssDNA which is essential for invasion and capturing of the homologous sequence. A mediator protein is utilized to unload RPA and promote the formation of the RAD51 filament. In mammalian cells, BRCA2 is the predominant mediator of RAD51 filament formation and RAD52 exists as a back-up, independent pathway. RAD52 knockout mice showed mild phenotype with no major effect on HR repair demonstrating a minor role for RAD52 when the BRCA2 pathway is intact. On the other hand, tumors harboring a non-functional BRCA2 pathway rely on RAD52 to repair their DSBs. Targeting both BRCA2 and RAD52 was shown to result in lethal accumulation of DSBs, chromosomal aberration and cell death. We hypothesize that targeting RAD52 in BRCA tumors with small molecule inhibitors (SMIs) can lead to specific treatments in malignancies and other DNA repair deficient cells. Here, we seek a targeted therapy exploiting the genetic defect of cells lacking a functional BRCA2 pathway, by targeting RAD52 function to induce synthetic lethality in these tumors. We specifically look to use small molecule inhibitors (SMI) due to their ability to act on protein level without affecting the genetic background in addition to their highly penetrant and rapid effect. For this purpose, we designed a fluorescence-based protein-protein Interaction assay (FluorIA) suitable for high throughput screening (HTS). The currently optimized assay will be used to screen different libraries of molecules. The effectiveness of candidate SMI's will be screened using an in vitro activity we designed as well as a cell-based assay. The outcome of our work will benefit patients harboring BRCA-related tumors and can be extended to individuals with other health conditions resulting from compromised DNA-damage repair.

HUMAN RAD52, RPA, AND DNA: STRUCTURE AND COMPLEX INTERACTION

Lucas Struble, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha, NE 68198

Double strand breaks (DSBs) are a dangerous form of DNA damage that human cells have to constantly repair if they are to survive. Homologous recombination (HR) is one of the main pathways by which this damage is repaired. HR can take two forms: the first being genetic conversion (GC) involving RPA, BRCA1, PALB2, BRCA2, and RAD51; and the second being single strand annealing (SSA) which involves RPA and RAD52. Multiple cancers, including familial breast cancer, pancreatic cancer, and certain anemias are characterized by a homozygous mutation of a key protein in the GC pathway, and depend on the SSA pathway for DSB repair. This means that interference with the activity of RAD52 will be synthetically lethal to these cancers, while leaving healthy cells unaffected. The first step in SSA is the binding of RPA to RAD52, and this complex formation is not simple. Both RPA and RAD52 possess two protein binding regions that can interact with each other. The actual molecular mechanism of how these proteins bind is unknown, and this information is important as this complex is a potential drug target in particular for cancer treatments. My proposal is to characterize the molecular mechanism of RPA and RAD52 complex formation in detail through the use of small angle X-ray scattering (SAXS) paired by molecular modeling with currently available crystal structure domains to create a model of the binding surfaces and amino acids that are likely to contribute to the protein-protein interface. I will then test this model through mutagenesis paired with SEC-MALS, fluorescence-based binding assays, and cell based experiments.

LARGE VOLUME CRYSTAL GROWTH OF SUPEROXIDE DISMUTASE IN MICROGRAVITY FOR NEUTRON DIFFRACTION STUDIES

Jahaun Azadmanesh, Department of Biochemistry and Molecular Biology, Scott Trickle, Carol Kolar, and Gloria E. O. Borgstahl, Eppley Institute for Research in Cancer and Allied Diseases, University of Nebraska Medical Center, Omaha, NE 68198

Astronauts encounter cell damaging ionizing radiation reactive oxygen species (ROS) which are combated by antioxidant enzymes called superoxide dismutases (SODs). SODs scavenge two superoxide molecules and facilitates conversion of one into oxygen and another into hydrogen peroxide in a cyclic oxidation and reduction fashion using a metal atom in the catalytic site. SOD mutations lead to diseases such as amyotrophic lateral sclerosis, Type II diabetes, and cancer. The complete enzymatic reaction of SODs are unknown due to limitations of identifying the binding sites of the substrate, product, and protons. Structural data of complexes and intermediates can be identified using up to 80 fold larger crystal growth in a microgravity environment or perdeuterated crystal growth with subsequent neutron diffraction in conjunction with X-ray diffraction. This will identify the role of the protons and differentiate substrates binding to the catalytic site of the enzyme, providing structural data for discerning the catalytic mechanism.

MECHANICALLY-INDUCED OSTEOCYTE/TH17 CELL SIGNALING AND SUBSEQUENT OSTEOCLAST RECRUITMENT

Travis McCumber and Diane Cullen, Department of Biomedical Sciences, Creighton University, Omaha, NE 68178

Mechanical loads of extreme force or repetition create bone damage, and stimulate the remodeling of the damaged matrix. We hypothesized that repetitive fluid shear stress (FSS) of osteocytes (MLO-Y4) would induce Th17 secretion of osteoclastogenic cytokine, IL-17. ELISA analysis of MLO-Y4 medium revealed greater Th17 cell stimulatory cytokines (IL-6 and TGF- β 1) in FSS versus Static groups. ELISA analysis of T cell culture medium (treated with 25% MLO-Y4 medium) revealed greater IL-17 in T cell cultures treated with FSS medium versus Static medium. ELISA and TRAP stain analysis of osteoclast cultures (treated with 25% T cell medium) revealed greater RANKL and TRAP+ osteoclasts in cultures treated with T cell medium (FSS TX) versus T cell medium (Static TX). Future in vivo studies examining the osteoclast response in relation to our osteocyte/Th17 cell signaling model would provide a new paradigm for targeted bone remodeling in response to mechanical stress.

EFFECTS OF VIRTUAL UPHILL WALKING ON LOCOMOTOR-RESPIRATORY COUPLING

William Denton and Jennifer Yentes, Biomechanics, University of Nebraska at Omaha, NE 68182

The objective of this research was to determine the effect uphill environments have on energy expenditure and locomotor-respiratory coupling (the coordination between the locomotor and respiratory systems) using virtual reality and uphill walking. To move any object against gravity requires energy, thus uphill walking requires more energy than level walking. However, even the perception of walking uphill, while actually walking on level ground could be similar to uphill walking. A similar response could be seen with the perception of level walking while actually walking uphill. Participants were asked to walk at their preferred walking speed on a treadmill that was either level (0%-grade) or inclined (10%-grade) while virtual reality was used to create an environment that appeared either level or inclined. A fifth condition used an oscillating level/incline virtual environment while walking on level ground. Data collections for this research project are still ongoing.

LOCOMOTOR ADAPTATION THROUGH MULTIPLE SENSORY MODALITY AUGMENTATION IN ASTRONAUTS

Jessica Fujan-Hansen, Biomechanics, University of Nebraska at Omaha, NE 68182

This project uses Virtual Reality technology along with auditory afferent feedback to enhance spatio-temporal transfer. The results will allow us to ascertain whether the use of multiple sensory modalities is more effective in gait restoration in astronauts after long duration space flight rather than the common protocol of a singular modality. Thirty healthy young adults were randomly assigned to one of three groups. The first group walked on a treadmill tied to optic flow presented via Virtual Reality. The optic flow entailed a walkway comprised of tiles of which each subject was requested to match stride for stride to the best of their ability. The second group also walked on a treadmill, but without optic flow instead listening to an auditory stimulus presented in the same pattern as the tiles within the optic flow pattern. The final group was presented with both the visual and the auditory stimuli simultaneously.

DEVELOPMENT OF A TREADMILL WITH A DYNAMICALLY ADAPTIVE SURFACE

Travis Vanderheyden and Kota Takahashi, Biomechanics, University of Nebraska at Omaha, NE 68182

This project encompasses the design of a Variable Surface Treadmill (VST) that utilizes dynamically adaptive terrain to influence how humans walk and run. The treadmill, comprised of hundreds of individually programmable, weight supporting actuators, is expected to generate random surface patterns that will make walking and running more challenging. Upon completion, the VST will house nearly 3000 actuators that can be manipulated by researchers during walking trials or programmed prior to collections in order to replicate both terrestrial and extraterrestrial terrain conditions. The outcome of this study could also provide astronauts with an additional exercise methodology for maintaining muscular strength and power, as well as for balance control during and following space travel.

THE ROLE OF VESTIBULAR PERCEPTION IN LEARNING A NOVEL LOCOMOTOR TASK

Allison Hoover and Mukul Mukherjee, Biomechanics, University of Nebraska at Omaha, NE 68182

A walking pattern should be stable and performed effortlessly, yet have enough variation to adapt to changes. Learning new movements is characterized by variation that allows for environmental exploration until a stable, low variation movement emerges. Locomotor adaptation requires input from visual, somatosensory, and vestibular systems. Disrupting these systems causes variation during locomotion. Increases in variation stimulates errors during treadmill adaptation, leading to improvements in learning and retention after training is complete. During this project, 18 subjects (with or without mastoid vibration) walked on a split-belt treadmill, driving one leg faster than the other. The vibrations were expected to cause locomotor instabilities. Limb excursion, step length, and double stance time were analyzed. The results showed variation between right and left leg. Vestibular stimulation did not disrupt the learning of split-belt adaptation. Multisensory integration allowed vision and somatosensory systems to decrease variation and recalibrate sensorimotor organization to allow continuous motor learning.

VALIDITY OF WEARABLE FITNESS TRACKERS ON SLEEP MEASURE

Alyssa K. Keill and Jung-Min Lee, Health, Physical Education and Recreation, University of Nebraska at Omaha, NE 68182

The purpose of this study is to examine the validity of wearable fitness trackers for estimating total sleep time minutes (TSTM) with respect to a sleep log as reference measure. Thirty-five healthy individuals (mean \pm SD; age = 28.7 ± 11.7 years; BMI = 25.03 ± 4.12 kg \cdot m²) participated in the study. Participants were randomly assigned to one of two groups. Group 1 (n=16) wore the ActiGraph Sleep (AG; Sadeh & Cole-Kripke algorithms), BodyMedia SenseWear Mini Armband (SWA), Basis Peak (BP), and Fitbit Charge HR (FB). Group 2 (n=19) wore the AG, Jawbone UP3 (JU), and Garmin Vivosmart (GV). Pearson correlation coefficients were 0.26, 0.43, and -0.09 for the SWA, FB, and BP with regard to log TSTM, respectively. Group 2 correlations between the log TSTM and Sadeh, Cole-Kripke, GV, and JU were 0.60, 0.65, 0.60, and 0.80, respectively. Further research using polysomnography is needed.

EFFECTS OF ENVIRONMENTAL STRESS ON TELESURGICAL SKILLS LEARNING

Moshen Zahiri and Carl A. Nelson, Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588, and Ka-Chun Siu, Physical Therapy Education, University of Nebraska Medical Center, Omaha, NE 68198

Teleoperation in space requires learning surgical skills with better stress management. During long-duration flight, crewmembers should learn how to better handle stressful situations while maintaining certain surgical skills proficiency. In this project, we recruited eleven novices to perform a laparoscopic surgical task using a standard training box. A set of countdown timers were presented either digitally or graphically on a monitor screen to create a stressful environment. Kinematic performance and muscle efforts were recorded. Unexpectedly, our results showed that none of those visual timers negatively impacted skills performance or muscle effort. Participants also reported that those visual timers motivated their learning. Presenting visual counters seems to not stress participants in this project. Different experimental designs, e.g. multitasking, to create stressful environments could also be considered, and different participants with varied medical backgrounds should be examined in future studies.

EFFECTS OF HAND DOMINANCE ON POSTURAL CONTROL DURING LAPAROSCOPIC SKILLS PRACTICE USING VIRTUAL REALITY SIMULATION

Anthony White, College of Medicine, Chun-Kai Huang and Ka-Chun Siu, Physical Therapy Education, and Dmitry Oleynikov, Department of Surgery, University of Nebraska Medical Center, Omaha, NE 68198

This study determined how hand dominance could influence postural control during laparoscopic skills practice using both the Virtual Reality Trainer (VRT) and Fundamentals of Laparoscopic Surgery training box (FLS). Ten healthy male medical students stood on a pressure mapping system and performed a peg transfer (PT) task using VRT or FLS. Participants performed each task five times with either their dominant or non-dominant hands. Surface electromyographical (EMG) data were collected, and the postural control was measured through the center of pressure (COP) data. In our study, EMG on the non-dominant side was significantly higher than on the dominant side while performing the PT task. Practicing with VRT reduced the area of COP on the non-dominant side. Compared with FLS, VRT could alleviate the impact of using non-dominant side on overall postural sway during practice. These results suggest that VRT provides a more ergonomic environment for laparoscopic surgical skills learning.

EFFECTS OF A TRANSITIONAL 3D-PRINTED PROSTHETIC HAND ON CO-CONTRACTION IN CHILDREN WITH UPPER LIMB DIFFERENCES

Jorge M. Zuniga, Dimitrios Katsavelis, and Ryan Smith, Exercise Science and Pre-Health Professions, Creighton University, Omaha, NE 68178

The purpose of the study was to investigate the effects of using low-cost 3D-printed hand prosthesis on co-contraction in children with upper limb differences. Co-contraction is the simultaneous activation of agonist and antagonist muscles that produce forces around a joint. Amputees display inefficient movement that can lead to increased co-contraction because of prolonged muscle inactivity.

Five subjects (Age= 6.6 ± 3.1 years) participated in the study. Subjects were tested twice, 6 months apart. Electromyographic activity of wrist flexors and extensors (flexor and extensor carpi ulnaris) was recorded during maximal voluntary contraction. Two by two repeated measures of ANOVA (time: pre and post; hand: affected and non-affected) showed a main effect for hand ($p < 0.05$), but not time. Thus, using low-cost 3D-printed hand prosthesis may improve co-contraction. Although the decrease in CI was not statistically significant there is an opportunity to improve wrist muscles efficiency after using low-cost 3D-printed hand prosthesis.

CASE STUDY: ULTRASOUND ANALYSIS OF ECHOINTENSITY AND ORPHOLOGY IN FOREARMS OF A TRANSRADIAL AMPUTEE

Maggie Fleita and Maggie Griffin, Exercise Science and Pre-Health Professions, and Joey Bowens, School of Medicine, Creighton University, Omaha, NE 68178

There are increasing numbers of children with traumatic and congenital hand amputations or reductions. Advancements in computer-aided design (CAD) programs and additive manufacturing (3D printing) offer the possibility of designing and printing prosthetic hands. This case study employed ultrasonography to analyze muscular echointensity and morphology as a means to quantify the effects of using the Cyborg Beast over time. It has been previously suggested that muscle echointensity directly reflects muscle quality. Similarly, muscle fiber pennation angle is a factor that determines the physiological cross-sectional area (PCSA) of muscle. Ultrasound images of the affected and unaffected (control) forearms were obtained. Sagittal ultrasound images were analyzed (ImageJ, version 1.46, NIH) to obtain the standard deviation of echointensity of the muscles of interest. Coronal ultrasound images were analyzed (Tracker, version 4.91, OSP) to determine muscle fiber pennation angle. Data were gathered during three visits over the course of one year.

THE NEIGHBORHOOD OF LOW-Z LOBAL QSOS

Wyatt Behn, Department of Physics and Astronomy, University of Nebraska at Kearney, NE 68845

Low-Ionization Broad Absorption line quasars (LoBALs) are a type of quasar classified by their extreme velocity winds in Mg II line. These LoBAL QSOS are scarce and make up $\sim 1\text{-}3\%$ of optically selected QSOS. Their low fraction could be explained by their orientation or by a short period of outflow manifest in all QSOS during their lifetime. We aim to better understand the viability of the evolutionary model using images from the Hubble Space Telescope, with WFC3. These images are analyzed using GALFIT in attempt to fit the structure of the underlying galaxy hidden by the QSO's intensity. Here we present GALFIT models of a sample of LoBAL QSOS in the redshift range $0.5\text{-}0.6$ in WFC3-UVIS images, and we investigate the presence of neighborhood galaxies within 150 kpcs and their possible correlation to apparent signs of interaction in the LoBAL host galaxies.

TOWARDS ULTRA-FAST SOLVENT EVAPORATION, THE DEVELOPMENT OF A COMPUTER CONTROLLED SOLVENT VAPOR ANNEALING CHAMBER

Gunnar Nelson, Chloe Drapes, Meagan Grant, Jeffrey Wong, and Andrew Baruth, Department of Physics, Creighton University, Omaha, NE 68178

Despite the promise of cheap and fast nanoscale ordering of block polymer thin films solvent vapor annealing, a standardized, scalable production scheme remains elusive. Solvent vapor annealing exposes a nano-thin film to the vapors of one or more solvents with the goal of forming a swollen and mobile state to direct the self-assembly process by tuning surface energies and mediating unfavorable chain interactions. We have shown that optimized annealing conditions, where kinetic and thermal properties for crystal growth are extremely fast (1s), exist at solvent concentrations just below the order-disorder transition of the film. However, when investigating the propagation of a given morphology into the bulk of a film during drying, the role of solvent evaporation comes under great scrutiny. During this process, the film undergoes a competition between two fronts; phase separation and kinetic trapping. Recent results in both theory and experiment point toward this critical element in controlling the resultant morphologies; however, no current method includes a controllable solvent evaporation rate at ultra-fast time scales. We report on a computer-controlled, pneumatically actuated chamber that provides control over solvent evaporation down to 15 ms. Furthermore, in situ spectral reflectance monitors solvent concentration with 10 ms temporal resolution and reveals several possible evaporation trajectories, ranging from linear to exponential to logarithmic. Funded by Dr. Randolph Ferlic Summer Research Scholarship and NASA Nebraska Space Grant.

DEVELOPMENT OF AUTOMATION AND ANALYSIS SOFTWARE FOR AN ARRAY OF COMMERCIAL RADIO DISHES

Matthew Hormandl, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68510

The project, paid for by a NASA Nebraska Space Grant fellowship, involves the placement of an array of radio telescopes at the Behlen Observatory in Mead, Nebraska using equipment commercially available to the public. This portion of the project involves the development of control and analysis software for said radio telescopes. The control software developed was based on pre-existing code used in the control software for the optical telescope present at Behlen Observatory. Due to time and material constraints, development of analysis software has not yet begun. The project remains in development, and work will continue after the end of the fellowship, including the construction of the array itself.

STATUS AND UPGRADES TO THE BEHLEN OBSERVATORY 30-INCH TELESCOPE AT THE UNIVERSITY OF NEBRASKA–LINCOLN

Shelby Clausen and Celeste Labeledz, Department of Physics and Astronomy, and Emma Schneider, Department of Mathematics, University of Nebraska–Lincoln, NE 68512

We present on the original status, completed upgrades, and planned future upgrades for the hardware and software controls of the 30-inch telescope at the University of Nebraska – Lincoln's Behlen Observatory near Mead, Nebraska. The original telescope controls were not automated and long outdated. Current and planned upgrades to the hardware include the refurbishment of the original encoders in the telescope and the implementation of new microcontrollers to connect the telescope to computer controls. Current and planned upgrades to the software include writing programs for location calibration, coordinate conversion, and connectivity to existing programs such as Stellarium.

UNL RADIO TELESCOPE ARRAY PROJECT, AUTOMATED TRACKING MOUNTS

Nicole Benker, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68506

The purpose of this project, funded by a NASA Nebraska Spacegrant fellowship, is to construct a radio telescope array at Behlen Astronomical Observatory in Mead, NE. This part of the project involves designing and constructing automated tracking mounts for the radio dishes to allow for long exposure data collection. I, with the help of sponsors and UNL staff, created and refined designs for these tracking mounts on a small budget, to be driven by Arduino microprocessors, so that interested amateur astronomers can recreate our results. At this time we have designs and a small number of parts, and are dependent upon securing materials funding for construction. Work on this project will continue after the fellowship ends.

CONTROL SYSTEM DESIGN FOR THE RADIO ARRAY PROJECT AT THE UNIVERSITY OF NEBRASKA–LINCOLN

Jennifer Hamblin and Savanna McDonald, Department of Physics and Astronomy, University of Nebraska–Lincoln, NE 68510

We will present the progress that has been made on the upcoming radio telescope array, specifically the design and implementation of the control user interface and the hardware that controls each dish. A remote interface application will be used to operate the radio array as well as other telescopes at the Behlen observatory. The addition of an updated interface offers operators a way to control multiple telescopes from the same application. We will present how the interface, developed in python, will be integrated into the radio telescope's hardware and software systems. Upon completion of the radio array project, students will have another tool for instruction and research projects. We plan to make information about the array accessible to students and educators.

PECVD OF BORON CARBIDE FOR NEUTRON VOLTAICS

N. J. Ianno, Department of Electrical and Computer Engineering, and A. Enders and P.A. Dowben, Department of Physics and Astronomy, University of Nebraska –Lincoln.

Since solar power is not available in deep space, deep space probes are currently powered by sub-critical thermo-nuclear reactors fueled by plutonium 238. As stated in the Strategic Plan the amount of this material available to NASA will be exhausted between 2017 and 2018. An alternate approach would be to employ neutron based photovoltaic devices, which have the potential to supply the energy needed to power deep space satellites and probes. This power generation approach relies on the direct conversion of neutrons into electric power, which can be highly efficient and requires a much smaller amount of radioactive material (to supply the neutrons) than the sub-critical reactor. In addition, the radioactive source is cold, as opposed to the hot sub-critical reactor providing additional weight savings since heat shields are not needed. The key component in this scheme is the neutron voltaic device. We will present our recent results with respect to the plasma enhanced chemical vapor deposition (PECVD) of boron carbide for use a neutron voltaic to power deep space probes.

AERONAUTICS AND SPACE SCIENCE

SESSION B

COLLEGE OF SAINT MARY ELEMENTARY SCIENCE OUTREACH PROGRAM: GROWING INTERACTIONS WITH SCHOOLS AND STUDENTS

Colleen Bernal and Hannah Pauley, Department of Biology, College of Saint Mary, Omaha, NE 68106

The College of Saint Mary Elementary Science Outreach Program (CSM-ESOP) aims to provide elementary students with exciting, hands-on learning to increase knowledge and spark interest in the fields of Science, Technology, Engineering, and Math (STEM). The CSM-ESOP offers a number of learning units and activities that are based on Nebraska state science curriculum, and are organized, taught, and delivered by undergraduate students from the College of Saint Mary. The CSM-ESOP is continuing in its fifth year, and has developed a number of different STEM related units for elementary teachers to choose from. An overview of the program's activities and hands-on learning will be presented, as well as information regarding participation in the program by undergraduate students, elementary schools, and K-6 teachers and students.

REACH FOR THE SKIES SATURDAY SPACE SCIENCE

Kayla Daniels, Meghan Krajicek, Leah Uhlir, Jennifer Balmat, Ann Buchmann, and Mike Leite, Department of Physical and Life Sciences, Tatum Renken, Department of Education (Elementary Endorsement), Mikayla Bower and Lane Swedberg, Department of Education (Secondary Science Endorsement), Douglas Poole and Beth Wentworth, Department of Mathematics, Chadron State College, Chadron, NE 69337

Enticing students into STEM fields is necessary for the continued advancement and progress of science, particularly in the field of space exploration. Students from rural communities, however, lack access to science museums, advanced science and math classes, scientific industries/internships, or other science and engineering opportunities that are available to students in more urban areas. Because of this, these students are often unaware of opportunities for careers in science and math, particularly in space science and engineering.

To increase student interest in and awareness of science and math, we have designed and implemented a series of space related hands-on activities for 3rd-5th graders based on NASA educational material. These activities were taught in 3 hour blocks on Saturdays for 20-30 students. The activities allowed students to explore a variety of areas of space science including rockets and rocket fuel, rovers, Martian landscapes, human body in space, and permanent settlements on Mars. Activities integrated math, science, and engineering principles. College students from both the science and elementary and high school education fields helped design and lead learning activities for the 3rd-5th graders and some of the lessons have been adapted by education students for use in the classroom. Training college students, particularly education majors, to develop hands-on educational activities will hopefully lead to better science education in elementary and secondary school. The elementary and middle school students were engaged in and excited about the We are hopeful that this type of science program can entice students from rural areas to pursue careers in science, math, and engineering.

DESIGNING ECOSYSTEM ANALYSIS FOR EDUCATORS, A UNO GRADUATE BIOLOGY COURSE, WITH SUPPORT FROM A NASA COURSE DEVELOPMENT MINI-GRANT

Carol Engelmann, Department of Biology, and Ashlee Dere, Department of Geology/Geography, University of Nebraska at Omaha, NE 68182

This NASA Nebraska Space Grant has funded a project to design a UNO graduate Biology STEM course titled, “Ecosystem Analysis for Educators”. This project is closely aligned with NASA’s Office of Education’s Institutional Engagement (IE) priority, which support efforts that build and develop capacity of formal and informal institutions for sustained STEM capabilities in topical areas of interest to NASA. The creation of this graduate course is also aligned with NASA’s CoSTEM priority areas on youth and public STEM Engagement, improving undergraduate education, and better serving groups historically underrepresented in STEM fields. We designed the course for in-service teachers that want to study at UNO’s Glacier Creek Preserve facility from an interdisciplinary perspective. The teachers will investigate the biology, geology, and chemistry of the prairie environment while using specialized sensors and software to analyze data and model the prairie ecosystem and habitats. We are developing activities that will integrate NASA satellite data (OCO-2 and SMAP) to promote an Earth System Science perspective. Both the satellite image analysis and hands-on ecosystem analysis in the field at the Glacier Creek Preserve will allow the teachers to focus on a wide variety of topics including basic ecology (systems thinking, energy transfer, food webs), prairie plant and animal (including vertebrates and invertebrates) diversity, stream analysis (chemical, biological, and physical parameters), soil analysis (chemical, biological, and physical parameters), and climate issues related to the tallgrass prairie environment and human impacts on the Earth System. UNO is working with Omaha Public Schools to pilot the course with the OPS Science Coaches in May 2016, and teach the course for OPS science teachers in July-August 2016. Starting Fall Semester 2016 the course will be offered for all metro area science teachers at least once a year.

ARDUINO TEACHING MODULES

Chase Cushman and William Spurgeon, Department of Business and Information Technology, Western Nebraska Community College, Scottsbluff, NE 69361

Teaching units were developed to add hands-on experience with hardware and software, using Arduino microcontrollers. Students in Introduction to Engineering and Introduction to Information Technology were taught the basics of writing code to interface with various sensors.

3D PRINTING STEM RESOURCE MANUAL

Marc Petrykowski and Jorge Zuniga, Department of Exercise Science and Pre Health Professions, Creighton University, Omaha, NE 68178

3D printing is growing and its applications to STEM careers are unlimited. NASA installed the first 3D printer in the International Space Station in 2015. The space crew printed a tool with a design file transmitted from the ground to the printer. There is a critical need to increase and facilitate knowledge of the use and troubleshooting of 3D printers. Over the past few years, many new companies have engineered new 3D printers and new printing materials. The cost of 3D printers have dropped significantly and the time to complete a print has been greatly reduced. However, understanding how to use, fix, and troubleshoot 3D printers can be difficult. It is critical for STEM careers to have access to different resources related to 3D printing. Our laboratory has developed a 3D printing STEM Resource Manual to provide a quick and simple manual to facilitate the understanding of how to use, fix, and troubleshoot the most common 3D printer models.

P-ROBOTS (PROGRAMMING ROBOTS SUITE)

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

P-ROBOTS (Programming Robots Suite) is an educational suite that will bring the attention of middle and high school students to computer science and robotics. P-ROBOTS gives to a young community the opportunity to learn and use state-of-the-art technologies that can be combined to build different systems. The project includes the construction of robots, mechatronic systems, electronic projects, and focuses on the programming side of the assembled systems to exhibit autonomous and intelligent behaviors. We are focusing on transferring knowledge and skills to middle and high school students by means of the development of kits that they can easily follow, understand, interact and learn. The use of P-ROBOTS will create a direct impact in the student's life and engage them to pursue science, technology, engineering, and mathematics (STEM) education.

AUTONOMOUS UAV NAVIGATION IN GPS-DENIED ENVIRONMENTS USING APRILTAGS

Sonum Chowdary Vuppuluri and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

Unmanned Aerial Vehicles (UAVs) are being increasingly used in many applications such as aerial surveillance in environments like deserts, agricultural surveying, etc. but are restricted only to outdoors. Hence, my research is to investigate solutions to the UAV indoor localization problem using AprilTags. An AprilTag is similar to a QR code but easier for cameras to detect robustly and at a distance. The idea is to pre-install markers embedded with AprilTags at different locations. Processing will be done on the Laptop and communicated with the UAV through a port to detect, analyze, maneuver itself towards the prescribed direction. If working with a team of ground robots, the ground robots could have April tags on them, allowing for localization of the UAV with respect to the ground robots. It can be very useful on Extraterrestrial planets as they do not have GPS available, or would be expensive to set it up.

AUTONOMOUS UAV NAVIGATION IN AN INDOOR ENVIRONMENT

Venkat Ramana Reddy Garlapati and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

UAV's are currently used extensively in outdoor environments, but their use in indoor applications have been fairly restricted, owing mainly to the difficulty to maneuver them in smaller indoor spaces and the inability to use GPS. Nevertheless, there are many indoor applications where UAVs could provide a safe, reliable and resilient means to perform operations that are dangerous for humans such as surveillance inside chemical plants, inventory scanning in cold storages etc., Autonomous UAV navigation in an indoor environment can be achieved by solving the coverage problem in a structured manner, a coverage path planning algorithm, Boustrophedon Cellular Decomposition is extended to 3-D plane, where the environment is dynamically divided into polygon-shaped cells of free space by the UAV as it covers the environment; each cell is then covered in sweeping motions. The results of this research are being used towards implementing an autonomous UAV navigation system for indoor environments.

SIMULTANEOUS CONFIGURATION FORMATION AND INFORMATION COLLECTION BY MODULAR ROBOTIC SYSTEMS

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

In extra-terrestrial environments, modular self-reconfigurable robots (MSRs) can be used to accomplish tasks like exploration or information collection more efficiently than fixed-configuration robots. We study a central problem in MSRs called the configuration formation problem - given a set of modules initially distributed arbitrarily within the environment and a desired target configuration involving those modules, how can each module select an appropriate spot in the target configuration to move to and form the configuration. We present a heuristic search-based algorithm to solve this problem where the modules select their navigation paths so that they can increase the amount of information they collect (such as rock/soil sample) using on-board sensors, while they are moving towards their positions in the target configuration. Experimental results from our algorithm within a simulated environment show that our planning approach has lower run-time and fewer messages exchanged than a state-of-the-art allocation algorithm for selecting modules' spots.

FAST PATH PLANNING USING EXPERIENCE LEARNING FROM OBSTACLE PATTERNS

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

One of the main challenges of extra-terrestrial exploration is to mobilize autonomously a rover on the surface of a remote planet or satellite that is situated thousands of light years away from Earth. Because the communication with the rover over such long distances is delayed and prone to intermittent down-times, it becomes essential to provide desired autonomy on the rover so that it can perform essential operations, such as exploration, in an efficient and resilient manner with very little to no human supervision. Our research addresses this problem by using a machine learning technique called experience-based learning to enable a robot to maneuver itself in initially unknown environment while reusing relevant knowledge learned from previous experience, to avoid collision with obstacles. Simulation experiments with different number/types of obstacles in an initially unknown environment have shown that our technique performs more efficiently and reliably than other existing robot navigation approaches.

MULTI-ROBOT INFORMED PATH PLANNING UNDER COMMUNICATION CONSTRAINTS

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

Autonomous exploration using multiple robots is a rapidly evolving technology that can reduce the dangers of human exploration in unstructured environments such as extraterrestrial planetary surfaces. In this case, the environment is initially unknown, and likely dangerous for humans to reach and maneuver within. Robots can reach the extraterrestrial planet and explore without risking human life. In this work, we propose a preliminary approach to exploration of unknown and unstructured environments using multiple robots in communication constrained environments. We plan to use Gaussian Processes to model the information gathered by the robots and the likelihood of communication. Based on these Gaussian Processes, we will select the point that best balances the objectives of information gain and communications, with a bias towards communications the longer the robot goes without successful communication. We plan to evaluate this approach in simulation and on physical robots available in the CMANTIC Robotics Lab.

ROUTING OPTIMIZATION IN INTERPLANETARY NETWORKS

Sara El Alaoui and Byrav Ramamurthy, Department of Computer Science and Engineering,
University of Nebraska – Lincoln.

Interplanetary Networks (IPN) are classified among challenged networks and hence do not behave optimally when operated using the standards and techniques of static networks. Delay Tolerant Networking (DTN) is one of the suggested solutions to overcome these networks' challenges. The more widely used implementation of DTN uses Contact Graph Routing (CGR) to find the path from source to destination. In this work, we identify the shortcoming of CGR and propose the Earliest Arrival Optimal Delivery Ratio (EAODR) Routing that examines all the paths in order to choose the earliest arrival path from a given node reducing the delay by 12.9% compared to CGR. We propose a Modified Temporal Graph (MTG) model that provides a near-real-time representation of the deterministic dynamic networks and base on it EAODR. We, finally, outline the steps to integrate EAODR and the MTG model to the Bundle Protocol, one of the main components in DTN protocol stack. This work is based on the master's thesis of Sara El Alaoui available online: <http://digitalcommons.unl.edu/computerscidiss/94/>

PRELIMINARY CONCEPT FOR USING MANUFACTURING ROBOTS AS SURGICAL ASSISTANTS

Alex Drozda and Carl Nelson, Department of Mechanical and Materials Engineering, University
of Nebraska–Lincoln, NE 68588

It is necessary to have two surgeons present for laparoscopic surgery: one to perform the surgery, and one to control the placement of the camera. With the high degree of training possessed by surgeons and the general shortage of medical personnel, this seems to be a waste of skills. One solution, allowed by the current rapid advances in sensor resolution and computer power, is to automate the task of controlling the camera. This has been proposed by other researchers, but at UNL it is being attempted using a commercially available robot called Baxter (Rethink Robotics, Boston, MA). This is a manufacturing robot, specially modified to operate safely around human workers. Using custom end-effectors and specially written programming software to overlay the off-the-shelf robot functionality, it is proposed that this advanced operational capability will allow greater functionality and easier integration in the environment of the operating room.

AUTONOMOUS VEHICLE NAVIGATION

Bailey Roth and William E. Spurgeon, Department of Business and Information Technology,
Western Nebraska Community College, Scottsbluff.

The project goal is to successfully compete in an autonomous vehicle race this summer. This is a continuation of a previous autonomous vehicle navigation project. An RC vehicle was modified to be controlled with an Arduino microprocessor by using GPS and an inexpensive electronic compass. The compass was affected by magnetic feedback so a better compass is being used. This compass utilizes tilt compensation and has the ability to handle magnetic distortion.

DEPLOYABLE AND RETRACTABLE BOOM SYSTEMS FOR MICROGRAVITY PAYLOADS

Taylor Kerl and Christopher Volle, Department of Mechanical and Materials Engineering,
University of Nebraska–Lincoln, NE 68508

The mission for the RockSat-X team was to design, build, and test a payload that contains a prototype deployable and retractable boom and solar panel system that would be feasible for implementation on sounding rockets. The payload is to be launched on board a Terrier Malemute Sounding Rocket to approximately 100 miles in altitude and will experience approximately three minutes of microgravity. The prototype boom mechanism is designed to expand four times its footprint and will be able to extend and retract safely in approximately 30 seconds each direction. The boom is designed with a generic interface so that any end effector that may need clearance from the rocket and payload section could be attached. The University of Nebraska–Lincoln is testing a prototype solar panel mechanism as the end effector with the guidance of engineers at NASA Langley and Kennedy Space Center. This solar panel mechanism is being tested as a proof of concept for future CubeSat missions being developed by NASA Langley. If this boom mechanism performs successfully, it will be available as an option for any future sounding rocket and payload capabilities.

2015-16 UNL UAV- INTERNATIONAL AERIAL ROBOTICS COMPETITION

Alex Drozda, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

For several years it has been apparent to the members of the UNL Aerospace Club that students in the Computer Science and Computer Engineering majors were showing disproportionately low membership in the Club. For this reason, one of the club officers attempted to start a group last year to compete in NASA's IceSat-focused quadcopter challenge. That challenge never materialized, and the team disbanded, but it did show that there was interest from students in such a challenge. Thus followed the formation of UNL UAV and its entrance in the International Aerial Robotics Competition. This competition is the longest running aerial robotics competition, and gives the competitors the challenge of completing computing tasks using flying vehicles which are considered impossible with current technology. Appearing in this competition will allow UNL UAV to demonstrate the technical abilities of graduates of the University of Nebraska to a very prestigious audience.

2015-16 UNL ROCKETRY- MIDWEST HIGH POWER ROCKETRY COMPETITION

Alex Drozda, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

The UNL Rocketry team was one of the original teams that made up the UNL Aerospace club at its founding. It has continued as a major part of UNL Aerospace since that time, successfully scoring the highest in the United States at the International Rocket Engineering Competition. Because of new rules for how rockets are to be fabricated for IREC, the team has chosen to compete in the Midwest High Power Rocketry Competition, an event sponsored by the Minnesota Space Grant Consortium. The goal of this event is both to launch a rocket with a particular height goal, and also to construct an active drag system on the rocket in order to control the height of the rocket. With many freshmen this year, this competition provides an excellent opportunity for everyone to get involved in various parts of the design.

UNIVERSITY OF NEBRASKA–LINCOLN DESIGN/BUILD/FLY

Jacob Quint, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

Each year, the University of Nebraska–Lincoln partakes in the American Institute of Aeronautics and Astronautics (AIAA) Design/Build/Fly (DBF) competition. The main objective of the competition is to allow student teams to design and manufacture an electric powered, radio controlled aircraft that can meet specific mission requirements. The mission requirements change each year to encourage innovation and creativity, but they always maintain the goal of having a well-balanced design that demonstrates good flight handling capabilities while ensuring economical manufacturing. The contest provides real-world aircraft design experience and practical application of engineering studies to students.

ASTEROID SAMPLE COLLECTION DEVICE

Maggie Clay, Carl Nelson, Ethan Monhollon, Luke Monhollon, Blake Stewart, and Kellon Ronspies, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

As part of their broader goal to advance research and development of equipment used in space exploration, NASA has introduced the Micro-g NExT program in which undergraduate students participate in design challenges relevant to current NASA programs. In spring and summer 2015, the Air and Space Research team from the University of Nebraska–Lincoln developed a simple and effective design to address the Micro-g NExT challenge of obtaining and securing asteroid surface samples. The specifications of the challenge required a compact device with the ability to separate target samples as well as secure small pebbles and rocks that could be either floating or loosely adhered to a surface. The device designed by the team addressed these and other constraints set forth in the challenge while also incorporating features to improve efficiency and ease of use. The final design consisted of a simple tong-like tool that used a modular collection cup interface to efficiently capture and package retrieved samples. The device was tested in NASA's Neutral Buoyancy Lab in August 2015. During testing, the tool proved to be a successful solution to the proposed problem, with its strongest benefits related to design simplicity and ease of use.

STRATIGRAPHIC POSITION AND AREAL DISTRIBUTION OF CONGLOMERATES IN THE SPOTTED TAIL RANGE OF DAWES COUNTY, NEBRASKA

Miles D. Chasek, Jennifer L. Balmat, Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337 and Hannan E. LaGarry, Department of Math, Science, and Technology, Oglala Lakota College, Kyle, SD 57752

The Spotted Tail Range is a salient of the Pine Ridge Escarpment located in central Dawes County, Nebraska. This region is host to extensive exposures of Arikaree Group sandstones and silty sandstones of the Monroe Creek, Harrison, and Anderson Ranch Formations as well as the Coffee Mill Butte beds (late Oligocene to early Miocene). Previous research recognized a local cross-bedded conglomeratic sandstone bed overlying the Anderson Ranch Formation in the Spotted Tail Range. Based on paleocurrent indicators and lithology, this cross-bedded conglomeratic sandstone bed was interpreted to originate from the Black Hills as tectogenic sediments transported during Early Miocene tectonic rejuvenation. In order to further characterize the extent and stratigraphic position of the cross-bedded conglomeratic sandstone bed in the Spotted Tail Range, we conducted a field study in which cross-bedded conglomeratic sandstone exposures were mapped and described in measured sections.

Our fieldwork showed that the cross-bedded conglomeratic sandstone bed can be mapped at a 1:6,000 scale and is confined to an area of about 5 square kilometers. A previously unrecognized coarse-grained cross-bedded sandstone bed containing occasional granule and pebble-sized grains was observed within the Harrison Formation. Exposures of this bed were confined to an area of approximately 1 square kilometer. The results of this study provide a foundational dataset for more detailed analyses on the cross-bedded conglomeratic sandstone beds of the Spotted Tail Range. This research was funded by the NASA Nebraska Space Grant Fellowship program.

ROLE OF HYDROPONIC MEDIA IN THE EPIDEMIOLOGY OF PYTHIUM ROOT ROT OF LETTUCE

Karen Saavedra and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha, NE 68106

Pythium is a soil-borne pathogen that causes seedling damping off, root rot, and stunting of plants. Pythium is an oomycete and produces flagellated zoospores that disperse in water. Although infestations can be limited in soil-based cropping systems due to limited dispersal by water, Pythium infection and dispersal in hydroponic systems is a significant concern. Various support media, such as clay balls, perlite, and coconut husk, are commonly used in hydroponic systems. Pythium inocula can harbor in the hydroponic support media and infect new seedlings. The purpose of this research is to evaluate the epidemiological impact of different hydroponic media on Pythium infection of lettuce (*Lactuca sativa*). Retention of water by seven different kinds of support media and their interactions with two species of Pythium were measured. Growth of lettuce seedlings with Pythium inocula was measured through seedling assays. In addition, lettuce seeds were germinated in rockwool and transplanted into support media and maintained hydroponically. Inocula were added to the media, and stunting and root necrosis were measured after several weeks. Comparisons between support media will be presented.

AERONAUTICS AND SPACE SCIENCE

POSTER SESSION

ANALYSIS OF QUASAR OUTFLOW ABSORPTION LINES

Sean Lindgren and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

Outflows from quasars can be detected from absorption lines in their ultraviolet spectra. Outflows might contain very large amounts of energy that could affect the galaxy's evolution. I will detail our analysis techniques, demonstrating how we determine the physical characteristics of an outflow from a UV spectrum of a quasar. I will present a sample analysis of a spectrum from the Hubble Space Telescope, demonstrating how we measure the column densities and covering factor from the absorption lines. Photoionization models are then used to determine ionization states and the total energy of the outflow.

FUNCTIONAL CHARACTERIZATION OF ANTIOXIDATION SIGNALING AND CELL-CYCLE REGULATION IN THE RICE BLAST FUNGUS MAGNAPORTHE ORYZAE

Lauren Segal and Richard A. Wilson, Department of Plant Pathology, University of Nebraska–Lincoln, NE 68583

Magnaporthe oryzae is the causal agent of rice blast disease. Within the rice (*Oryza sativa*) host, *M. oryzae*, must neutralize host reactive oxygen species (ROS) bursts. The oxidative stress the fungus is exposed to, and the many genes needed for antioxidation, are key to cellular survival and proliferation of this organism. We sought to identify additional components of this oxidative defense pathway that are under the control of the glucose-6-phosphate (G6P) sensing trehalose-6-phosphate synthase 1 (Tps1) protein. Here, we functionally characterized the negative regulator of antioxidation, RSR1. Under oxidative stress, Δ rsr1 mutant strains were increased for radial growth and antioxidation gene expression and reduced for pathogenicity and sporulation compared to wild type. Using forward genetic approaches we identified two additional genes involved in cell-cycle and redox homeostasis that are crucial for infection. Together, this research furthers our understanding of how life can thrive under such severe oxidative stress conditions.

EFFECTS OF AUDITORY STIMULUS NOISE LEVELS ON THE LOCOMOTOR-RESPIRATORY COUPLING

Casey Wiens, Biomechanics, University of Nebraska at Omaha, NE 68182

Breathing and walking are two physiological processes that are naturally coupled in humans. Previously, an invariant noise signal (i.e. metronome) has been used to enhance the degree of coupling. However, the absence of variability between beats may negatively affect the physiological systems, as variability is a natural characteristic in healthy systems. This study compared the effects of three different auditory stimuli (different levels of variability in time between beats) on the coupling. Seven healthy, young adults ages 19 through 35 years. An auditory stimulus was played during 12 of the 14 conditions, and there was an instruction to walk to the beat in three of the conditions, as well as breathe to the beat in three other conditions. Step time, breath time, and walking and breathing data were used to calculate locomotor-respiratory frequency ratio and strength of coupling.

HUMAN SKELETAL MUSCLE RESPONSE TO TEMPERATURE

Roksana B. Zak, Robert J. Shute, and Dustin R. Slivka, Health, Physical Education, and Recreation, University of Nebraska at Omaha, NE 68182

One of the major physiological problems associated with weightlessness is skeletal muscle atrophy and the decline in endurance capacity. Our laboratory is actively working on the development of strategies to optimize the response of human skeletal muscle to exercise. We have uncovered a potential synergistic interaction between exercise and alterations in temperature. We have demonstrated alterations in mitochondrial biogenesis and muscle mass regulation after exercise during exposure to different temperature stimuli. Specifically, exercise and subsequent recovery in a cold environment has demonstrated enhanced expression of key genes associated with mitochondrial development, while local muscle heating before and during exercise has shown enhancement of genes related to muscle growth. Our long-term goal is to develop a practical temperature-optimized protocol to aid in the prevention and treatment of disorders associated with mitochondrial and muscle dysfunction, including the optimization of exercise protocols when exposed to microgravity.

DEVELOPING ANDROID BASED MOBILE APP TO STUDY HOUSEHOLD EMISSIONS OF CARBON DIOXIDE GAS BY MONITORING INDIVIDUAL UTILITY BILLS

Megan Kyle and Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha, NE 68106

Natural gas and electricity are the most common types of energy used for heating and cooling of homes. They contribute significantly to global carbon dioxide emission and cause global warming and climate change. In this presentation the discussion will be on climate change and its consequences, carbon cycle and carbon sequestration, US household energy usage data and the steps involved in developing an Android based mobile app to calculate the household emissions of carbon dioxide gas by monitoring individual utility bills. In this app the user will get some interesting facts about carbon dioxide emission, climate change and also learn different strategies to conserve energy at home. The objective of developing this mobile app is to educate people and change their habits of energy usage.

CLIMATE CHANGE AND WEATHER DATA COMPARISONS: A COMPARATIVE STUDY OF LOCAL, STATE, NATIONAL AND GLOBAL WEATHER INFORMATION

Christina Coffman, Falon Torez, Lorrain Smith, and Thomasina Whipple, Department of Math and Science, Nebraska Indian Community College, Niobrara, NE 68760

Climate Change has forced communities around the world to adapt to changing environmental conditions. This includes Indian Country. The purpose of this research project is to take local, state, national, and global historical temperature, precipitation, drought and tornado data and find correlations that give us insight to future climate trends that will affect our respective Indian communities. It is vital that our communities are prepared for the ever changing circumstances that climate change has and will create.

PRODUCTION OF PYTHIUM INOCULA FOR EPIDEMIOLOGICAL STUDIES IN HYDROPONICS

Demi Eble and Phyllis Higley, Department of Biology, College of Saint Mary, Omaha, NE 68106

Pythium is a primary concern in the cause of root rot, stunting of plants, and seedling damping off. Pythium is an oomycete and produces zoospores, sporangia, and oospores. Zoospores are flagellated, motile spores. In hydroponic systems zoospores are of primary interest because they are dispersed throughout the water, and therefore facilitate the spread of Pythium. The purpose of this research is to create a protocol for the production of reliable inocula. Different media and incubation protocols were tested for their effectiveness in generating mycelial, zoospore, and sporangial inocula.

ACTIVE GALACTIC NUCLEI CONTINUUM AND BROAD ABSORPTION LINE VARIABILITY

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

Active Galactic Nuclei (AGN) are compact, incredibly luminous regions at the centers of galaxies. AGN are powered by mass accretion onto super massive black holes (SMBH). As matter accretes onto the SMBH, the gravitational potential energy is converted into electromagnetic radiation. A significant fraction of AGN have mass outflows, matter ejected from the area surrounding the SMBH at relativistic velocities. These show up in spectra as Broad Absorption Lines (BAL). This project is designed to determine a relationship between AGN variability and BAL depth by analyzing spectral data from the Sloan Digital Sky Survey and comparing it to photometric data from the Catalina Sky Survey. This will help us better understand the nature of AGN.

ANTHROPOLOGY

LINGUISTIC ANTHROPOLOGY: HIGH GERMAN AS A CASE STUDY OF THE SIGNIFICANCE OF HISTORICAL LINGUISTICS

Aaron Pattee, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Throughout time, language has served as the primary method by which humans have conveyed meaning. Articulated speech and written symbols compose the two main elements of conducting language, influenced both by nonverbal language and natural environments. Historical linguistics, an aspect of linguistic anthropology, concerns the evolution of languages and their relationships to one another. Cultural implications in the linguistic evolutionary process are essential in defining and discovering dialectal similarities. Dialects are linguistic subdivisions closely associated with certain regions, and provide the connections between languages both extinct and extant. From an anthropological perspective, language is paired to the environment, with evidence provided from regional cultures, natural settings (e.g. landscapes), and archaeological sites. The derivation of High German from its linguistic ancestors provides an excellent example of each anthropological interaction (cultural, biological, and archaeological). This paper provides a concise overview of historical linguistics intertwined with a discussion of its main contributors, High German as a case study, and why historical linguistics is not merely a topic to be explored as auxiliary to larger research frameworks, but that it is the very fabric by which humans have sewn their cultures.

HISTORICAL AND PRESENT-DAY CHALLENGES OF PRESERVING THE LIVONIAN LANGUAGE IN THE BALTICS

Enia Kiusals, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Beyond its value as a method of communication, a language preserves the integrity of a people's culture. An effort to revive a dying language cannot be separated from a larger goal of preserving a way of life connected to that language. The near-extinction of the Livonian language is an example of what happens when the growth of a local community is disrupted by the arrival of foreign settlers. The occupation of Courland by foreign forces in the mid-1500s began the slow process of integrating Livonian locals into the larger population. This integration essentially came to a halt in 2013 when the last native speaker of Livonian passed away. Attempts at reviving the Livonian language have been semi-successful, but the constituents of this effort have been faced with many challenges. These stem from the continual refusal of occupying forces to recognize the Livonian people as a distinct group within Latvia. Since the declaration of Latvia as an independent state in 1991, Livonian song and interest groups have become available for descendants of native Livonians, and for those who are interested in preserving the language. I aim to expand on the factors that have led Livonian to the brink of extinction, and to highlight the efforts that are being made to keep the language in circulation.

BIG BRAINS: WHY ONE DEFINING TRAIT OF “HUMAN-NESS” IS SO UNIQUE

Sean Field, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368.

Aiello and Wheeler (1995) first introduced the expensive-tissue hypothesis (ETH), a metabolic tradeoff between energy expensive tissues, as a possible facilitation for encephalization without an increase in basal metabolic rate in the genus *Homo*. They assert that such a tradeoff was supplemented by an increase in dietary quality, which is characteristic of subsistence shifts pursued by members of this genus. The expensive-tissue hypothesis has been criticized for its lack of support from modern biological analogues. Specifically, the ETH has been discredited as a viable evolutionary solution

because such substantial metabolic tradeoffs are not found in any living primates nor mammalian species. However, epigenetic evidence from methyl group patterns as well as metabolite concentration studies, reveal significant shifts in metabolic and dietary shifts in hominid evolution. These studies have strengthened the relationship between diet related pressures and changes in the metabolic abilities of different tissues; whether these shifts are causational or facultative of encephalization remains uncertain. I assert that a concentration on genetic studies, not organism comparative studies, may be the best option in depicting whether the relationship between the digestive tract and the brain is a legitimate “human” solution. Further, the non-necessity of modern mammalian comparisons, especially when considering the presence of a unique mutation that defined a major hominid developmental stage, will be extensively discussed.

A COMPARISON OF CRANIOMETRIC METHODS: RELIABILITY OF THREE-DIMENSIONAL SCANNING METHODS TO DIRECT HAND-HELD MEASUREMENTS

Megan Hoffman and Emily Hammerl, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Construction of the biological profile is the primary means for arriving at an individual identification in forensic work and allows for the reconstruction of past populations in bioarchaeological work. Established methods for estimating the biological profile combine both metric and non-metric methodologies. With the growth of 3D imaging technologies, the possibility of measuring remains offers a new way to examine what may be delicate, irreplaceable materials while preserving a faithful record of the remains. However, the error inherent in measuring a 3D model rather than the actual remains is still being examined. This study examines the reliability and reproducibility of craniometric measurements taken from 3D models and comments on their usefulness in current forensic and bioarchaeological practice. The specimens used in this study (N=6) consist of 6 crania on loan to the University of Nebraska–Lincoln from UC Davis School of Medicine through their Body Donation Program. The crania were scanned using a NextEngine 3D laser scanner. Images were compiled and reconstructed using ScanStudio software. In accordance with standard practice, a total of 24 measurements were taken on both the actual crania and the 3D models, with digital measurements made using the open source software MeshLab. Results reported include reliability estimates for the digital models and actual crania as well as a discussion of the applicability of these results to the burgeoning field of digital osteology

AN OVERVIEW OF THE ETIOLOGY OF FOOD ALLERGIES AND THEIR PREVALENCE IN DIFFERENT ETHNIC GROUPS

John Wagoner, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Awareness of food allergies has increased in the past few decades, but this increase has been mainly reported in Western, developed nations. Is there something unique about the environments of Western, developed nations that increases the risk of developing food allergies? Is this apparent increase in food allergy risk caused by genetic factors or some phenomena related to population genetics? By examining the diagnostic criteria for food allergies, molecular methods of transmission, and the prevalence of food allergies among various ethnic groups within the US, Europe and Australia, it was found that certain ethnic groups were at greater risk for developing food allergies. However, this variation cannot be explained only by genetic factors. The environmental factors thought to be at play are numerous, but establishing causation is difficult. Some of the relevant environmental factors include UV exposure, exposure to parasites, and nutrition. The molecular factors include alternate DNA methylation patterns, variants in the major histocompatibility complex, and various transcription factors relating to immune cell function. As such, future studies of food allergies may benefit from sampling of cohorts with diverse ancestries when studying their etiology.

ARCHAEOPARASITOLOGICAL AND DIETARY ANALYSES OF DOG (*CANIS FAMILIARIS*) COPROLITES FROM LA CUEVA DE LOS MUERTOS CHIQUITOS (600-800 CE), RIO ZAPE VALLEY, DURANGO, MEXICO

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Previous studies of La Cueva de los Muertos Chiquitos (CMC) [600-800 CE] have revealed evidence of parasites known to infect domestic dogs (*Canis familiaris*). Formerly, only a single coprolite from CMC was reported to have originated from a canine depositor. Using a combination of archaeoparasitological and dietary analyses, we report the recovery of an additional 4 dog coprolites from this site. The recovery of macrofossils such as bone, insect remains, reptile scales, mammalian skin fragments, rope sections, fur, and plant fragments, are consistent with dietary residues common in domesticated canines. Such macrofossils were present among 5 of the 136 coprolites examined in the present study. Archaeoparasitological analyses of these coprolites revealed evidence of two dog-specific parasites: *Dipylidium caninum* and *Physaloptera* sp. The first was published in a previous study that did not include macroscopic analysis of dietary residues. Herein, we report the results of macrofossil analysis from coprolites microscopically examined in the previous study. Additionally, we report the recovery of *Physaloptera* sp. eggs from 3 CMC coprolites along with their macrofossils. The multidisciplinary examination of diets and parasitism via coprolite analysis provides instrumental insights regarding depositor identity, behavior, and public health among populations of the past. The present study offers new evidence regarding the role that dogs played in the perpetuation of parasite life cycles at CMC between 1,200 and 1,400 years ago.

ACCESS TO RESOURCES AND SERVICES FOR MALE SURVIVORS OF INTIMATE PARTNER VIOLENCE: A HOLISTIC AND INTERDISCIPLINARY PERSPECTIVE

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This paper focuses on a synthesis of research exploring male survivors' experiences of intimate partner violence (IPV) as well as their awareness of and ability to access various supportive resources and services. Male survivors of IPV face many physical, psychological, and social barriers to accessing and receiving medical, counseling, legal, and shelter services. Furthermore, resources often fall short of providing male-inclusive language and service providers may not receive any or adequate training related to assisting male survivors of IPV. Given the lack of existing research and knowledge concerning male survivors' experiences, service providers would greatly benefit from an increased understanding of male survivors' understanding of male survivors' experiences and barriers faced when accessing care. This paper provides an overview of existing literature and attempts to capture male survivors' experiences and identifies and discusses various barriers that they may face when accessing resources and services.

SEX WORK, PUBLIC POLICY, AND STIGMA

Abby Wild, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Sex work has long been a cause for concern to the world of public health. The public policy surrounding sex work and sex workers often divorces the humanity from the profession. Although sex work can take many forms, sex workers from all backgrounds face shared dilemmas, like how to live and work under different frames of public policy, how their careers affect their personal lives, and how they negotiate their positions in both the social and professional worlds. This research paper examines how public health and how public policy shape both the banalities of daily life for sex workers and the social, political, and cultural discourse that transcends it.

NICHE MARKETPLACE INFLUENCES ON POST-HARVEST COFFEE PROCESSING DECISIONS

Jonathan E. Ferguson, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

With the rise of specialty markets presenting opportunities for coffee producers to participate in supplying value-added lots for increased financial returns, questions arise as to whether introduction of non-traditional processing techniques are able to sustainably adapt to newly acquired cultural, economical, political, and environmental conditions. There are additional concerns to whether allocating resources for specialty coffee production will benefit or detrimentally impact coffee producer livelihoods. The post-harvest coffee processing methods addressed in this study are the following: natural (dry-processed), washed (wet-processed), semi-washed (pulped-natural), honey-processed, and wet-hulled.

A RESILIENT POMPEII: APPLYING RESILIENCY THEORY TO POST-EARTHQUAKE OF 62 CE POMPEII

Rebecca Salem, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Resiliency theory is the attempt to observe the source and role of change in a system that has adapted due to a specific perturbation, following the theory's adaptive cycle. This cycle follows a pattern of reorganization, conservation, growth, and release periods, all contributing to the building of a system's resilience. The Roman city of Pompeii provides a unique opportunity to consider the resiliency theory in an archaeological context. In 62 CE a massive earthquake devastated the city, but Pompeii proved its resilience to this occurrence through the reconstruction and reorganization of specific areas of the city up until its eventual end in 79 CE following the eruption of Mount Vesuvius. These two events provide an excellent start and end point to observe what steps were taken within the city as a response to the earthquake and the resilience being built up over time. The application of resiliency theory to Pompeii following the earthquake of 62 CE provides a new approach to understanding what was done to ensure the continuation of the city following this event.

USING GRAVESTONE PATTERNS AS A FORM OF NON-INVASIVE ARCHAEOLOGICAL RESEARCH

Erik Schulz, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

One of the most useful archaeological remains is not excavated, rather displayed publicly in order to memorialize deceased loved ones. Gravestones can tell cultural similarities and changes through time with regard to economic and social systems. Depending upon a multiplicity of these influences, distinct patterns of gravestones can shift. In turn, these gravestones provide a non-invasive source with which archaeological research can be performed. The rich history of Lincoln, Nebraska's past residents varies in ancestry, familial ties, and social classes. Using the varying patterns, texts, and materials, I hope to find a distinct theme of gravestone heads and help tell the stories of Lincoln's ancestry through this form of research.

THE BIOARCHAEOLOGY OF VIOLENCE: SKELETAL ANALYSIS ON VICTIMS OF TORTURE AND BRUTAL EXECUTION IN MEDIEVAL AND EARLY MODERN EUROPE

Lindsey Peterson, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

In this paper I will analyze the specific skeletal markers left by various torture techniques popular in the middle ages and early modern period in Europe. The marks left on bones from this time could show signs of torture or brutal execution which could help to determine the most implemented forms of torture and execution as well as the most prominently distinguishable marks left on bones of the victims. This analysis will also look into the possibility of the identification of remains by reviewing records of torture, execution, and inquisition during the time. While this is a relatively unused method of applying bioarchaeology to historical records, I will show how this method should be implemented more regularly when studying the use of torture in medieval and early modern time periods.

EMERGING IN CONTROVERSY AND FUELED BY NEW TECHNOLOGIES: BIOARCHAEOLOGY REVEALS A STORIED PAST

Maia Behrendt, Department of Anthropology, University of Nebraska–Lincoln, NE, 68588-0368

My paper explores the origins of bioarchaeology both in medicine and in the unlawful procurement of dead bodies for medical research in the 18th and 19th centuries in Europe and in the United States. Desperation to acquire cadavers led Resurrectionists, body snatchers paid by medical schools, to the less protected cemeteries that held the bodies of minorities, such as Africans, African Americans, Native Americans, prisoners, and those who died in asylums and workhouses. Not surprisingly, medical literature from these periods reveals a pervasive theme of white European superiority in many of the conclusions drawn from physical examinations of the bodies of minority individuals. My paper examines the inevitable tensions between these early medical practices and the racial biases of the time. Ultimately, these early practices of body snatching and medical dissection metamorphosed over time into today's more culturally sensitive and sophisticated methods of analyzing human remains and human ancestries.

USDA/UNL ARTIFACT ROADSHOWS: THE DEVELOPMENT OF A 2D ARCHIVE OF GREAT- PLAINS PROJECTILE POINTS FROM PRIVATE LANDS

Maia Behrendt, Department of Anthropology, University of Nebraska–Lincoln, NE, 68588-0368

The USDA Forest Service and the University of Nebraska have initiated “Artifact Roadshows” to document and digitize artifacts collections obtained from private lands in the North American Great Plains. In this region, artifact collections obtained from private lands are a common and potentially important source of information about the past. Public knowledge about archaeological sites on abundant private lands in GreatPlains states is likely greater than that of the professional archaeological community. Through Roadshow events, we have been able to learn about collector motivations, educate on best practices for documenting sites, and have helped land owners and collectors to learn about the history of the artifacts they have collected. In this talk we will discuss efforts to digitize these remains for public and research consumption via an online digital archive. The result will provide a document of finds on public lands that can aid in regional comparison and research on projectile point stylistic variation as well spatial variation in Great Plains occupation histories.

USDA-UNL ARTIFACTS ROADSHOW DIGITAL ARCHIVE: REDUCING PROCESSING TIME AND INCREASING MODEL SUCCESS RATES IN 3D PHOTOGRAMMETRY

Amos Sobotka, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

This paper/presentation analyzes the processes used to digitally document artifacts in 3D photogrammetry, specifically the capture of high quality images. The process of creating quality digital images is key to successful digital 3D model creation and reduces time spent processing images in 3D modeling software. Various variables that lead to greater success rates are addressed.

VICTORIAN DOMESTICITY ON THE FRONTIER: AN EXAMINATION OF NINETEENTH CENTURY ARCHAEOLOGICAL MATERIALS FROM A LINCOLN CISTERN

Kami Ahrens, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

This project re-examines the passiveness associated with the domestic sphere during the Victorian period. While women were generally excluded from the public sphere, the traditional approach to domesticity overlooks female agency. Despite segregation, women still exerted choice and authority within their sphere, many of them actively choosing their roles. The development of consumerism played an essential part in contemporary gender and family structures, allowing women to wield some control over the physical and metaphorical home. Much of this power centered on the kitchen and stemmed from women’s roles as household consumers. This study integrates textual, pictorial, and artifactual resources to re-evaluate female gender roles in the mid-nineteenth century. The works of Sarah Josepha Hale and Sarah Stickney Ellis serve as representations of Victorian middle-class domesticity. Ceramics, culinary tools, and related artifacts are utilized as material supplements to the textual records. Artifacts, from both museum holdings and archaeological excavations, provide physical evidence of the consumer choices of women, sharing everyday values and personalities through design choices. Materials salvaged from a Lincoln cistern formerly located beneath the current Nebraska Union will serve as a case study for this re-evaluation of domesticity. These remains will be largely represented as 3D digital models created from photogrammetry. Translating these artifacts into digital resources will not only enhance the argument of the project and provide local connections, but will

also connect with audiences in a new way that will encourage them to explore the connections between gendered identity and material culture. Ultimately, this project endeavors to examine the breadth of consumer power granted to women by industrialization and domestic authority as a source of agency through the integration of text and artifact.

RETRACING NEBRASKA'S EUROPEAN PAST THROUGH DIGITAL RESEARCH METHODS OF PRESERVATION

Chelsey Pounds, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

The application of digital technologies within archaeological research provides new possibilities to preserve not only physical heritage, but also the intangible cultural meanings that come from these historical sites. Digital reconstruction plays a vital role in rendering the past, meanwhile maintaining the integrity of spatial archaeological research of sites that may no longer exist. St. Joseph's Church in the Schneider Township of Buffalo County, Nebraska stood as a place of worship during the first half of the nineteenth century until its unfortunate destruction via windstorm in 1950. The most important role in the digital reconstruction of this church is the ensuing research to gather information, however scarce, about the upbringing of the area and the migration of immigrants to the Schneider Township. The Homestead Act of 1862 and the Burlington Railroad brought new opportunities of open land, work, and agriculture to European immigrants, ultimately enticing a group of German and Czech immigrants to the rolling plains of Buffalo County, Nebraska. The subsequent construction of St. Joseph's, St. Wenceslaus, a Bohemian Catholic Church; and Zion German Lutheran Church suggest signs of the importance of having a place of worship within these immigrant communities. However, information on the history of these communities is seemingly unavailable. Using photos and written records as well as 3D Modeling and Geographic Information Systems (GIS), I seek to retrace the history of these immigrants and assist in the preservation of what is now an intangible heritage.

DIGITAL HERITAGE AND PUBLIC OUTREACH: THE CREATION OF 'YOUR NATIONAL GRASSLANDS STORY' WEBSITE

Lexus Wellman and Luke Hittner, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

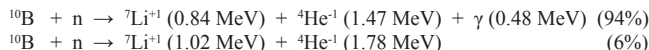
The National Grasslands Visitor Center (NGVC) is a federal government institution partly dedicated to the public education and interpretation of the archaeological and cultural resources of all twenty National Grasslands. These Grasslands, administered by the United States Forest Service and located mostly in the Great Plains, comprise nearly four million acres of public land. The Grasslands are often intermingled with private land holdings, creating cultural resource management challenges. In the rural communities that border Grasslands private artifact collections are common. The prevalence of these collections is aided by the abundance of regional cultural surface deposits. The University of Nebraska–Lincoln Anthropology Department has partnered with the NGVC to promote the unique stories of our National Grasslands, hosted at the Center for Great Plains Studies. This experience will include an interactive story map dedicated to each National Grassland, various oral histories from local landowners near these National Grasslands, and a digital archive of 2D and 3D images of artifact collections from the UNL "Artifact Roadshows".

APPLIED SCIENCE AND TECHNOLOGY

IMPROVING BORON CARBIDE NEUTRON VOLTAICS

Ethiyal Raj Wilson, Elena Escheverria, George Petersen, Michael Nastasi, Sean King, Tino Hofmann, Axel Enders and Peter A. Dowben, University of Nebraska–Lincoln, NE 68508; and Bing Dong and Jeffrey Kelber, University of North Texas, Denton, TX 76203

The low k-dielectric, boron carbide, has a number of possible applications. NASA announced in 2011 that it plans to build deep-space probes to explore the outer reaches of our solar system and beyond. There are problems, however, because the probes will be too distant to be powered by solar energy and they need to be protected from high energy exposure from the power source. Our work on boron-carbide semiconductors seeks to present a solution to both of these problems by creating the world's first neutron-voltaics and protective neutron-absorbing coatings. Novel semiconducting icosahedral boron carbides, fabricated from plasma enhanced chemical vapor deposition (PECVD) of closo-carboranes, in the presence of aromatic linking units, have excellent rectifying characteristics. These materials are also excellent dielectrics with 10^{11} Ohm-cm resistance. Charge extraction in our devices can be studied with the abrupt creation of roughly 10^5 charges, resulting in pulse widths of about 1 μsec or less. At a frequency of 1 MHz, the capacitance follows the expected $1/C^2$ relationship for a wide range of reverse bias DC voltages, deviating only within 1 V of zero bias. The dark current capacitance is greater than some 1.8×10^{-10} F at zero bias as expected with capacitance increasing with decreasing frequency. Neutron-voltaics work just as photovoltaics do, but absorb neutrons instead of photons. The basis for boron-carbide neutron capture is as follows:



While it is known that pure boron carbide is an excellent candidate for neutron-voltaics, nitrogen-based moieties, such as pyridine, cross-linked with boron carbide have improved the neutron-voltaic capabilities of boron carbide. Thus, the characteristics of pure boron carbide and boron carbide linked with pyridine were compared to quantitatively measure how the moieties improve the performance of the neutron voltaics.

HOLLAND COMPUTING CENTER: COMPUTATIONAL RESOURCES FOR COLLABORATIVE NEBRASKA SCIENCE

David R. Swanson, Holland Computing Center, University of Nebraska–Lincoln, NE 68588

Since 2009, the Holland Computing Center (HCC) at the University of Nebraska (NU) has provided advanced computational resources for data intensive science to Nebraska scientists and students. Access to HCC is available to researchers and students statewide in various ways. HCC resources range from traditional high-performance computing platforms to distributed high-throughput computing on the Open Science Grid (OSG), an international collaboration among over one hundred universities and national laboratories. This talk will present several current research projects which provide an overview of these HCC resources and illustrate the expertise of Nebraska scientists and HCC staff. Possibilities for future collaborations, including an outreach program that includes loans of HCC hardware to Nebraska institutions, will be discussed.

DETERMINING SUSCEPTIBILITY GENE EBE VARIATION ACROSS 3,000 SEQUENCED RICE GENOMES

Dalton Bichlmeier, Blake Kostal, Michael Shavlik, and Erin Doyle, Department of Biology, Doane College, Crete NE 68333

Rice is a staple food crop for much of the world's population. It is estimated that rice production must increase 25% or more by 2030 to feed the predicted world population of 9 billion people. Recently, researchers sequenced genomes of 3,000 different rice lines in an attempt to characterize the genetic diversity found in rice. This data will allow researchers to identify genetic loci associated with beneficial traits, such as disease resistance, that could be genetically engineered to increase rice production. The rice pathogen *Xanthomonas oryzae* uses transcription activator-like (TAL) effector proteins to manipulate the host plant's gene expression in specific ways that make the plant vulnerable to disease. TAL effectors accomplish this through the activation of disease susceptibility (*S*) genes in the host plant. Each TAL effector finds and activates its *S* gene target by binding to a specific Effector Binding Element (EBE) in the gene promoter. We created a custom Python script to analyze EBE sequences across all 3,000 sequenced rice genomes to quantify the amount of variation and to identify novel alleles that may be useful for engineering improved disease resistance. Comparison of variation in *S*-gene and non-*S*-gene promoters may also provide evidence for selection at EBE loci. We will report on our progress towards quantifying EBE variation, and comparing variation between classes of EBEs and across gene promoters.

NORTHWESTCHEM: A HIGH-PERFORMANCE COMPUTATIONAL CHEMISTRY SOFTWARE SUITE

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

NorthwestChem (NWChem) is a comprehensive quantum computational software suite developed and supported by the Environmental Molecular Sciences Laboratory, which is a part of the Pacific Northwest National Laboratory (PNNL) in Richland, Washington. Since NWChem was developed and is maintained by PNNL, it is an open source alternative to commercially available quantum chemistry modeling software. NWChem is available for use at the Holland Computing Center (HCC) operated by the University of Nebraska. Examples of job submission files (SLURM) as well as various types of NWChem job files (ie. DFT, TDDFT, HF, and Solvation) will be presented. Available documentation for HCC and NWChem will also be discussed as well as the NWChem users group.

IDENTIFYING GENETIC LOCI ASSOCIATED WITH MORPHOLOGICAL PHENOTYPES FROM MOUSE BRAIN IMAGE DATA AS AN UNDERGRADUATE COURSE PROJECT

Tyler Brookshire, Hunter Creglow, Nolan Field, Qing Li, Michael Shavlik, Jessica Swanger, Erin Doyle, and Tessa Durham Brooks, Department of Biology, Doane College, Crete, NE 68333

Despite significant scientific advances that make it relatively easy to sequence an organism's entire genome, making sense of that information remains a difficult and complex task. Genomics, the study of how an organism's genetic code is constructed and used, and phenomics, the study of how all of an organism's functions depend on its genetic makeup and environment, are intimately linked fields. They encompass many subdisciplines, such as bioinformatics, proteomics and metabolomics, statistical genetics, and systems biology. Brought together, these two fields have the potential to help scientists revolutionize human health and agriculture by enabling prediction of phenotypes from genotypes.

Adequately defining and measuring a process or trait of interest so that significant associations with a population's genetic variation can be made is a common issue in statistical genetic studies. Students currently enrolled in Genomes and Phenomes at Doane College have been exploring these fields through investigations of primary literature and a course research project linking genetic loci to measured phenotypes. Students used the tool ImageJ to measure up to three morphological features from mouse brain images. R/qtl was used to perform QTL analysis, resulting in identification of genome regions correlated with the measured phenotypes. Students combined data from the UCSC Genome Browser, NCBI, and other online databases to narrow their lists of candidate genes within each QTL identified to those with the strongest evidence of being causally linked to the measured phenotype. Students will report on their progress on the project, as well as on their experiences in the course overall.

BIOLOGICAL AND MEDICAL SCIENCES **SESSION A**

UNDERSTANDING THE ROLE OF OXYGEN IN THE STABILITY OF A PUTATIVE NICKEL BINDING SITE IN A NICKEL METALLOCHAPERONE

Melissa Davison and Amanda Glass, Department of Chemistry, University of Nebraska at Kearney, NE 68849

At least one-third of proteins characterized to date require a metal ion cofactor for activity or structural stability. In some cases, metallochaperones are required; metallochaperones are proteins that sequester a specific metal ion from the cellular milieu, protect it from reactivity with other cellular components, and mediate metal ion binding or insertion into the protein. The *E. coli* protein SlyD is such a metallochaperone, responsible for nickel ion insertion into nickel-iron hydrogenase (an enzyme responsible for cellular redox cycling) in the bacterium.

This research project involves characterizing a metal-peptide complex from the metal binding domain (MBD) of the nickel metallochaperone SlyD. Purchased peptide segments of the metal binding domain were characterized using UV-Vis spectroscopy. These electronic absorption spectra will be used to help determine the likely structure of the complex. Our data will likely support and/or enhance current understand the binding ratio and stoichiometry in the whole protein.

One of the major objectives of this project is to compare the stability of the peptide's metal binding domain produced in aerobic and anaerobic environments. Aerobic environments subject proteins to oxidation reactions. Oxidation of amino acids within a protein can alter its structure, and therefore its function, in this case its ability to bind to nickel. Production of, and experimentation on, the peptide-metal complex took place in an anaerobic glove box, to generate an unoxidized product. Results of these studies were compared to previous domain characterization that did experience oxidation, from both literature data and previous projects in this lab, which obtained spectroscopy data that indicated oxidation. The results of this work contribute knowledge about the transport of metal ions in biological systems. This work was funded in part by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

PATTERNS OF ANTIMICROBIAL RESISTANT *E. COLI* ISOLATED FROM DOMESTIC AND WILD DOGS IN NORTHERN NEBRASKA

Megan McLean, Brianna Butler, and Ann Buchmann, Chadron State College, Chadron, NE 69337

Multi-drug resistant bacterial species are a growing health concern. Antimicrobial resistance can rapidly spread through horizontal transfer and prevent effective treatments for a multitude of diseases caused by bacterial infections. Domesticated pet dogs have been shown to be a potential source of antimicrobial resistant *E. coli* strains that may be hazardous to their human owners. The purpose of this study was to determine the prevalence of antimicrobial resistant and *E. coli* strains in dogs of northern Nebraska and to compare the antimicrobial resistance patterns of domestic dogs and feral dogs in order to better understand the effect human interaction and veterinary care have on antimicrobial resistance patterns in pets. Fecal samples were collected from various domestic dogs and feral dogs in northern Nebraska and plated on Eosin Methylene Blue (EMB) agar to harvest any *E. coli* strains present. Metabolic tests were used to confirm the presence *E. coli* populations. The isolated *E. coli* colonies were plated with ampicillin, streptomycin, tetracycline, amoxicillin/clavulanic acid, cefoxitin, and ceftiofur disks. The zones of inhibition were measured and compared to standards set by the Kirby-Bauer test in order to determine the patterns of antimicrobial resistance. 29% of the domestic dogs had resistance to at least one antibiotic and 24% of these domestic dogs had *E. coli* resistant to two or more antibiotics while 11% of the feral dogs had antibiotic resistance and only 5% had multidrug resistance. Both the pattern and amount of antibiotic resistance varied significantly between domestic and feral dogs, suggesting that human interaction plays a major role in the acquisition of antibiotic resistant bacteria in companion animals

PREDICTED GLUTAMIC ACID-RICH PROTEIN GENE KNOCKOUT CRITICALLY IMPAIRS THE ABILITY OF TOXOPLASMA GONDII TO FORM CYSTS

Maggie Bartlett, Prasad Potluri, and Paul Davis, University of Nebraska at Omaha, NE 68134

Toxoplasma gondii is an opportunistic, obligate, intracellular parasite that nearly 30% of American adults are chronically infected with worldwide. The latent stage of infection is characterized by bradyzoite-stage cysts localized to the brain and muscle tissue. A glutamic-acid rich protein that has been shown to be early-upregulated in the transition from tachyzoite to bradyzoite was knocked-out, and the mutant was then analyzed for virulence, cystogenesis, and efficacy as a vaccine. The knock-out showed profound loss of parasitic cyst formation in mice as well as malformed cyst walls in vitro.

EXPLORATION OF CELL WALL PERMEABILITY TO ANTIBIOTIC *GLMS* RIBOSWITCH ANALOGS

Nick Bartschat and Juliane K. Soukup, Department of Chemistry, Creighton University, Omaha, NE 68178

The *glmS* riboswitch is a genetic “switch” prevalent in many gram-positive bacteria. Riboswitches are RNA structural elements found in non-coding regions of mRNA molecules and gene expression is modulated when metabolite binds directly to the RNA. Many riboswitches, once liganded, repress expression of associated or adjacent genes involved in the synthesis of the metabolite, providing an efficient feedback mechanism of genetic control. These RNA sequences have attracted the interest of many scientists, as they control essential pathways to form bacterial cell wall components. In order to develop potential antibacterial drugs that target the *glmS* riboswitch, delivery of non-natural metabolite

analogs into the bacteria is necessary. We have tested bacterial cell wall permeability using one previously identified artificial ligand, glucosamine, due to its availability in radioactive form. We tested the ability of glucosamine to permeate the cell wall of both gram-positive (*B. subtilis*, *S. pneumonia*) and gram-negative (*E. coli*) bacteria. Results showed that despite differences in cell wall make-up, the glucosamine transport was similar among all types of bacteria. Due to low amounts of transport overall, we have investigated different methods of increasing permeability. Results of these assays will be discussed.

The project described was made possible by a grant from the National Institute for General Medical Science (NIGMS) (2P20GM103427), a component of the National Institutes of Health (NIH), and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

CIRCULAR DICHROISM AS A TOOL TO DEFINE THE ELECTRONIC STRUCTURE OF METAL-BINDING PEPTIDES

Ellie Lesiak and Amanda Glass, Department of Chemistry, University of Nebraska at Kearney, NE 68849

The goal of this research is to increase understanding of the metal-peptide binding ratio within the metallochaperone SlyD, an *E. coli* protein. A metallochaperone is a protein that has the capability to isolate a specific metal ion and protect that ion from reacting with other cellular components. Three distinct peptide segments derived from the c-terminal metal binding domain of SlyD were analyzed using Circular Dichroism (CD) spectroscopy. Nickel binding was evaluated through the comparison of CD profiles of unaltered peptide segments and CD profiles of each peptide after the addition of various nickel equivalents and in the presence and absence of oxygen.

The spectra obtained will be used in an effort to determine the structures of the metal-peptide complexes. The stability of the binding domain in anaerobic and aerobic conditions will be evaluated as well. In addition, the CD spectra from this research will be compared with UV-Vis spectra collected by a collaborating researcher. Ultimately, information gained from this research will add to the existing knowledge of metal ion transport via proteins in biological systems. This work was funded in part by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

COMPARISON OF SELF-ETCH ADHESIVES WITH ATOMIC FORCE MICROSCOPY AND OPTICAL PROFILOMETRY AND ITS IMPLICATIONS

Nicholas G. Fischer and Andrew Baruth, Department of Physics; and Wayne W. Barkmeier, School of Dentistry, Creighton University, Omaha, NE; and Toshiki Takamizawa, School of Dentistry, Nihon University, Tokyo, Japan

Traditionally, adhesive dentistry has utilized 35% phosphoric acid etchants to prepare and roughen enamel surfaces for bonding. Recently, self-etching adhesives have gained popularity in the United States due to their time effectiveness. Self-etch adhesives prepare enamel and bond at the same time, compared to the traditional method of preparing and then bonding. While the ultimate goal of using etching agents is to promote a strong bond between enamel and restorations, we show self-etching agents create weaker bonds than 35% phosphoric acid etched. Simulating the oral environment's mechanical forces, we show this reduced bonding using both shear bond strength (SBS) and shear fatigue limit (SFL) testing using a one way analysis of variance with a Tukey's post hoc analysis ($\alpha=0.050$).

To visualize the effects of each etching agent on enamel, and to link surface roughness to bond performance, we examined the surface of enamel after etching. The enamel surface topography has been reconstructed with atomic force microscopy and optical profilometry, two common techniques in dental materials research. By combining two measurement techniques, two lateral scales of features can be analyzed. This combining of techniques ensures the topographical characterization is robust and clinically relevant. We analyzed the quantitative measurements of surface using a one-way analysis of variance with a Tukey's post hoc analysis ($\alpha=0.050$) and looked at its ramifications in consideration of SBS and SFL. The use of a standalone measurement technique is common in dentistry with results cross-compared with other techniques, yet our work shows that measurements are instrument-dependent. The implications of this on dental materials research as a whole will be explored.

PREVALENCE OF PATHOGENIC BACTERIA IN THE AMERICAN DOG TICK (*DERMACENTOR VARIABILIS*) IN DAWSON COUNTY, NEBRASKA

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The American dog tick (*Dermacentor variabilis*) has a wide distribution that spans the eastern United States and extends into central Nebraska. *D. variabilis* has been known to carry the pathogenic bacteria *Rickettsia rickettsii*, *Ehrlichia chaffeensis*, *Anaplasma phagocytophilum*, and *Francisella tularensis*, which can cause Rocky Mountain spotted fever (RMSF), ehrlichiosis, anaplasmosis, and tularemia, respectively. Very little is known about the risk of contracting these diseases in central Nebraska, yet the chance of encountering a tick during the warmer months is high. To investigate this, 93 male and 64 female ticks were collected from Dawson County, Nebraska to be tested for these four pathogenic bacteria. Total DNA was extracted from each tick and subjected to PCR using primers specific for *Rickettsia spp.*, *Ehrlichia spp.*, *Anaplasma spp.*, and *Francisella spp.* followed by gel electrophoresis. Positive PCR reactions for *Ehrlichia spp.* were found in 30 females (47%) and 21 males (23%). No *Francisella spp.* or *Anaplasma spp.* were found in either our male or female samples. *Rickettsia spp.* was found in 4 females (7%) and 2 males (3%) from our samples. Five of the *Rickettsia spp.* positive PCR samples were sent in for sequencing, and were all identified as *R. montanensis*, which is a nonpathogenic relative of *R. rickettsii*. These results suggest that the risk of contracting tick-borne RMSF in central Nebraska is not as high as previously assumed. The specific identity of the *Ehrlichia spp.* found in our samples is currently under investigation. The project described was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (8P20GM103427), a component of the National Institutes of Health.

MOLECULAR PHYLOGENY AND BIOGEOGRAPHICAL HISTORY OF SUBTRIBE NEPETINAE (LAMIACEAE): AN EXAMINATION OF THE EAST ASIAN AND NORTH AMERICAN DISJUNCTION WITHIN THE GENUS *AGASTACHE*

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Agastache is a 22-taxa genus of aromatic flowering plants within the family Lamiaceae (subfamily Nepetoideae, tribe Mentheae, subtribe Nepetinae). The genus is important in the horticultural trade, commonly known as “giant hyssop”. *Agastache* is currently taxonomically divided into two sections, Brittonastrum and Chiastandra, based on geographic occurrence and staminal conformation, defined by Lint and Epling, 1945. Twenty-one species of *Agastache* are found across North America, while a lone species, *A. rugosa*, is endemic to eastern Asia. This study employs internal and external transcribed spacers (ITS and ETS, respectively) and pentatricopeptide repeat (PPR) nuclear DNA regions to analyze relationships within the Nepetinae subtribe, examines the geographic distribution of ancestral lineages with special emphasis on the *Agastache* disjunction. There is convincing support for the divisions between the two sections with PP>0.90 for nodes grouping sampled taxa for each section. This study did not find that *A. rugosa* is grouped in section Chiastandra, but rather is a first divergent species and shares common ancestry with both sections with a Eurasian/North American distribution, coinciding with a circumboreal flora around 3mya. Ancestral node for the whole Nepetinae subtribe appears to have Eurasian origins, based on rooting to *Agastache* to outgroups within the Nepetinae. The results of this study supports the Acto-tertiary distribution and the hypotheses of a circumboreal flora prior to the Pliocene and floral response to cooling trends during the mid-late Miocene.

BUGGY CREEK VIRUS DISTRIBUTION AND DYNAMICS IN SWALLOW BUGS (*OECIACUS VICARIUS*) IN CLIFF SWALLOW (*PETROCHELIDON PYRRHONOTA*) COLONIES IN SOUTHEAST NEBRASKA AND SOUTHWEST IOWA

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Alphaviruses are positive sense RNA viruses carried by arthropods that are responsible for a number of encephalitic and rheumatic diseases in vertebrates. Buggy Creek Virus (BCRV) is an alphavirus that is transmitted to birds by the cimicid swallow bug (*Oeciocacus vicarius*) via infestation of the birds’ nests. It is hypothesized that in times of high stress (such as in overwintering bugs), BCRV produces incomplete particles called defective interfering (DI) particles that prevent assembly of the full wild type phenotype. We located five active cliff swallow colonies with swallow bugs and tested swallow bugs for the presence of BCRV over time and in different age classes of swallow bugs. Upon collection, bugs were sorted into five age groups, homogenized and frozen for downstream testing of viral presence and cytopathic effect. Viral RNA was detected through RT-PCR, and viral infectivity was measured using a modified TCID50 procedure. Over the course of three months, we saw a positive correlation between cliff swallow nesting activity and swallow bug populations, as well as detectable BCRV. Specifically, detectable BCRV decreased 52% in bug pools after cliff swallows left our sites. The results of this project indicate that BCRV persistence in swallow bugs is highly dependent on the presence of cliff swallows, with peak BCRV RNA being detected during the nesting season. Although high levels of BCRV RNA were detected across multiple swallow bug age classes and sites, BCRV isolated from bugs at all time points was only minimally cytopathic. Future work is needed to determine the genomic structure of BCRV isolates from swallow bugs and to confirm possible involvement of DI particles in the viral dynamic patterns detected in this project.

PHOSPHATIDYLINOSITOL-4-PHOSPHATE AND OXYSTEROL BINDING PROTEINS ARE NECESSARY FOR LYSOPHOSPHOLIPID TRANSPORT IN SACCHAROMYCES CEREVISIAE

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A cell's ability to carry out basic life functions depends on how well the cells' can synthesize, degrade, and transport phospholipids. Aside from being an integral part of a cell's life, phospholipids are also key players in biogenesis and apoptosis. Miltefosine (MIL), an alkylphospholipid and a stable analog to lysophosphatidylcholine (lyso-PC), is known to induce apoptosis in cells by accumulating in cellular membranes (Van Blitterswijk & Verheij, 2013). However, the mode by which miltefosine travels to and accumulates in intracellular membranes is not understood. Through miltefosine resistance screens and fluorescence microscopy we aim to find out which intracellular membranes miltefosine is targeting and how it is getting to those specific organelles. We have found that mutants that either lack Sac1p (a phosphatidylinositol-4-phosphate phosphatase), have a decrease in expression of Stt4p (a phosphatidylinositol-4-kinase), or lack Osh2 (encoding an OxySterol binding protein Homolog that binds phosphatidylinositol-4-phosphate) exhibit miltefosine resistance and altered transport of fluorescent lyso-PC. The Sac1 mutants tend to collect Top-Fluor LysoPC (TF-PC), a fluorescent analog to miltefosine, in their vacuoles while the Stt4 mutants tend to collect TF-PC in vesicles. Our findings have implications for the improvement and development of new and more effective lipid-targeting chemotherapy drugs.

PARASITES AS AN ECOLOGICAL BAROMETER

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Biological surveys help us understand inter-species interactions in ecosystems. Relatively little is known about parasite species distributions within Native American Reservations and South Dakota in general (Ahterson 1917). Previous studies suggest that the environment plays a role in parasite distribution (Faulkner 2014) and so may indicate ecosystem health. Parasites have complicated life cycles that utilize a variety of hosts (Gaston 2006). Thus their presence or absence can indicate the disturbance level and relative health of an ecosystem (Froeschke 2013). Higher parasite diversity should indicate a less disturbed ecosystem while lower parasite diversity should indicate a more disturbed ecosystem.

To test this, we surveyed small mammals and their parasites in Pine Ridge Indian Reservation. We predicted that the healthier, less disturbed environment would have a greater species diversity of parasites and hosts.

BIOLOGICAL AND MEDICAL SCIENCES
SESSION B

MUTANT BVDV WITH MODIFIED N^{pro} INDUCES TYPE I INTERFERON PRODUCTION VIA RLR-DEPENDENT PATHWAYS (INCLUDING: MAVS, TBK-1, PKR, IRF-3 AND IRF-7)

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Viruses can interfere with components of the type 1 interferon (IFN-1) induction and signaling pathway to subvert the innate immune system. Bovine viral diarrhea virus (BVDV) is a member of the genus *Pestivirus*, family *Flaviviridae*. The N^{pro} product of BVDV targets the host's innate immune response and prevents the production of IFN-1. BVDV N^{pro} induces proteasomal degradation of interferon regulatory factor 3 (IRF-3) but does not reduce the transcriptional activity of the IRF-3 promoter and does not affect the stability of IRF-3 mRNA. In the present study, we used a noncytopathic (ncp) NY93-BVDV2 wild-type (BVDV-wt) and its mutant with modified N^{pro} fused with enhanced green fluorescent protein (mutant BVDV) to characterize the effects of BVDV2 N^{pro} on the roles of IFN-1 cell signals that function via RIG-like receptor (RLR)-dependent pathways (including: MAVS, TBK-1, PKR, IRF-3 and IRF-7). Bovine cells infected with mutant BVDV synthesized a significantly ($p < 0.0001$) greater level of IFN-1 compared to BVDV-wt. Further characterization of the *in vitro* temporal production of mRNA using a real-time quantitative-RT-PCR assay suggests that mutant BVDV with dysfunctional N^{pro} upregulates the expression and function of IFN-1 cellular signaling components MAVS, TBK-1, IRF-3, IRF-7, and PKR greater than that of the BVDV-wt with a functional N^{pro}. Upregulation of RLR-dependent pathway genes was observed as early as 2 hours post-infection, depending on the gene, and peaked 5 days post-infection for all signals analyzed. The levels of RLR-dependent pathway gene mRNA expression on day 5 post-infection of mutant BVDV were up regulated [MAVS (1.7X), TBK-1 (2.3X), PKR (3.5X), IRF-3 (4X), IRF-7 (3X)] compared to BVDV-wt. Up regulating the host's immune response by use of a mutant BVDV while maintaining antigenicity may contribute to the development of a safer and more effective BVDV vaccine.

CHARACTERIZING METAL BINDING IN PEPTIDES DERIVED FROM THE SLYD METALLOCHAPERONE USING ISOTHERMAL TITRATION CALIBRATION

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One-third of proteins characterized to date require a metal ion cofactor for structural integrity or activity. However, metal ions are also capable of facilitating detrimental chemistry in the cell. Therefore, metal ion transport proteins and systems have evolved. The research focus in our labs is on the *E. coli* metallochaperone protein SlyD, which binds to and delivers nickel to the enzyme nickel iron hydrogenase in the bacterium. We work with small peptides derived from the sequence of SlyD in order to define individual metal binding sites and better understand nickel binding and release in the metallochaperone.

Using isothermal titration calorimetry (ITC), metal binding can be characterized within these peptides. This includes stoichiometry, equilibrium constants, and the heats of reactions. ITC can help distinguish if there are multiple binding sites for the metal in the compound. The relationship between the rate of heat and time in the reaction that occurs can be learned. This data is helpful for understanding the binding properties of the peptides, and will provide insight in to how metal ions are transported within biological systems. This could be used in the future for the inspiration of new therapeutic molecules developed against organisms that require nickel ions for their pathogenicity. This work was funded in

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INFLUENCE OF SIR-2 ON PHYSIOLOGICAL DNA BREAKS IN ALZHEIMER'S DISEASE MODEL *DROSOPHILA MELANOGASTER*

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Activation of neurons by neurotransmitters naturally induces DNA damage in the form of double stranded breaks which are repaired efficiently in normal cells but not in cells from mice with Alzheimer's disease, presumably affecting learning and memory in these mice. We are examining *Drosophila melanogaster* models of Alzheimer's and Huntington's disease to see whether physiological brain activity leads to formation of double stranded breaks in the fruit fly brains. To induce learning and memory in the olfactory cortex/mushroom bodies of the fruit flies, we have used a technique that pairs a specific odor with a negative shock followed by a T maze choice of 2 odors. Levels of DNA damage were assayed by immunofluorescence of the mushroom bodies of fly brains using antibodies to the phosphorylated form of H2Av (the *Drosophila melanogaster* version of H2AX) as a marker for DNA damage.

Sir-2, the *Drosophila melanogaster* homolog of Sirt-1/Sirt-3 is involved in prevention of aging in fruit fly and mammalian models. Sir-2/Sirt-1 has contradictory effects on age related neurodegeneration, with inhibition of Sirt-1 generally beneficial in reducing symptoms of Huntington's disease and activation of Sirt-1 through the drug resveratrol shown to be beneficial in Alzheimer's disease. To determine whether Sir2 has a role in the repair of physiological double stranded breaks, we will mate the Alzheimer's and Huntington's fruit flies with those which have decreased expression of the Sir2 protein via RNAi. We will observe the fruit flies with and without the presence of Sir2 and compare physical behaviors including movement, climbing, and olfactory learning of affected flies with and without the presence of Sir-2. We will then compare the learning behaviors with the induction and repair of DNA damage using immunofluorescence of phosphorylated H2Av in mushroom bodies.

MOLECULAR AND PHYSIOLOGICAL RESPONSE OF MEDICAGO SATIVA L. (ALFALFA) TO SALINITY STRESS

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Salinity in soils creates an imminent threat to crop yields. This study examines the physiological effects of salinity stress on *Medicago sativa* L., commonly known as alfalfa. Alfalfa is a perennial forage species of legume. It is a high yielding crop cultivated in areas affected by salinity in attempts to restore productivity. Salt tolerance is complex genetically and physiologically. The life cycle stages of alfalfa affect growth through cellular responses to osmotic effects as well as reduction in growth from accumulation of salts. Salinity decreases chlorophyll content and net photosynthetic rate in plants as ions are accumulated in an unbalanced, toxic manner through adversely effecting essential respiration processes. Studies in alfalfa looking into effects of salinity have been successful in creating more salt tolerant lines, though a comprehensive understanding of mechanisms engaged in salt tolerance has not yet been achieved. The effects of salt stress are studied through observing responses during germination, growth, photosynthesis, ion accumulation, and antioxidant involvement in alfalfa. Four varieties of alfalfa are used and five different concentrations of NaCl to treat the plants; there were ten plants per treatment per variety, or fifty plants per variety of alfalfa, generating a total of 200 alfalfa plants. Chlorophyll data was taken using a SPAD chlorophyll meter. Enzyme assays were used to detect

reactive oxygen species which indicate heightened environmental stress response. RNA analysis was employed to compare changes in genes due to salinity stress. My null hypothesis is that there will be no difference in alfalfa productivity in plants exposed to salinity stress compared to those not exposed to salinity stress. My alternative hypothesis is that alfalfa plants not exposed to salinity stress will show maximal germination and growth while plants under salinity stress will have decreased productivity. Increasing salt tolerance in crops is crucial for plant breeding to maintain global food production.

A REVIEW OF EXPERIMENTAL COMPOUNDS DEMONSTRATING ANTI-TOXOPLASMA ACTIVITY

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Toxoplasma gondii is an apicomplexan parasite capable of infecting humans and other mammals. Treatment options for *T. gondii* infection are severely limited and have major flaws, including high toxicity and low tolerability. Additionally, no treatments are approved by the FDA for the treatment of pregnant women, a high-risk population due to the risk for transplacental infection. Therefore, there is a need for the development of novel treatment options; in order to aid in this effort, we have compiled information on compounds currently under development that have provided, at minimum, *in vitro* data regarding the molecule's ability to inhibit infection. These compounds have been evaluated based on traditional characteristics of successful drug compounds, including: the fifty percent inhibitory concentration, therapeutic index, and *in vivo* anti-Toxoplasma activity in model organisms.

CHARACTERIZING NORTHERN GOSHAWK HABITAT AND PREDICTING POTENTIAL LOSSES TO CLIMATE CHANGE

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Climate change poses a major threat to many different habitats and species. The Northern goshawk, an apex forest raptor and indicator of boreal ecosystem health, is one important species threatened by the effects of climate change. Warmer temperatures have allowed the mountain pine beetle to thrive, leading to the widespread destruction of large old growth forest stands throughout the Rockies. Due to a lack of understanding of habitat preferences for goshawks, it has been difficult to mitigate the impact of climate induced habitat destruction. In an attempt to quantify preferential nesting and post-fledgling habitat, we conducted an in depth survey of vegetative characteristics of goshawk nest sites in the Lewis and Clark National Forest, Montana. From the active nest sites identified in this study, we were also able to collaborate with a team at NASA to use the NASA Earth to locate and model potential suitable nesting habitat in the area. In the future, we also plan to take this a step further using LiDAR technology to map these sites. By creating a comprehensive list of habitat preferences and identifying potential suitable habitat for goshawks, we may be able to alter habitat to fit these parameters as a means to remedy further habitat destruction in the future. If this method of habitat characterization is successful, we expect that it may be more widely applicable to other key species and habitats as well.

FLOWER VISITS BY MONARCH BUTTERFLIES AT FOUR EASTERN NEBRASKA PRAIRIES

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There is increasing concern about the plight of the Monarch butterfly (*Danaus plexippus*), leading to a variety of efforts to support and increase populations. While most efforts have concentrated on providing sufficient milkweed host plants for Monarch caterpillars, another important consideration is providing a season-long, diverse community of nectar sources for the adult butterflies both during the breeding season and fall migration. Here, we present data from over 1400 Monarch visits to 51 species of flowers, observed in conjunction with Pollard Transect population surveys, from four Eastern Nebraska prairies: Glacier Creek Preserve and Bauermeister Prairie near Omaha (observations from 2002 to 2015), and Ninemile Prairie and Spring Creek Prairie near Lincoln (2005-2014). In addition to overall results, we categorize Monarch flower visits by site, month, and habitat. More than half of all visits were made to Tall Thistle (*Cirsium altissimum*), but a number of other flower species were also important at different sites and times of year. To support Monarch butterfly populations, conservation efforts should not only aim at providing adequate milkweed host plants, but also a season-long variety of adult nectar plants that are favored by this iconic and threatened species.

ORANGE SULPHUR BUTTERFLIES, *COLIAS EURYTHEME*, ACQUIRE SUBSTANTIAL AMOUNTS OF POLLEN WHEN VISITING PRAIRIE FLOWERS

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Relatively little is known about the importance of butterflies as pollinators. While undoubtedly less important than bees overall, more knowledge is needed to assess the role of butterflies in the pollinator community. This study focused on pollen acquisition by the Orange Sulphur butterfly (*Colias eurytheme*) at Glacier Creek Preserve in Eastern Nebraska. Previous research suggested that Orange Sulphur butterflies are flower constant, a necessity for effective pollination. The goal of this research was to determine if flower-visiting butterflies actually pick up pollen and if the type of pollen picked up is consistent on individual and population levels. To do this, we measured and characterized the morphs of a total of 459 pollen grains collected from the proboscis and legs of 27 individual Orange Sulphur butterflies. The majority of pollen carried on most individual butterflies was of an echinate sphere morph, and of similar size. The majority of butterflies in the population carried the echinate sphere morph, also of similar size. These findings suggest that butterflies could be important pollinators in prairie ecosystems and should be taken into account in the management or restoration of prairies.

REPRODUCTIVE DEVELOPMENT IN THE AQUATIC SPECIES *RUPPIA MARITIMA*

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Ruppia maritima is an aquatic angiosperm found in alkaline lakes and coastal areas around the world. *Ruppia* is a water-pollinated (hydrophilous) species and this has consequences for many reproductive traits. The goal of this study was to characterize reproductive structures and development in *Ruppia*. The timing of pollen reception, stigma receptivity and anther dehiscence were determined, with stigma receptivity both preceding and overlapping anther dehiscence. Pollen loads were highly variable, consisting of up to 15 pollen grains. The average pollen-to-ovule ratio in *Ruppia* was also calculated. Investigating the reproductive biology of *Ruppia* will provide crucial information regarding the effect of the transition to hydrophily on reproductive traits.

CHARACTERIZATION OF THE PROGAMIC PHASE IN *RUPPIA MARITIMA*

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Ruppia maritima is an aquatic angiosperm that grows in brackish estuarine and coastal waters on every continent except Antarctica. *R. maritima* exhibits water pollination, in which pollen grains are transported across the water surface in pollen rafts to receptive stigmas. The goal of this research was to characterize the progamic phase, the period of development from pollen germination to fertilization, in *R. maritima*. In order to determine the rate of pollen germination and pollen tube growth, immature flowers were field collected and kept in individual aquaria in a greenhouse until the stigmas became receptive. The flowers were then hand-pollinated and collected at intervals of 5-15 minutes after pollination. Carpels were stained and imaged using fluorescence microscopy. Pollen grains germinated within five minutes after pollination and fertilization was achieved within an hour after pollination. Pollen tubes were measured at each time point to determine the average rate of pollen tube growth. Rapid pollen germination and pollen tube growth rates in *R. maritima* are important for achieving reproductive success, as fertilization must occur before pollen grains are washed off of the stigma. We also confirmed that *R. maritima* can self-fertilize, thus improving its reproductive success. This study not only yields data regarding the progamic phase in *R. maritima*, but also provides insight into reproductive traits associated with successful water-pollination.

CLONING, EXPRESSION AND CHARACTERIZATION OF 5-AMINOLAEVULINIC ACID DEHYDRATASE FROM *ESCHERICHIA COLI*

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The tetrapyrrole biosynthetic pathway produces important biological products such as hemes, chlorophylls, siroheme, and cobalamin. After the initial production of 5-aminolaevulinic acid (ALA) in the first step of the pathway, two ALA molecules are combined together by 5-aminolaevulinic acid dehydratase (ALAD) to produce porphobilinogen, a structural piece used to create the basic tetrapyrrole structure characteristic of the hemes and chlorophylls. Notably, much is still not understood about the enzymes that construct this pathway, including ALAD, which is responsible for several life threatening and poorly understood disorders. The purpose of this study is to clone, express and characterize the activity of ALAD in order to lay the foundation for future studies of this enzyme in our lab. This goal has been accomplished by amplifying the gene, *hemB*, and incorporating asymmetric cut sites through PCR of genomic DNA of *E. coli*. This product was digested and ligated into pET28a+ in frame with the N-terminal 6X-His tag. Clones were screened for the presence of the inserted gene and sequenced. ALAD was expressed in BL21 cells and purified via Ni-NTA chromatography. Enzyme assays have been performed on the His-tagged and non-His-tagged versions of the enzyme.

BIOLOGICAL AND MEDICAL SCIENCES
SESSION C

QUANTIFYING *PSEUDOMONAS AERUGINOSA* USING FLUORESCENCE SPECTROSCOPY

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This study examined the relationship between each of optical density, colony forming units (CFU) plate-count and fluorescence as a function time, which relates directly with the concentration of the bacteria, *pseudomonas aeruginosa* (PA). Since Nicotinamide adenine dinucleotide (NADH) is present in all living cells, a measure of its autofluorescence as a function of time can be used to monitor the population of any strain of *Pseudomonas aeruginosa* (PA). NADH shows fluorescence at 450nm when excited at 340nm. A generic strain of PA, PA01, was used for fluorescence of NADH. PA with green and enhanced fluorescent protein incorporated (PA14/EGFP) fluoresces at 514nm when excited at 475nm, and is therefore a convenient reporter for this study because it does not appear to overlap the autofluorescence of the cells.

INVESTIGATING THE POTENTIAL ROLE OF LONG NON-CODING RNA IN MICROGLIAL POLARITY

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We have established an *in vitro* system to address a timely and important issue that differential expression of long non-coding RNA (lncRNA) regulates microglial plasticity and determines whether microglia function as pro-inflammatory (M1), neurogenic (M2), or homeostatic surveillance cells. Our preliminary data suggest that microglia responding to damaged neurons acquire an M2 phenotype expressing higher levels of M2 markers CD206 and Arg1, and lower levels of M1 markers CD45 and MHCII. Media from co-cultured microglia and damaged neurons contains a significant decrease in M1 neurotoxic cytokines IFN- gamma and TNF-alpha, and a $23 \pm 2.5\%$ increase in the M2 neurogenic cytokine MCP-1. Reactive nitrogen species (RNS) production by homeostatic microglia was 2.20 ± 0.06 mM and by M2 microglia was 1.26 ± 0.09 mM which differed significantly from RNS production by M1 microglia (6.05 ± 0.06 mM) as measured by Greiss reaction. RTPCR analysis is being performed to verify ELISA data regarding the M1 and M2 states. We have demonstrated that the long intergenic ncRNA (lincRNA), lincRNA-Cox2 is an early-primary gene controlled by NF- κ B signaling in M1 stimulated microglia, suggesting that other lncRNAs may be involved in microglia plasticity and polarization. lncRNAs may be critical mediators of microglial functional plasticity and may participate in pathogenesis of various inflammatory and neurodegenerative diseases making them targets for therapeutic interventions. This project was funded by a Health Science Strategic Initiative Award (Creighton University).

TRANSLOCATION OF DOLUTEGRAVIR-PLGA-NANOPARTICLES AND DOLUTEGRAVIR-CELLULOSE ACETATE PHTHALATE- NANOPARTICLES INTO HUMAN CELLS

Marisa Varghese, Charlton Meyer, and Annemarie Shibata, Department of Biology; and Subhra Mandal and Christopher Destache, School of Pharmacy and Health Professions, Creighton University, Omaha, NE 68178

Acquired immune deficiency syndrome (AIDS), caused by HIV infection, is responsible for an estimated 34 million deaths so far, including 1.2 million in 2014 alone. Antiretroviral drugs acting before integration of the virus with human DNA are being evaluated for pre-exposure prophylaxis (PrEP) of

HIV infections. Our collaborators have synthesized nanoparticles (NPs) using two types of polymers: cellulose acetate phthalate (CAP) and poly(lactic-co-glycolic acid) (PLGA). CAP is a widely used low cost pharmaceutical excipient that has been found to have potential use as a topical microbicide. PLGA is a biodegradable polymer used to target nanoparticles to specific organs and cells, such as the brain. In this study, both CAP and PLGA NPs are loaded with dolutegravir (DTG), an FDA-approved integrase inhibitor, with high intrinsic membrane permeability. NPs were tagged with fluorescent rhodamine in order to visualize delivery into cells. The translocation of these CAP-DTG-NPs and PLGA-NPs into the human cervical HeLa and vaginal VK2/E6E7 cells lines was measured using immunofluorescent microscopy. Delivery into human primary human peripheral blood cells (PBMCs) was determined using flow cytometry with a LIVE/DEAD® counter stain. Identifying the best method of delivery of the drugs to human cells will allow for the development of targeted therapies. Research reported in this publication was supported by the National Institute Of Allergy And Infectious Diseases of the National Institutes of Health under Award Number R15AI118550. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

INVESTIGATION OF THE TRANSMISSIBLE MINK ENCEPHALOPATHY SPECIES BARRIER EFFECT VIA AGGREGATION AND SOLUBILITY SCREENING ALGORITHMS

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Transmissible mink encephalopathy (*TME*) is a rare spongiform prion disease affecting the central nervous system of adult mink (*Mustela vison*), but not ferret (*Mustela putorius furo*). The primary sequences of mink and ferret cellular prion proteins (PrPC) differ only at two locations: Phe179→Lys and Arg224→Gln. In this work, computationally predicted conformations of mink and ferret PrPC were investigated using aggregation and solubility screening algorithms for providing potential role in the TME species barrier effect to shed light on the influence of native PrPC conformation on the species barrier effect. The Aggrescan3D and Structurally Corrected Camsol algorithms were utilized to identify varying aggregation propensities of the three-dimensional structures and solubility characteristics of the primary sequences, respectively. A number of residues in the second and third α -helices display contrasting aggregation or solubility trends for mink and ferret. Determining which PrPC residues and regions contribute to PrPC misfolding in mink but not ferret can either provide a possible explanation of the species barrier effect or pose questions other conformational dynamics methods may answer.

INTERACTIONS AND ORIENTATION OF THE PRION PROTEIN AT THE MEMBRANE INTERFACE

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Prion proteins may act as infectious agents that cause transmissible spongiform encephalopathies (TSEs), a class of fatal neurodegenerative diseases in many mammals, including humans. The physiological function and misfolding pathway of prion proteins is not well known, but they are normally found GPI-anchored to the outside of cells throughout the body and brain. Understanding how prion proteins interact with the membrane interface and surrounding environment provides insight on these uncertainties. In this presentation, we will discuss our results based on biomolecular modeling

techniques that identify favorable modes of interaction of the PrPc molecule with model membranes. We found that factors such as prion protein orientation with respect to the membrane, membrane thickness, and lipid head group size influence PrPc binding on the membrane interface.

GROWTH SUPPRESSIVE EFFECTS OF INHIBITORS OF STAT3, SYK, AND BRAF ON CHRONIC LYMPHOCYTIC LEUKEMIA: SUPERIOR EFFICACY OF STAT3 INHIBITOR

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Chronic lymphocytic leukemia (CLL) is the most common adult leukemia in the western hemisphere, with approximately 10,000 new cases every year in the United States. It is an indolent B cell malignancy that is characterized by CD19+CD5+CD23+ cells accumulated in peripheral blood, bone marrow, and lymph nodes. CLL patients have small actively proliferating populations of mutant B cells that reproduce in bone marrow and lymph nodes. These proliferating centers provide a tumor microenvironment that provides stimuli for the cells' survival and proliferation and activates several aberrant pathways in the CLL cells. We have identified three pathways, STAT3, Syk, and MAPK, that are important to survival of CLL cells. We propose to inhibit a small molecule contributing to each pathway in order to decrease the survival and proliferation of the CLL cells. Three inhibitors have been identified, one for each pathway. Primary CLL cells obtained from CLL patients and the Mec-1 CLL cell line were each treated with four increasing doses of pathway-specific inhibitor for 24 and 48 hours. A microculture tetrazolium (MTT) assay was performed to assess the viability of CLL or Mec-1 cells. Annexin V staining was also performed to measure the rate of apoptosis in each treatment. STAT3 inhibitor consistently produced the greatest decrease in cell viability for both Mec-1 and primary CLL cells in 24 and 48 hours. Syk and Braf (MAPK pathway) inhibitors provoked a more pronounced decrease in cell viability at 48 hours compared to 24 hours. These results were confirmed through the annexin V staining. Inhibition of individual pathways in Mec-1 showed that inhibition of STAT3 resulted in 93% apoptosis while inhibition of Syk and Braf resulted in 32% and 29% apoptosis, respectively. When STAT3 and Syk inhibitors were combined and used to treat cells, there was an increase in apoptosis to 94%. When STAT3 and Braf were combined and used to treat Mec-1 cells, there was a resulting increase in apoptosis to 68%, demonstrating synergistic effects of the inhibitors. While all three inhibitors produced a decrease in cell viability, STAT3 exhibited the highest efficacy.

THE TWO MICROELECTRODE VOLTAGE CLAMP: TALKING WITH PROTEINS ELECTRICALLY

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G-protein-coupled receptors (GPCRs), such as the Oxytocin receptor, are a diverse group of membrane proteins which provide an information connection between the interior of a cell and stimuli from the environment. GPCRs allow cells to process external stimuli, like chemicals, peptides, and proteins. Understanding the role of GPCRs provides a greater insight into how cells receiving information at the molecular level can be transmitted to whole organism actions like behaviors. The long-term goal of studying GPCRs is to establish a connection between the reception of signals and observable behaviors. The first step to comprehending the role of GPCRs in organism is to understand how structure and function fit together. Molecular dynamics and the two microelectrode voltage clamp (TEVC) of *Xenopus* oocytes are the major techniques used in this study.

To obtain the skills needed for the TWVC, two control systems, γ -Aminobutyric acid (GABA) and flu virus CM2 and DM2 protein derivatives, were used. GABA is a neurotransmitting GPCR in the brain and is a primary inhibitor of the mammalian central nervous system. The GABA receptor is an ion channel receptor which when properly ligated opens up an ion channel to alter the membrane potential of a cell. Because the GABA receptor has a relatively weak membrane potential signal, CM2 and DM2, influenza ion channel proteins, acted as controls to develop the GABA receptor procedure. Expression, CM2 and DM2 protein derivatives in *Xenopus* oocytes in vitro provided a controlled environment to measure the effect of stimuli on the ion channels and create laboratory procedure for data collection and processing. The GPCR proteins were expressed in *Xenopus* oocytes through microinjection of cRNA. Electrical stimulus was applied to the oocytes to activate the ion channels using the TMVC method and data on the membrane potential was collected. The developed laboratory procedure for the CM2 and DM2 protein derivatives will be replicated on the GABA receptor. From successful GABA receptor testing, the experiment will move on to studying the influence of environmental stimuli on the Oxytocin receptor which has major impacts on human reproduction and social bonding.

INTRON DEGENERATION AND HETEROGENIETY IN THE LICHEN FUNGI TELOSCHISTES

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Introns have no known general function, however improper splicing can have serious consequences. Despite their ubiquity and importance, their origin is not well understood. We are particularly interested in ribosomal RNA (rRNA) introns and hypothesize that they arise from group I ribozymes. Here we focus on one position in the small subunit (SSU) in the fungal genus *Teloschistes*. This study has two main objectives. First, to increase sampling and discover additional introns that represent intermediate steps in the transition from group I ribozymes to spliceosomal introns. We have thus far collected 14 specimens from Nebraska, five herbarium specimens from Mexico, and four herbarium specimens from Europe. However, not all herbarium specimens yielded DNA that could be amplified by PCR. The intron sequences we do have confirm that all are closely related, yet variable and show loss of group I intron specific helical domains. In addition, RT-PCR assays indicate differences in splicing. Thus far, the Nebraska samples all appear to either not splice, or splice at low efficiency, whereas ligated exons were amplified from a subset of the herbarium specimens. Second, we would like to understand the heterogeneity of introns within a single genome. Concerted evolution is known to be a strong homogenizing force in multi-copy genes. However, previous results suggest that it is inefficient in rRNA introns. This could be an important confounding factor when trying to discern the evolutionary history of these introns. To gain a better understanding of this process we are sequencing multiple clones both from within the same thallus and between different thalli. If concerted evolution is at work, then we expect greater diversity between thalli compared to within a single thallus. The project described was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (8P20GM103427), a component of the National Institutes of Health.

GENETIC AND PHYSIOLOGICAL RESPONSES TO DROUGHT STRESS IN ALFALFA

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Medicago sativa (Alfalfa) is a widely grown legume, usually for pasture or hay. While demand for this crop increases the availability of water for irrigation decreases. Drought tolerance is for the most part measured on the molecular level. A change in genes and gene expression is the most common method. Other observations such as shoot and root length, leaf senescence, and chlorophyll content are physiological manifestations of altered genes and also provide great information on the overall tolerance of the plant and how drought-affected genes respond on the whole-plant level. In this study, four varieties of alfalfa with four different drought levels each were tested for drought tolerance over the course of 8 weeks. For each, chlorophyll measurements were taken using a SPAD chlorophyll meter. Tissues were also collected for measuring oxidative stress through peroxidase and catalase assays. Lastly, dry weight measurements were performed for all of the treatments. All assays and measurements were performed in triplicate with biological replicates. We will present our data for each of these experimental measurements as well as future directions. The authors wish to acknowledge financial support from the Cary Alfalfa Research Fund through the University of Nebraska Foundation.

USING COMPUTATIONS TO DEFINE POSSIBLE GEOMETRIES FOR NICKEL-PEPTIDE COMPLEXES TO UNDERSTAND NICKEL BINDING IN A NICKEL METALLOCHAPERONE

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Though metal ions are known to be required for the activity and stability of one-third of proteins, the process by which metal ions are transported to specific proteins remains inadequately understood. One mechanism by which metal ions are transported is through the use of metallochaperones. Metallochaperones are proteins that transport specific metal ions to their target protein, while preventing the metal ion from reacting elsewhere. One such metallochaperone is SlyD, which is responsible for the delivery of nickel ions to nickel-iron hydrogenase in *E. coli*. The nickel-iron hydrogenase is a required enzyme for cellular redox cycling. This research project aims to better understand the mechanism by which nickel ions bind to SlyD through computational analyses. Specifically, density functional theory will be used to construct peptide-nickel complexes derived from the metal binding domain (MBD) of SlyD and to calculate their energies. The energy values of the computational models will be compared to experimental values to find the most accurate peptide atomic geometry. The results of this study will supply information related to nickel transport via SlyD and transition metal transport in general. This work was funded in part by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

GENERATION OF A FLUOROGEN-ACTIVATING TAG FOR *CANDIDA ALBICANS* PROTEIN LOCALIZATION

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Candida albicans is a pathogenic fungus that resides in the human body. Normally *C. albicans* is benign within the human body, however in immunocompromised patients it can pose a significant threat to human health. The mortality rate of such an infection can reach up to 40% even in the event of treatment. Our lab studies a group of proteins, septins, that are imperative for morphogenic conversions that play a key role in the pathogenesis of *C. albicans*. Furthermore these septin protein complexes also play a role in antifungal drug susceptibility. Septin localization and abundance within the cell appears to play a role in its response to antifungal drugs and in morphogenic transitions. The use of GFP-tagged septins has revealed novel responses to environmental conditions linked with pathogenesis and *C. albicans* response to antifungal drugs, however bleaching of the signal means that it is not possible to track individual cell response to these conditions over time. In order to tackle this problem, we are generating a Candida-specific SCFV tag for septin proteins. This antibody-like tag binds to malachite green, this constraining of malachite green creates fluorescence in the green spectrum. This eliminates the bleaching of the signal because of the kinetics of binding between the SCFV and malachite green. This lets us observe septins during stress, giving us insight on their dynamic response to environmental signals. Furthermore, this work will allow us to create a novel tag for *C. albicans* that could be used to visualize the localization of other stable proteins in the cell.

STRUCTURES RELATING TO VIRULENCE CHARACTERIZED BY SHAPE ANALYSIS OF CHIMERIC COXSACKIEVIRUS 5' UNTRANSLATED REGION RNA

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Coxsackievirus B3 (CVB3) is a single-stranded RNA virus that causes pancreatitis and myocarditis in humans. The goal of this project is to determine how nucleotides in the 5' untranslated region (5'UTR) of the RNA genome interact to form structures. The shape of CVB3's 5' UTR is believed to interact with host cells' Poly(rC) Binding Protein 2 (PCBP2). This RNA-protein interaction is believed to be responsible for increasing the efficiency of viral replication, and thus contribute to its virulence. Two chimeric strains of CVB3 were studied: 28-SL2-GA and GA-SL2 28. These chimeras are a mixture of the virulent (CVB3/28) and nonvirulent (CVB3/GA) strains. The 5' UTR from both chimeric genomes was generated in vitro. This RNA segment was obtained by isolating plasmid DNA containing these chimeric inserts, and digesting the DNA to enable transcription by the T7 RNA polymerase. The RNA products then underwent the chemical modification approach called SHAPE analysis to assess the rigidity of the RNA's phosphate backbone and determine structural interactions in the folded RNA. The results will provide insight into base pair interactions and the shape of the RNA molecule. Future studies will assess how PCBP2 binding influences the structure of 5'UTR RNA.

VITAMIN D DEFICIENCY IN KERATINOCYTES INDUCES DNA DAMAGE MEDIATED PRO-APOPTOTIC FUNCTIONS THROUGH PHOSPHORYLATION OF RB

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Here we studied the role of Vitamin-D in modulating DNA damage induced apoptotic functions in porcine keratinocytes. Yucatan microswine were grouped as Vitamin-D deficient or sufficient. Animals in the sufficient group alone received 2000 IU of Cholecalciferol for six months. Histological analysis of the skin sections showed ROS or RNS mediated induction of DNA damage in the deficient group only. Our results show Vitamin-D supplementation protects induction of DNA damage in skin keratinocytes. To understand the underlying mechanism, we cultured human keratinocytes and tested the expression of tumor suppressor protein, Retinoblastoma (RB). Our results showed that RB was phosphorylated at Serine 807/811 in response to Cholecalciferol or Calcitriol deficiency. While the phosphorylation of RB was found to be inhibited up to 4 hrs of treatment with Calcitriol, treatment with Cholecalciferol for up to 24 hrs did not induce the phosphorylation of RB. Cell division regulating kinase CDK4, is known to bind to the C-terminal region of RB and inactivate it by phosphorylating it at Serine 807/811 in healthy normal cells. Also in normal healthy cells, RB mediates cellular check by preventing the cycle entry into S-phase. By bind to the two transcription factors DP1 and E2F1, RB inhibits transcription of genes that are required for progression of cell cycle into S-phase. It has been shown that in DNA damage induced keratinocytes; the interaction of RB with E2F1 persists and leads to transcriptional activation of pro-apoptotic genes. In addition, we also identified that both the check-point kinases CHK1 and CHK2 were activated in response to Vitamin-D deficiency, which play major roles in responses to DNA damage. Treatment with Cholecalciferol did not promote activation of either CHK1 or CHK2 for up to 24 hrs. However, treatment with Calcitriol showed expression of CHK1 at basal levels when treated up to 4 hrs and complete activation of CHK1 was restored at 24 hr treatment. Interestingly, no significant difference in the activation of CHK2 was observed in cells that were treated with Calcitriol for up to 24 hrs. Interestingly, expression of CHK2 has also been implicated in the phosphorylation of E2F1 at serine 364, which was observed exclusively as a part of the RB-E2F1 complex that mediates induction of cellular apoptosis by binding to the promoter regions of pro-apoptotic genes in cells undergoing DNA damage. In this study, we also identified a significant decrease in the cell density in the epidermis of the skin in the histological sections of Vitamin-D deficient swine. Therefore, we hypothesize that RB mediates induction of apoptosis through RB-E2F1 complex in Vitamin-D deficient swine's in response to DNA damage. Our results show that during Vitamin-D deficiency, CHK1 and CHK2 interact with RB and induce cellular apoptosis that contributes to the decrease in cell density in skin epidermis. This work was supported by research grants R01HL116042 and R01HL120659 from the National Institute of Health, USA, to DK Agrawal.

CORRELATION BETWEEN CARDIAC ARRHYTHMIA AND BALANCE

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Cardiac arrhythmia, or irregular heart rhythm, is a phenomenon that occurs more frequently with aging and is known to be linked to heart disease. It is also known that the risk of falling increases with cardiac arrhythmia. A study was done using transcranial Doppler to measure cerebral blood flow velocity in the middle cerebral artery within the brains of two subject populations: 1) patients undergoing treatment for heart problems and 2) age- and gendermatched controls. Cerebral blood flow was measured simultaneously with a series of balance tests. A balance score was given for each test based on the subject's body sway during controlled force plate movement. Ten subjects exhibiting heart disease were measured, and to date five controls have been tested. Preliminary results show a correlation between patient arrhythmia and the balance score given to subjects undergoing heart treatment. The aim of this study is to better understand how arrhythmia affects balance with a secondary aim of better understanding how vestibular stimuli affects arrhythmia.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION D

POSSIBLE DETECTION OF QUORUM SENSING MOLECULES RELEASED DURING *PSEUDOMONAS AERUGINOSA* BIOFILM FORMATION WITH A UNIQUE COLORIMETRIC SENSING ARRAY, DETECHIP®

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DETECHIP®, is a unique colorimetric sensing nylon array that has shown efficacy in detecting a wide array of molecules, including drugs, pesticides and explosives. The DETECHIP® nylon arrays are printed using commercially available ink jet printers. After exposure of the array to an analyte, the arrays are then scanned with a desk top scanner and the Red Green Blue (RGB) values are extracted and used for further analysis with various statistical methods in the software 'R'. Currently the specific efforts of the DETCHIP® technology are focused on the discrimination of known quorum sensing molecules released during biofilm formation from the bacteria *Pseudomonas aeruginosa*. These molecules include: N-acyl homoserin lactone, oligopeptide, autoinducer-2 and *Pseudomonas* quinolone signaling molecules. Successful discrimination could provide broad biomedical and clinical usages.

THE YEAST QUORUM-SENSING MOLECULE, FARNESOL, PROMOTES INNATE INFLAMMATORY RESPONSES

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The commensal, polymorphic, fungal pathogen, *Candida albicans*, resides in the human mouth and gastrointestinal tract with the capability of causing infection in immunocompromised individuals. As a polymorphic pathogen, it has been shown to stimulate different immune responses, based on which morphology the pathogen abides. While the white (yeast) cell morphology is known as the virulent type, the opaque (hyphae) cell morphology is not known to show virulent effects. The difference in virulence between its common morphologies can be attributed to this yeast to hyphae switch. Similarly, they also show a difference in the production of the quorum-sensing molecule, farnesol. Since the white

cell morphology of *C. albicans* is the morphology that naturally secretes farnesol, we asked whether or not its virulence could be attributed to this molecule. Previous data had shown farnesol's ability to act as a chemoattractant for macrophages and other immune cells *in-vitro*, so this finding led to the study of *in-vivo* effects of farnesol on the immune system. Mice were initially injected in the peritoneal cavity with farnesol. Cells within the peritoneal cavity were then harvested at multiple time points following injection, and abundance of inflammatory macrophage and neutrophils within each sample was measured using fluorescence activated cell sorting (FACS). Expression of cytokine and chemokine genes was also measured in each sample using qPCR. Neutrophil populations were sustained over time in the farnesol-treated mice, while inflammatory macrophage showed a delayed response by a dramatic increase in migration at 3 days post-injection. Farnesol showed sustained expression of chemokines 3 days post-injection, however the chemokine CCL-2 expression was significantly higher at 12-hours post-injection. Lastly, farnesol induced significantly higher expression of the cytokine, TNF- α , than the controls at 3 days post-injection. These findings suggest that farnesol acts as the "alert" signal to the innate immune system at the presence of *C. albicans*.

GEOTAXIS ANALYSIS OF NORA VIRUS INFECTED *DROSOPHILA MELANOGASTER*

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Nora virus is a member of the picornavirus family that infects *Drosophila melanogaster* with no known pathogenic effects. One possible pathogenic effect of Nora virus that has not been studied is locomotor ability. In this study, geotaxis assays and longevity curves were used to determine if Nora virus infection has an effect on *D. melanogaster*'s locomotor ability. Ten small cages were established each containing 60 virgin female flies. The cages were marked with a line two thirds from the bottom of the cage. Every third day since cage establishment, the flies were tapped to the bottom and given one minute to reach the top. The number of flies crossing the threshold line were recorded as were the dead flies. Longevity curves were created and examined using Student's paired t-tests with $p < 0.05$. The data demonstrated a significant decrease in geotaxis when the *D. melanogaster* were infected with Nora virus. The data demonstrate that geotaxis and locomotor dysfunction may be a pathogenic hallmark of Nora virus infection. Overall, a better understanding of Nora virus may give us insight into other viruses in the picornavirus family. The project described was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (8P20GM103427), a component of the National Institutes of Health.

EVOLUTION OF AN rRNA INTRON AT ONE POSITION IN TELOSCHISTALES

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Spliceosomal introns have been found in every sequenced eukaryotic genome, have no known general function, and unclear evolutionary origins. It has been proposed that the need to separate transcription from intron splicing was the driving force for the origin of eukaryotes. Thus, understanding their origin may be important for understanding the evolution of eukaryotes in general. In this study, we focused on a set of newly-derived spliceosomal introns with the overall goal of understanding how they originated. The overall hypothesis is that rRNA spliceosomal introns are derived from group I introns. The specific objective of this study was to identify and characterize introns at one position in the small subunit (SSU) of lichen-forming fungi. This position was chosen for primarily two reasons.

First, it is a common position, with at least 38 taxa having introns at this position. Second, there is wide variation in intron length and sequence, which meets our expectation for the presence of multiple intron types. In fact, it appears that within one set of closely related species (*Caloplaca glorieae*, *Fulgensia bracteata*), some have a group I intron at the position and others a spliceosomal intron. To carry out the objective, introns at this position were first compiled from existing databases. These introns were mapped onto a host tree and then characterized for the presence of sequence and secondary structure features found in spliceosomal and group I introns. Most of the introns were found to be in the order Teloschistales. We next sought to increase taxon sampling by sequencing additional taxa from the genus *Caloplaca*. The overall goal is to show a stepwise transition over evolutionary time from a group I intron to a spliceosomal intron. The project described was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (8P20GM103427), a component of the National Institutes of Health.

PROLIFERATION OF BREAST CANCER CELLS IN TYPE 2 DIABETES

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Hyperglycemia reduces the potency of cancer therapeutics, and increases incidence, metastasis, recurrence and mortality of cancer. Type 2 diabetes (T2D) involves hyperglycemia and hyperinsulinemia, which are associated with several other disease states including hypertension, cardiovascular dysfunction, renal impairment, and even increases incidence of some types of cancer. Here we tested the hypothesis that T2D states hyper-proliferate breast cancer cells compared to hyperglycemia alone. Our results have shown that treatment of early stage breast cancer cells, MCF-7, with high glucose (25 mM) increases cell proliferation significantly with longer periods of incubation (72-120 hrs). This effect was even greater when cells were treated with HG in combination with varying doses of insulin (50 ng/ml-200 ng/ml), which is indicative of T2D. Interestingly, use of fructose (25 mM) alone and with insulin also shows a similar effect as glucose in enhancing cancer cell division. These findings indicate that early stage breast cancer cells proliferate excessively in T2D conditions, and use of glucose as well as fructose (as in high fructose corn syrup) must be cautioned in T2D patients with breast cancer.

DISTRIBUTION OF TARDIGARDES IN SOUTH DAKOTA

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Terrestrial tardigrades are microscopic extremophiles inhabiting the film of water on mosses, lichens and leaf litter. Aquatic tardigrade species inhabit marine and freshwater sediment. There is limited research on the phylum Tardigrada overall, and no published records of tardigrades in South Dakota were found. Over 30 samples from western, south central, and northeastern counties in South Dakota were collected and analyzed. All specimens were preserved and identified to genus providing documentation of tardigrades for South Dakota. Tardigrade distribution from the Black Hills, Badlands, River Hills, Wetlands and Highlands was analyzed. The results show abundance of Milnesiidae, Hypsibiidae, Murrayidae, and Macrobiotidae families in all regions. Tardigrade data from South Dakota was compared to data from surrounding states including Kansas, Missouri, Montana, Arkansas, and Nebraska. Initial observations suggest that taxonomic distribution of tardigrades in South Dakota is similar to their distribution in surrounding states. Distribution of tardigrades in South Dakota and the region will be discussed.

PRODUCTION OF MONOSPECIFIC ANTISERA FOR *VAGO* & *VIRUS INDUCED RNA-1 (VIR-1)*

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Monospecific antisera production is used for experimental analysis of a protein of interest because it allows functional annotation. In *Drosophila melanogaster*, the genes *Vago* and *virus induced RNA-1 (vir-1)* are involved in innate immunity during Nora virus infection. However, the antiviral mechanism that *Vago* is involved in is not fully understood and the role of *vir-1* within this mechanism has not been determined. For further experimental analysis, codon optimized proteins were constructed for *Vago* and *vir-1*. CD-1 Swiss outbred female mice were injected with either the *Vago* or *vir-1* codon optimized protein for monospecific antisera production. Western Blot analysis demonstrated positive products for both antisera (*Vago* – 18.1 KDa; *vir-1* – 47.4 KDa). The antisera will be used to determine the location of expression of *Vago* and *vir-1*, in conjunction with Nora virus infection, and to determine tissue-specificity. This research is novel because previous production of *Vago* protein was unsuccessful due to poor stability during production and the monospecific antisera for *Vago* did not exist until now. Ultimately, by monospecific antisera for *Vago* and *vir-1* proteins will allow for future work in determining the antiviral mechanism of action. The project described was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (8P20GM103427), a component of the National Institutes of Health.

MICROGLIA POLARIZED TO AN M2-LIKE STATE BY NEURONAL DAMAGE ENHANCE NEUROGENESIS

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Microglia are immune cells found in the central nervous system. Microglia exhibit functional polarization becoming pro-inflammatory (M1) or anti-inflammatory (M2) depending upon the activating stimulus, such as IL-4 (M2) or LPS (M1). The response of microglia to traumatic injury of cortical neurons has not been well characterized and little is known about the intracellular mechanisms regulating microglial activation states. We hypothesize that traumatic injury to cortical neurons activates microglia to induce neurogenesis (enhance migration) by acquiring an M2-like phenotype. We have developed an in vitro model system to examine how the effects of neuronal damage influence microglial polarization as compared to classic IL-4 and LPS stimulation to M1 and M2 states respectively. Microglia are cultured with following stimuli, 1. damaged primary cortical neurons, 2. non-damaged primary cortical neuron cultures, 3. IL-4 (20ng/ml), or 4. LPS (50 ug/ml) for 24 h. Microglia cultured in media alone serve as the control. Following stimulation, immunocytochemical and western blot analysis is used to determine microglial polarization by examining expression of M1 (CD86, CD45, MHCII) or M2 (CD206, Arg 1) protein markers. Our data suggest that microglia acquire a neurogenic M2-like state in response to traumatic neuronal damage. Additional studies in our lab are focused on investigating the intracellular signaling pathways and epigenetic modifications underlying microglial polarization. The project described was supported by a Health Science Strategic Initiative Award (Creighton University).

INVESTIGATION OF INTRACELLULAR SIGNALING PATHWAYS UNDERLYING THE POLARITY OF MICROGLIA

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Microglia, the resident immune phagocytic cells of the CNS, are known for their functional polarity in response to different neuronal conditions. They are involved in the triggering of anti-inflammatory or pro-inflammatory mechanisms within this system to promote either neurogenesis or neurotrophic events. Our hypothesis states that activation of unique intracellular signaling pathways direct microglia polarity in response to traumatic neuronal damage. In order for us to understand the intracellular pathways associated with microglial polarity, we use an *in vitro* model system. In this system we induce polarization of microglia in response to neuronal damage and compare the activation of intracellular signaling pathways in those activated microglia to that of pro-inflammatory (M1), neurogenic (M2), or homeostatic (M0) microglia. Immunoblotting, immunocytochemistry, and flow cytometry have been used to analyze microglial polarity and intracellular pathway activation. An understanding of how intracellular pathway activation in microglia responding to neuronal damage compares to known pro-inflammatory (M1), neurogenic (M2), or homeostatic (M0) microglial intracellular signaling is necessary to determine whether manipulation of these states allows for regulation of microglial polarity. Future work will focus on whether manipulation of intracellular signaling pathways can be used to promote and sustain the neurogenic state of microglia in response to neuronal damage. The project described was supported by a Health Science Strategic Initiative Award (Creighton University).

CHARACTERIZATION OF A POSSIBLE IRES SITE IN THE NORA VIRUS GENOME

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Nora virus is a picorna-like virus that has four open reading frames (ORFs), which is in contrast to the more common one long ORF found in most members of this group. The coding potentials of the ORFs are reasonably well characterized. ORF3 and 4 are known to code for the capsid proteins and ORF1 codes for an RNAi inhibitor. Between ORF3 and ORF4 there are 85 nucleotides of non-coding RNA, which may act as an internal ribosome entry site (IRES) for the translation of ORF4. However, this region is not obviously related to any known IRES sequences. To test this hypothesis, we designed multiple RT-PCR primers that flank ORF3 and ORF4, and the IRES region. The results suggest that subgenomic RNAs are not being produced, but studies are underway to further characterize this region. GFP constructs designed to test the IRES potential of the non-coding region between ORF3 and ORF4 are currently being evaluated. The project described was supported by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (8P20GM103427), a component of the National Institutes of Health.

THE EFFECTS OF A PPARGAMMA AGONIST ON THE STEREOLOGICAL ANALYSIS OF THE HIPPOCAMPUS AND HYPOTHALAMUS IN AN EPILEPTIC MODEL

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Epilepsy affects approximately 3 million people in the United States. There are many epilepsy syndromes with a variety of causes. Approximately 30% of epilepsy cases are pharmaco-resistant. The ketogenic diet (KD), is one of the few effective non-surgical treatments against refractory seizures.

However, as a high fat, low carbohydrate and protein diet, the KD is unpalatable. The goal of our research is to the KD's mechanism(s) of action to identify a novel therapeutic target for refractory epilepsy. We have found that the nutritionally-regulated nuclear transcription factor PPAR γ plays a critical role in the anti-seizure effects of the KD. We hypothesize a PPAR γ agonist, pioglitazone, will have neuro-protective effects on the hippocampus and hypothalamus that resemble the KD. Research has shown that severe seizures can result in cytoarchitectural remodeling in the hippocampus. This project looked at the seizure-generating hippocampus and specific sleep-regulating hypothalamic regions in a genetic mouse model of Temporal Lobe Epilepsy (TLE). Past experiments show a decreased seizure burden following pioglitazone injection. This project's goal was to determine the cellular and structural effects of pioglitazone treatment on the hippocampus. Sleep problems are a common comorbidity in people suffering from epilepsy. Poor sleep also lowers the seizure threshold. This increased seizure activity leads to further sleep disruption, perpetuating the cycle. We hypothesized that a difference in cell number in these regions contribute to a pathology of sleep regulating circuitry in TLE.

This project looked at the CA1, CA3 and dentate gyrus regions of the hippocampus as well as the periventricular nucleus (PVN) and suprachiasmatic nucleus (SCN) of the hypothalamus. To observe cell number and astrogliosis, we stained our samples using hematoxylin and eosin and GFAP, respectively.

We analyzed our results using unbiased stereology. We found no statistical differences among groups in the hippocampus in cell number or extent of astrogliosis. The hypothalamic regions also showed no statistical significance.

Our colony exhibits decreased cell death compared to other colonies of the same strain. This suggests the potential for a unique genetic variation in our animals. Our results from the hypothalamic regions suggest that sleep problems do not stem from a simple change in cell number in these areas. Our new project has a more genetic approach to the KD and epilepsy. We will compare which PPAR γ -dependent genes are activated in WT and KO groups, and look for effects of the ketogenic diet.

FABRICATION AND CHARACTERIZATION OF DOLUTEGRAVIR-LOADED CELLULOSE ACETATE PHTHALATE NANOPARTICLES FOR HIV PROTECTION

Rachel Pham, Patrick Bruck, Michael Rezich, and Annemarie Shibata, Department of Biology; and Subhra Mandal and Chris Destache, School of Pharmacy and Health Professions, Creighton University, Omaha, NE 68178

HIV infects 2.3 million people annually and is the sixth leading cause of death in the world. Current HIV treatment, based in the use of antiretroviral therapy, is effective but requires tight adherence by the patient to a daily, and high-dose, drug regime. The resultant pill burden is detrimental to individual health and is costly. Thus it is necessary to develop delivery methods for prevention of HIV infection that is both long-lasting and highly efficacious. Our goal is to formulate cost-effective, long-lasting antiretroviral (ARV) drug loaded nanoparticles (NP) incorporated thermosensitive gel to be used for pre-exposure prophylaxis (PrEP). NP formulations have the potential to increase ARV drug bioavailability by promoting its cellular uptake and sustaining ARV release over time. Thermosensitive gel fabrications allow for delivery via a stable and self-administered vaginal application. Here we report the fabrication of combination antiretroviral NPs by oil-in-water emulsion nano-precipitation method. For our polymeric NP base we used cellulose acetate phthalate (CAP) polymer, an anti-microbial polymer with specific antiretroviral properties inhibiting HIV entry. CAP NPs were loaded with dolutegravir (DTG), an integrase inhibitor, and incorporated into vaginal gel at pH4 and pH7. These combination NP fabrications were tested for NP characteristics such as particle size, zeta potential, and encapsulation efficiency of DTG. NPs in thermosensitive gels were assessed for pH dependent drug release and cellular cytotoxicity. Future studies will examine the pharmacokinetics of DTG delivery by our gel NP fabrications in mice.

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IN VIVO AND EX VIVO ANALYSIS OF DOLUTEGRAVIR-LOADED NANOPARTICLES FOR HIV-1 PROPHYLAXIS

Patrick Bruck, Rachel Pham, Michael Rezich, and Annemarie Shibata, Department of Biology; and Subhra Mandal and Chris Destache, School of Pharmacy and Health Professions, Creighton University, Omaha, NE 68178

Human Immunodeficiency Virus-1 (HIV-1) is a major global issue responsible for nearly forty million deaths in the last thirty years. Currently, more than two million new infections are reported each year, showing a clear need for effective HIV preventive treatments. Our collaborators have synthesized nanoparticles (NPs) from cellulose acetate phthalate (CAP), a generic anti-microbicide that serves as an HIV entry inhibitor. Additionally, these CAP-NPs have been loaded with an FDA-approved integrase inhibitor dolutegravir (DTG) to provide combination drug delivery. We hypothesize that these CAP-DTG-NPs will provide an effective option for HIV pre-exposure prophylaxis (PrEP) when incorporated into a thermosensitive vaginal gel. These formulations will be tested for cytotoxicity in the following cell lines: cervical HeLa, vaginal VK2/E6E7, and H9 T cells, as well as, in primary human peripheral blood mononuclear cells (PBMCs). Cytotoxicity to vaginal tissue will be evaluated using a 3-D EpiVaginal™ model system. Intracellular drug delivery of the formulations over a sustained time course will be analyzed using high-performance liquid chromatography (HPLC). Finally, formulations will be tested for HIV prophylactic activity in both indicator TZM-bl cells and human PBMCs. Research reported in this publication was supported by the National Institute Of Allergy And Infectious Diseases of the National Institutes of Health under Award Number R15AI118550. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

AN ASSESSMENT OF THE DISTRIBUTION OF THE CYP2D6 ALLELE FREQUENCIES WITHIN THE (SUDANESE OR KAREN) POPULATIONS IN NEBRASKA

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Many essential drug-metabolizing enzymes are contained within the cytochrome P450 superfamily. One of these enzymes, cytochrome P450 family 2 subfamily D member 6 (CYP2D6) plays an important role in the metabolism of 20-25% of clinically used drugs. Compounds metabolized by CYP2D6 include some antidepressants, neuroleptics, and opiates. Over 100 allelic variations contribute to the range of enzyme hydroxylation capacity. The range of metabolism levels include poor (PM), intermediate (IM), extensive (EM), and ultrarapid (UM). Relative CYP2D6 allele frequencies vary between genetic populations. Clinicians can use studies of CYP2D6 allele frequencies to make properly informed prescribing decisions. The test group of this study will consist of volunteers from the Karen and Sudanese populations in Lincoln and Omaha, Nebraska. DNA will be extracted from buccal cells, and genotyped via PCR.

CHEMISTRY AND PHYSICS
CHEMISTRY

OPTIMIZATION OF ON-COLUMN ENTRAPMENT CONTAINING HUMAN SERUM ALBUMIN FOR THE STUDY OF DRUG-PROTEIN BINDING BY HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY

Shiden Azaria and John Vargus, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

High performance affinity chromatography (HPAC) uses an immobilized biologically-related binding agent (e.g. a protein or antibody) as a stationary phase in an HPLC column. In this method, the interactions of various analytes can be studied with the same preparation of the biological agent, reducing the cost, time and amount of reagents that are needed for such studies. In this project an immobilization technique based on entrapment was used for preparing HPAC columns. In this approach, the binding agent (e.g., human serum albumin, or HSA) is physically confined within the pores of the support. A flow-based entrapment format was used in this study to prepare small 1.0 cm length \times 2.1 mm columns that contained HSA or glycated HSA. This approach involved recirculating a solution of HSA or glycated HSA through columns that had been previously packed with hydrazide-activated silica, with mildly oxidized glycogen also been used as a capping agent that could react with the hydrazide groups. These columns were used for measuring the affinity of HSA and glycated HSA for warfarin and L-tryptophan, which are common probes for Sudlow site I and Sudlow site II of HSA, respectively, and the affinity for acetohexamide (i.e., a drug used to treating type II diabetes. The association equilibrium constants that were measured by this approach were $2.4\text{--}3.8 \times 10^5 \text{ M}^{-1}$ for warfarin, $1.1 \times 10^4 \text{ M}^{-1}$ for L-tryptophan and $0.13\text{--}1.3 \times 10^5 \text{ M}^{-1}$ for acetohexamide with the HSA and glycated HSA. These results were in good agreement with literature values and demonstrated that this method could be used for the rapid screening of drug-protein binding.

THE DEVELOPMENT OF HIGHLY-ORIENTED 3D NANOSTRUCTURES FOR USE WITH ULTRA-THIN LAYER CHROMATOGRAPHY AND ELLIPSOMETRY

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Planar chromatography is an effective method of performing rapid on-site chemical analysis in fields such as clinical, biochemical and pharmaceutical testing. Ultrathin-layer chromatography (UTLC) is a form of planar chromatography that combines traditional thin layer chromatography with thinner and more efficient supports to provide faster separations, shorter development distances and better limits of detection. Recently, an instrumental system has been developed for detection of spatial and time-resolved microscopic images that combine transmission birefringence imaging detection with ellipsometric measurements. This label free detection has been used with the nanofabrication technique glancing angle deposition (GLAD) to create sculptured thin film (STF) microstructures on transparent glass substrates, followed by the deposition of thin layers of alumina by using atomic layer deposition (ALD). These UTLC plates have been tested for use in the separation of lipophilic dyes by applying the mobile phase through capillary action and gave a partial separation of these dyes. Work is now being carried out to improve the resolution between the dyes by tailoring the support/stationary phase and other separation conditions. Microfluidic transmission cells are also being designed for use with similar UTLC supports in systems with pressure-induced flow.

METHOD DEVELOPMENT FOR SEPARATING LITHIUM ION ELECTROLYTE CARBONATES USING ION-MODERATED PARTITION HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Anuja Bhalkikar, Chris M. Marin and Chin Li Cheung, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

A major thrust in lithium ion batteries research is the development of new materials for electrolytes and electrodes to increase the lifetime of these batteries. The electrolyte mixtures in these batteries are typically analyzed by gas chromatography which destroys the analytes due to the high operating temperatures employed making it impossible for any follow up analysis. An ion-moderated partition high performance liquid chromatography (HPLC) method was developed for the separation and identification of common organic carbonates present in the electrolyte mixtures of commercial lithium ion batteries. Chromatographic variables that include HPLC column temperature and elution flow rate were evaluated to improve the peak resolution of the chromatograms. The developed method required no separate sample preparation, employed an isocratic, aqueous mobile phase and was found to be sensitive at quantifying these carbonates down to the ppm level.

DETERMINATION OF LEAD CONCENTRATION IN SOIL AT EPA SUPERFUND SITE ACROSS NORTHEASTERN OMAHA

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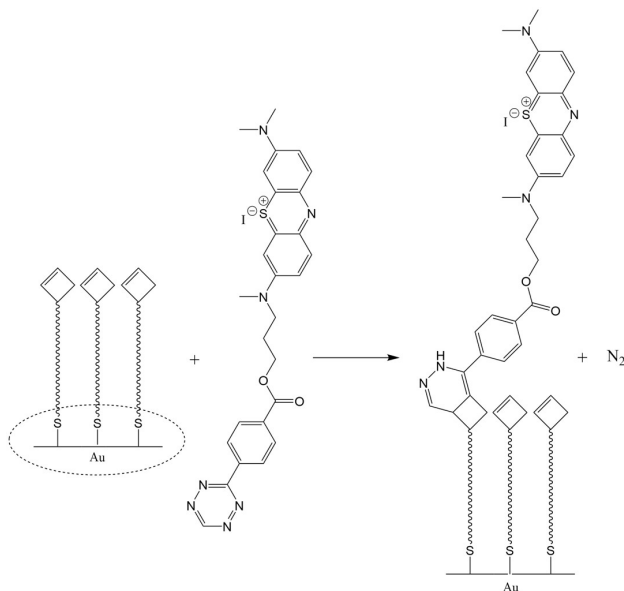
The Omaha Lead Superfund Site is one of the largest residential superfund sites in the nation. The designation was due to lead contamination of surface soils present at residential-type properties in the City of Omaha, Nebraska, as a result of deposition of air emissions from historic lead smelting and refining operations. After more than 15 years of EPA testing, there remains more than 40,000 locations that have not yet been tested plus commercial and industrial properties that were excluded from the defined site. This study, supported by MCC Mini-Grant, is an effort to bring community involvement into the testing and cleanup of Omaha lead sites while enhancing our curriculum by focusing on real world problem. In this paper, we describe a simplified electrochemical method, suitable for undergraduate research, for the determination of soil lead and the initial results obtained on 50 EPA sites across northeast Omaha. Our undergraduate students are divided into research groups which collect, process and perform the subsequent analytical determinations on the soil samples. The goal is for these students to obtain research experience in our general Chemistry laboratory course at the Metropolitan Community College while helping the community. The soil samples were collected at a depth of three inches and then placed in a drying oven for 12 to 24 hours before extracting the lead using a nitric acid and concentrated hydrogen peroxide method. The extracted solutions were analyzed for total lead using an anodic stripping method. Preliminary results of our samples show a wide range of lead concentrations ranging from a few ppm to a few hundred ppm.

Our plan is to establish routine sampling and analytical procedures suitable the accurate determination of lead in soil samples. Our measurement results will be used to map out the locations and lead levels across the Omaha lead sites. It will also allow our students to gain experience in soil sampling, testing protocols, and using their science knowledge to solve real world problems.

BIOORTHOGONAL REACTION OF AMPHIPHILIC CYCLOBUTENES AND 1,2,4,5-TETRAZINES

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The relatively new field of bioorthogonal chemistry has flourished in recent years based upon the potential to conduct ligations in or around living cells. Bioorthogonal reactions involve pairs of molecules designed specifically to couple with one another rapidly, irreversibly, spontaneously and under conditions compatible with living cells. A bioorthogonal reaction of great current interest involves the strain-promoted inverse electron-demand Diels-Alder 4+2 cycloaddition of cycloalkenes and 1,2,4,5-tetrazines. We are exploring the application of 3-substituted cyclobutenes as a new class of substrates for this reaction. This research has focused on the design and synthesis of amphiphilic 3-substituted cyclobutenes with an alkane thiol tail, the application of these substrates in the formation of reactive self-assembled monolayers on a gold surface, and functionalization of the monolayer surface with a previously uncharacterized 1,2,4,5-tetrazine incorporating a methylene blue type redox indicator.



NITRATE EFFECT ON MICROWAVE-ASSISTED SYNTHESIS OF CERIA NANOCUBES

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Fluorite-structured cerium oxide (ceria; CeO_{2-x} , $0 \leq x < 0.5$) possesses unique catalytic activity to promote redox reactions. Among the most common facets of ceria, the $\{100\}$ facets of ceria nanocubes have been found to be more catalytically active as well as better noble metal supports than the $\{111\}$ facets of ceria nanopolyhedra. Use of sodium nitrate as the surface modifying agent (SMA) with microwave-assisted heating methods provides a facile synthetic route for ceria nanocubes. Microwave methods directly scaled from conventional hydrothermal parameters were found to produce mixtures of ceria nanocubes and ceria nanorods. The effect of sodium nitrate on the shape-control growth of ceria nanocubes was investigated by using various mole ratios of sodium nitrate to the cerium nitrate precursor in the synthetic study. From our morphological analysis of resulting ceria products, the mechanistic roles of the SMA were postulated to destabilize the growth of $\{110\}$ and $\{111\}$ facets of ceria nanocrystals.

METHOD AND ANALYSIS OF THE HYGROSCOPICITY OF AMINO ACID AEROSOLS

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Aerosols are a major component of the Earth's atmosphere and are known to contribute greatly to the overall radiative balance. Aerosols are generated through various mechanisms, but sea-spray, from crashing waves, generates a significant amount of organic aerosols with the potential to affect the properties of well-studied inorganic salt aerosols. Out of these organic aerosols, simple water soluble biodegradation products such as amino acids have been found to be some of the more prevalent compounds. Because water content can affect an aerosol's optical properties, it is necessary to measure their hygroscopic properties. This can be done by probing their water absorption as a function of relative humidity (RH). The hygroscopicity of the amino acids glycine, lysine, and alanine was measured with an IR spectrometer using a flow cell apparatus. It was determined that glycine began to uptake water around 60% RH and showed signs of deliquescence at 90% RH even though it is predicted that glycine deliquescence occurs at >90% RH. It was also observed that glycine effloresced between 53–60% RH. Alanine deliquescence was not observed within the limitations of our instrument. It is predicted that alanine deliquescence takes place at >90% RH. Alanine efflorescence was observed at 55–65% RH. Finally, lysine deliquescence was observed around 70% RH and its efflorescence was observed between 37–45% RH.

SOLVENT VAPOR ANNEALING

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The directed self-assembly of block polymer thin films is an area of great interest due to the potential production of life-easing and industry changing commodities. For example, the sub-twenty nanometer dimensions accessible could be applied to ultrafiltration applications. Traditionally, the organization of polymer thin films was achieved using thermal annealing, through enhancement of the mobility of the polymer structures. Exploration into the use of solvent vapors to achieve similar goals at faster rates have recently emerged. Of practical importance, a goal of creating hexagonally-packed, perpendicularly-aligned morphologies with a low anneal time, low defect density, and high reproducibility is paramount. We have successfully demonstrated such ultra-fast ordering in

polystyrene-*block*-polylactide (PS-PLA) thin films, where ordered perpendicular cylinders were achieved through solvent vapor annealing in tetrahydrofuran. However, issues with reproducibility and exact parameterization remain. Building on our acquired knowledge of PS-PLA, PS-PDMS (polystyrene-*block*-polydimethylsiloxane) has potential for creating smaller feature sizes than PS-PLA and serves to confirm the generality of our results on PS-PLA on a distinctly different polymer system. In this talk, I will discuss our transition to PS-PDMS and the associated challenges, including thin film synthesis, annealing, post-annealing treatments and imaging. In practice, many of our standardized protocols require some level of modification. In particular, I will focus on the role of O₂ reactive ion etching to systematically remove the organic constituents of the polymer film and oxidize the silicon within the PDMS structures. This is a necessary precursor to our imaging process with non-contact atomic force microscopy. Thus, identifying etching protocols is critical for successful imaging of final thin film morphologies.

SUBSTITUTED AMINO ACIDS AS LARGE-NEUTRAL AMINO ACID TRANSPORTER 1 (LAT-1) SUBSTRATES FOR DRUG DELIVERY

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Overcoming the blood-brain barrier (BBB) is a major challenge for treating brain diseases such as Alzheimer's. Yet, many nutrient molecules (e.g. amino acids, vitamins, saccharides) are readily transported across the BBB. The transporter protein Large-neutral Amino Acid Transporter 1 (LAT-1) is responsible for transporting amino acids such as tyrosine and phenylalanine as well as thyroid hormones. Our group is interested in using LAT-1 as a delivery mechanism. We seek molecules with improved LAT-1 activity relative to native amino acids in order to design pro-drugs with brain levels superior to parent drug. To date, the structure-activity relationship (SAR) for what makes a compound a LAT-1 substrate has received only a cursory exploration. To be useful for drug delivery, a better understanding of this SAR is needed. The amino acids tyrosine and phenylalanine, known LAT-1 substrates, were substituted at the meta position of the aromatic ring. The meta position is preferred because it has been shown to provide greater brain uptake relative to substitution at the para position. We hypothesized that substitution at the meta position with hydrophobic groups would improve the binding of amino acid analogs to LAT-1, resulting in greater substrate activity. To test this hypothesis, we synthesized a series of amino acids with substitution by halogen, alkyl, and aryl groups and then assessed compounds using *cis*-inhibition and *trans*-stimulation assays with Human Embryonic Kidney cells engineered to overexpress LAT-1 (HEK-LAT1). Substituted amino acids were tested alongside parent phenylalanine or tyrosine (positive controls) and the non-substrate arginine (negative control). From these experiments, it was determined that meta-substituted analogs with small alkyl groups or halogens were viable substrates for the LAT-1 protein. Contrary to our hypothesis, larger alkyl groups had diminished substrate activity and were found to be inhibitors for LAT-1. The synthesis of these meta-substituted amino acid analogs will be presented along with their LAT-1 activity.

PROGRESS TOWARDS A UNIVERSAL CHEMICAL DETECTOR: COLORIMETRIC SENSOR ARRAY FOR THE IDENTIFICATION OF ACIDS AND BASES AND DETERMINATION OF THEIR CONCENTRATIONS

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Colorimetric sensors are a method for quickly and easily identifying chemicals. Challenges of traditional colorimetric sensors are that the sensors are either non-specific and react the same for all molecules in a class, or the sensors are too specific and are only valid for a single analyte and may require multiple tests to make an identification. Combining multiple sensors into an array and analyzing the unique pattern of color changes creates a method that can identify specific analytes and is also applicable to a wide range of chemicals. Digital images of the array can be collected with a scanner, digital camera, or smartphone, and the RGB color values are analyzed with various statistical techniques including principal component analysis (PCA) and k-nearest neighbor analysis (KNN). We have developed a sensor array that utilizes 8 common pH indicators and can identify acids and bases and their concentrations between 0.1 and 10M with >80% accuracy. This method has the potential to be extended to other classes of chemicals including explosives, pesticides, and environmental contaminants.

ANALYSIS OF INTERACTIONS BETWEEN PLATINUM-CONTAINING DRUGS AND HUMAN SERUM ALBUMIN BY USING IMMUNOEXTRACTION AND AFFINITY MICROCOLUMNS

Jeff Post, Xiwei Zheng, David S. Hage, Chemistry Department, University of Nebraska–Lincoln, NE 68588

An immunoextraction method based on affinity microcolumns was developed to study the interactions between platinum-containing anti-cancer drugs and serum transport proteins. The drugs cisplatin, carboplatin and oxaliplatin were investigated for their binding with the protein human serum albumin (HSA). A drug/HSA mixture was passed through an affinity microcolumn containing anti-HSA antibodies. The non-protein bound, or free, fraction of the drug in the injected mixture was eluted as a non-retained peak while the HSA and drug-HSA complex were retained. Samples containing the drug or protein alone were also applied to the microcolumn, and the results from all of these injections allowed the free fraction of the drug in the drug/protein mixtures to be determined. By measuring the free drug fraction at various times after combining the drug with HSA, it was possible to estimate the association rate constant of the each drug for HSA. This approach should be valuable in the analysis of interactions that have slow binding processes, such as those that occur between platinum-containing drugs and HSA. This method could also be extended to other metal-containing drugs and plasma proteins or for other types of biomolecular interactions with slow binding processes.

DIRECTING REGIOSELECTIVE 2+2 PHOTOCYCLOADDITION WITHIN A MACROCYCLIC CAVITAND

Maresh Pattabiraman and Nga Nguyen, Department of Chemistry, University of Nebraska at Kearney, NE 68849

The relative orientation of guests within ternary inclusion complexes is governed by the host–guest and guest–guest non-covalent interactions. Selectivity in 2+2 photocycloaddition between two alkenes included within a macrocyclic cavitand can be controlled using non-covalent interactions. In our group we employ this “cavitand-mediation” approach to control reactivity of organic molecules. This

talk will present results from our research that demonstrates the effectiveness of the cavitand-mediation approach to controlling regioselectivity in a photocycloaddition between alkenes. Our findings show that selectivity in the reaction can be switched completely from head-to-head dimer formation to head-to-tail dimer. The reactions were also stereoselective in most cases. Stoichiometry experiments were performed to explore relative stabilities of the complexes, which indicate that the ternary complex is more stable than others. Selectivity in the photocycloaddition reaction was also applied retrospectively to deduce intermolecular orientations. Time-dependent conversion study we performed indicates that the observed reactivity of alkenes is representative of the intermolecular orientations in the bulk of the complex medium. Experimental observations and computational studies were used to qualitatively understand the complex structures and relative magnitudes of the weak interactions.

CAVITAND-MEDIATION APPROACH TO CONTROLLING CHEMICAL REACTIONS

Maresh Pattabiraman, and Nga Nguyen, Department of Chemistry, University of Nebraska at Kearney, NE 68849

Chemical reactions often yield multiple products, and directing molecular reactivity towards specific product(s) is an important endeavor in applied chemistry. Research in my group aims to use weak, non-covalent interactions between molecules to control product selectivity in reactions. We achieve this by understanding and manipulating weak attractive/repulsive forces between molecules. With the use of large (macro-) molecules that would temporarily bind to the subject molecule to produce a complex, wherein the ‘natural state’ of the subject molecule is altered, its inherent reactivity is modified. This forms the basis of the “cavitand-mediation approach”, wherein, through appropriate choice of complex-components and reaction conditions chemical reactions are steered towards specific product(s). This talk will feature the ongoing effort in our group to understand the interplay of non-covalent interactions within a complex and utilization of that knowledge to direct reaction selectivity.

METABOLIC DYSFUNCTION INDUCED AND POTENTIATED BY GENE-ENVIRONMENT INTERACTIONS LINKED TO PD

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Parkinson disease (PD) is a progressive neurodegenerative movement disorder. The etiology of PD is likely to arise from the convergence of genetic susceptibility, environmental exposures (gene-environment interactions), and a long-term exposure to these conditions (aging). However, molecular mechanisms of the interplay between gene and environment factors remain elusive. Besides the loss of dopaminergic neurons in the substantia nigra, another pathological hallmark of PD is the accumulation of inclusion bodies (Lewy body) of aggregated α -synuclein. Therefore, we aim to investigate the interaction between α -synuclein (gene) and paraquat (PQ) exposure. As a first step, we investigated the alterations in the metabolome in dopaminergic cells exposed to PQ. A combined metabolomic approach using 1D ¹H NMR and MS was used to identify specific patterns in the metabolome of cells exposed to PD mimetics. We observed unique metabolic profile changes in response to all toxins, but paraquat exposure induced the most profound alterations. ¹³C-glucose flux analysis demonstrated that metabolites within the pentose phosphate pathway (PPP) such as fructose 6-phosphate, glucono-1,5-lactone and erythrose 4-phosphate were increased by paraquat treatment. Proteomic analysis also found an increase in the expression of enzymes in the PPP such as glucose 6-phosphate dehydrogenase (G6PD), which supplies reducing equivalents by regenerating nicotinamide adenine dinucleotide phosphate (NADPH)

levels. Overexpression of G6PD was shown to selectively increase paraquat toxicity. These results suggest that paraquat “hijacks” the PPP to increase NADPH reducing equivalents. The metabolic alterations induced by PQ were further confirmed *in vivo* by using a novel combined metabolomics approach (1D ^1H NMR and direct infusion ESI-MS). Importantly, the metabolic alterations are observed to be limited only in the striatum and midbrain regions in a mouse animal model. In addition, by exposing α -synuclein overexpressed N27 dopaminergic cells with PQ, we observed a selective synergistic gene-toxin interaction between α -synuclein and PQ in dopaminergic cells. ^{13}C glucose metabolic tracing analysis with 2D ^1H - ^{13}C HSQC NMR experiments was used for a detailed investigation of metabolic alterations arising from the synergistic α -synuclein-PQ interaction. Our data shows that α -synuclein potentiates the metabolic dysfunction induced by PQ. Specifically, changes in glucose metabolism and PPP were observed. The NMR/MS metabolomics data were further supported by cell-based assays analyzing the impact of glucose deprivation, inhibition of GLUT-like transporters with 4-[[[4-(1,1-Dimethylethyl)phenyl]sulfonyl]amino]methyl]-N-3-pyridinylbenzamide (STF-31) or Ascorbic acid (AA), and inhibition of PPP with 6-aminonicotinamide (6-AN) on the α -synuclein and PQ interaction. Glucose deprivation and inhibition of glucose transport with STF-31 abolished the stimulatory effect of α -synuclein overexpression on PQ toxicity. Similarly, the synergy was significantly reduced by the addition of AA. These results demonstrate an interplay between gene and environmental factors that play a crucial role in dopaminergic cell death induced by metabolic dysfunction. Our results also demonstrate the importance of metabolomic studies to identify novel molecular mechanisms regulating neuronal cell death in PD.

DEVELOPMENT OF A SCANNING MICROFLUIDIC SYSTEM FOR CHROMATOGRAPHIC-BASED BINDING ASSAYS

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Microfluidic devices are becoming popular as a means for miniaturizing liquid chromatographic (LC) systems for use in small and portable devices. This project examined the development of a microfluidic system and chromatography-based binding assays that also used surface-enhanced fluorescence (SEF) and near infrared (NIR) fluorescent labels to achieve low limits of detection. This system utilized a NIR fluorescence microscope that was combined with a scanning microfluidic platform for on-column detection. The channels of the microfluidic device were packed with a monolithic support that was based on glycidyl methacrylate-co-ethylene glycol dimethacrylate, onto which binding agents such as human serum albumin were immobilized. The microfluidic system initially provided a limit of detection in the nanomolar range for an NIR fluorescent, and it was found this limit could be reduced to the picomolar range upon the addition of silver nanoparticle to create surface-enhanced fluorescence. The integration of these components is now being tested for use in formats such as a displacement assay that can be used for the detection of drugs and other solutes in environmental or biological samples.

NANOLUCIFERASE FRAGMENTS AS SENSITIVE PROBES FOR PROTEIN SOLUBILITY IN LIVING CELLS

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Protein misfolding is implicated in numerous human diseases, including Alzheimer's disease, Parkinson's disease, and cystic fibrosis. Moreover, protein solubility can dramatically influence the yield of protein from heterologous expression systems, impacting structural characterization as well as the ability to mass produce biological agents for the clinic. Consequently, robust assays to rapidly assess protein solubility are essential for screening compounds that influence protein aggregation/folding as well as optimizing constructs for heterologous expression systems. Herein, we describe a set of self-assembling nanoluciferase (Nluc) fragments that produce luminescence readout that can be modulated by tuning the solubility of the N-terminal nanoluc fragments. Leveraging this observation we demonstrate the ability to assess protein solubility by fusing a protein of interest (POI) at the N-terminus of the N-terminal fragment of NanoLuc. The resulting luminescence of living bacteria is directly proportional to the solubility of the POI. This approach offers a novel, genetically encodable luminescence readout for the aggregation of disease-associated proteins in living cells. To demonstrate this approach we assessed the influence of mutations known to disrupt amyloid-beta 1-42 (A β 1-42) aggregation, as well as inhibitors of protein aggregation.

GLYCOFORM ANALYSIS OF ALPHA1-ACID GLYCOPROTEIN BY CAPILLARY ELECTROPHORESIS

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An alteration in the distribution of glycoforms can result from changes in the glycosylation of the serum protein alpha1-acid glycoprotein (AGP) in various disease states. This research sought to use capillary electrophoresis (CE) to provide a fast analysis method with good resolution that could be used to screen and measure the glycoforms of AGP. Several capillary modification methods were examined for use in this work, including static, dynamic and permanent coatings, and were compared in terms of their effects on the electroosmotic mobility and resolution of glycoform peaks. The use of buffer additives and various pH values for the separation were also considered when optimizing this method. In the final CE method, a capillary with static and dynamic coatings of polyethylene oxide was used for the separation of AGP glycoforms at pH 4.2. This method was then used to examine the change in AGP glycoform patterns with certain disease states and to measure the amounts of these AGP glycoforms in serum.

CHEMISTRY AND PHYSICS
PHYSICS

THE ROLE OF ULTRA-FAST SOLVENT EVAPORATION ON THE DIRECTED SELF ASSEMBLY OF BLOCK POLYMER THIN FILMS

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The directed self-assembly of nano-structures in block polymer thin films via solvent vapor annealing is complicated by several factors, including evaporation rate. Solvent vapor annealing exposes a disordered film to solvent(s) in the vapor phase, increasing mobility and tuning surface energy, with the intention of producing an ordered structure. Recent theoretical predictions reveal the solvent evaporation affects the resultant nano-structuring. In a competition between phase separation and kinetic trapping during drying, faster solvent removal can enhance the propagation of a given morphology into the bulk of the thin film down to the substrate. Recent construction of a computer controlled solvent vapor annealing chamber provides control over evaporation down to 15 ms. Furthermore, in situ spectral reflectance, with 10 ms temporal resolution, monitors the swelling and evaporation. Presently, cylinder-forming polystyrene-block-poly(lactide) thin films were swollen with 40% (by volume) tetrahydrofuran, followed by immediate evaporation under a variety of conditions. This includes various times, ranging from 15 ms to several seconds, and four unique rate trajectories, including linear, exponential, logarithmic and combinations. Atomic force microscopy reveals specific surface morphologies of the resultant films, dependent on specific evaporation conditions. Funded by the Clare Boothe Luce Foundation and Nebraska EPSCoR.

EFFECTS OF CHEMOTHERAPY-INDUCED ALTERATIONS IN CELL MECHANICAL PROPERTIES ON CANCER METASTASIS

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Although chemotherapy drugs target and kill malignant cells during cancer treatment, it is not certain whether such drugs inadvertently promote metastasis. Yet, it is metastasis, a complex multistep process that leads to death in over 90% of cancer cases. Here, using standard image segmentation algorithms, we show that cancer cells treated with chemotherapeutic drugs including doxorubicin and daunorubicin, progressively become smaller in size even beyond the on-set of apoptosis and necrosis. Moreover, in the first four hours following treatment, the reduction in size is not statistically significant. Since an important step in the metastatic cascade is the deformation of cells through capillary constrictions that are smaller than the cell's diameter, our concurrent studies done using a microfluidic device that mimics the microcirculation, enables the separation of morphometric changes from mechanical changes, giving insights into the roles of both during metastasis.

ANALYSIS OF ELECTRON-POSITRON PAIR PRODUCTION IN SIMULATED ULTRA PERIPHERAL AuAu COLLISIONS

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The Relativistic Heavy Ion Collider (RHIC) accelerates beams of gold ions to near-light speeds (200 GeV/nucleon) before directing them into head-on collisions with one another, producing particles which are then detected by the Solenoidal Tracker at RHIC (STAR). Not all ions impact each other directly; ultra-peripheral collisions occur when ions pass very near each other without making direct physical contact. Although hadronic interactions are suppressed in this case, these events are still considered to be collisions because the gold ions do interact with each other via electromagnetic fields.

These interactions can produce a variety of particles, including electron-positron pairs. Studying these ultra-peripheral collisions can improve our understanding of electromagnetic interaction in intense non-perturbative fields. In order to study these electron-positron pairs, we must first develop a system of detector triggers so that collisions can be recorded. Then, we must find a way to filter the signal from the detector such that ultra-peripheral collisions can be distinguished from other collisions. Finally, we must further filter the data to select only those ultra-peripheral collisions which yield electron-positron pairs. This presentation will describe these selection techniques and provide an example of such techniques applied to simulated collision data.

BACKGROUND STUDIES FOR FOUR-TRACK EVENTS WITH CHARM AT ALICE

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A Monte Carlo study of four-track events in the ALICE (A Large Ion Collider Experiment) detector at CERN has been carried out. Background processes to the photoproduction of the η meson in $\sqrt{s_{NN}}=5.12$ TeV ultraperipheral Pb-Pb collisions have been studied, taking into account the acceptance and efficiency of the detector. A comparison of the meson's predicted signal in the $K^*(892)^0 K^- \pi^+ \rightarrow K^+ \pi^- K^- \pi^+$ decay channel is made with the composite background. It is found that the η should produce an observable signal in data from the second run of the Large Hadron Collider.

IMPLEMENTATION OF AN ALARM SYSTEM FOR HARDWARE CONTROLS AT THE STAR EXPERIMENT

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The STAR (Solenoidal Tracker At RHIC) experiment at Brookhaven National Laboratory is a detector system used for studying nuclear interactions at the Relativistic Heavy Ion Collider (RHIC). The experiment uses EPICS (Experimental Physics and Industrial Control System) as its computer-based monitoring and controls system for the experiment's 60,000 process variables. The system currently uses the Alarm Handler (ALH) for providing operators with the system status. ALH is being replaced by a different alarm system, known as BEAST (Best Ever Alarm System Toolkit). Background on the STAR experiment and a progress report on this software project will be presented.

ELECTRON-POSITRON PAIR PRODUCTION IN ULTRA-PERIPHERAL COLLISIONS AT STAR

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The Relativistic Heavy Ion Collider (RHIC) accelerates fully stripped gold nuclei to nearly the speed of light, later allowing these ion beams to collide head on in six different locations around the accelerator ring. The Solenoidal Tracker at RHIC (STAR) detects and studies collisions of the nuclei in the beams. These collisions can vary in their overlap, with everything from head on collisions, all the way to ultra-peripheral collisions. In ultra-peripheral collisions, the impact parameters are greater than twice the nuclear radius, thus the interactions are electromagnetic, and not hadronic. In these ultra-peripheral collisions intense electromagnetic interactions can produce, among other things, electron-positron pairs, thus providing us with an insight to quantum electro-dynamics. The data collected must be compared to models to interpret the underlying physics. To do this, we use STARlight, a Monte Carlo implementation of one current model of ultra-peripheral collisions. In experimental results, the electron positron pairs we observe can be produced through many channels. With STARlight we can predict what might be seen if each channel of electron positron pair production were isolated. We can combine these isolated predictions to model what we would expect to see in experimental data. I will present the results of this combined prediction of electron positron pair production through the use of the STARlight Monte Carlo.

ON THE VIABILITY OF TWO DIFFERENT SPEEDS OF LIGHT IN LORENTZ TRANSFORMATIONS AND CAUSALITY

Adam N. Davis, Department of Physical Sciences, Chemistry, and Mathematics, Wayne State College, NE 68787

The speed of light is a fundamental constant for our known universe and expresses itself many times in the interactions described by General Relativity and the Standard Model of Particle Physics. But those descriptions have only been measured directly with about 5% of the universe. I explore the possibility that a different “speed of light” exists. Specifically I look at the possibility that if a different speed of light exists can causality violations occur under varying Lorentz transformations.

EARTH SCIENCE

VALIDATING GROUND OZONE AT ULTRAVIOLET (UV) BAND WITH SATELLITE MEASUREMENTS FROM AURA OZONE MONITORING INSTRUMENT (OMI)

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UV radiation from the Sun is an extremely plentiful, high energy resource on Earth. High energy ultraviolet solar radiation can significantly damage plants, crops, animals, and ecosystems, alone or in combination with other environmental stress factors such as temperature and moisture. It is of great significance for the scientific community to accurately measure and study this band of radiation. In order to do this, we use many different methods of measurement.

Aura is one of the premier polar-orbiting satellites used today. The Ozone Monitoring Instrument (OMI) aboard the Aura satellite can distinguish between aerosol types, such as smoke, dust, and sulfates, and measures cloud pressure and coverage, which provides data to derive tropospheric ozone. The OMI instrument employs hyperspectral imaging in a push-broom mode to observe solar backscatter radiation in the visible and ultraviolet. This study makes use of Level 2 Products of surface spectral irradiance and erythemally weighted UV Flux (OMUVB) irradiance values.

The UV-B Monitoring project employs over 30 different ground sites across the U.S. to better record and measure solar irradiance and UV band radiation. This study utilizes this data and makes the assumption of “ground truth”. The NREL data are assumed to be the “correct” values for our purposes. All satellite comparisons use the data directly over these sites, or at local noon time. This research project compares irradiance retrievals by the Aura satellite to ground-site observations. The comparisons are for a 10-year period over the continuous U.S., from 2005-2014. Figures are presented in scatterplots and line graphs to easily visualize and compare the data. Each site has its own scatterplot and each year is a different color on the graph. The correlation of these graphs are important for studying the similarities between the data sets.

Analysis of OMI local noon-time data interpolated to the UVB band is compared to NREL site UVB values at a matched time. OMI Erythral Dose Rate improves correlations, but seems to overestimate ground-site values. This is likely due to UVA band inclusion in the Dose Rate data. Lastly, an analysis of Cloud Optical Thickness looks to improve OMI-ground site comparisons. Cloudy days with Cloud Optical Thickness values above a certain threshold are shown to cause large errors in these comparisons.

A GIS ANALYSIS FOR BASALTIC GREYWACKE AS A MARTIAN ANALOG

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The search for mafic-clast sedimentary Earth analogs to serve as a stand-in for those found on Mars has yielded only limited results for scientists at the National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory (JPL). Earth analogs are needed to test the rover sampling drill for the 2020 Rover mission to Mars. The targeted lithology is basaltic greywacke because sand sized basalt grains have been observed on the surface of Mars by both the rovers Spirit and Opportunity. Previous searches have produced only a limited number of results and JPL scientists are intensifying the search for better analogs, especially as launch time grows closer. The present study is the first attempt at using Geographic Information System (GIS) to construct a sedimentary provenance model for prediction of outcrops of basaltic greywacke. The source for this analysis is the geologic map of the United States by King and Beikman published in 1974. Using the USGS Lexicon for the geology of the United States and the legend from King and Beikman's map I identified 50 geologic units containing either basalt or sandstone. From a set of polygons resulting from a buffered intersect of those units I selected only those where the basalt was older and therefore could have been a source for the greywacke. The results were reduced down to a select few polygons within a 150 mile radius of Altadena, CA, that had a greater number of occurrences of candidate sandstone. From there, geologic maps and literature were used to locate areas to survey in the field. Taking the map in the field, I was able to verify the presence of mafic sandstone at one of the predicted locations in the Tehachapi, CA, area. GIS opens the possibility of inquiring into data sets by modeling geological provenance. Future modifications of the method could tailor it to locate analogs for other planetary missions or other purposes.

ENVIRONMENTAL SCIENCE

STUDIES OF NITRATE TOXICITY IN NON-BITING MIDGES

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We have formed an ecotoxicology group to study the effects of increased nitrogen content in water supplies on macroinvertebrates. Nitrogen is one of the most abundant elements found on this planet, but only a limited supply is necessary for the normal processes of life to occur. Any excess of nitrogen will disrupt the nitrogen cycle, and humans can easily do this by inputting ammonium (NH_4^+) nitrates (NO_3^-) or nitrites (NO_2^-) into the environment. Nitrogen input increases through runoff from crop fertilizers, livestock waste, and industrial wastes. These molecules are water soluble, and when they get into water sources, such as lakes and streams, and begin to affect the organisms there. A common group of aquatic flies is the non-biting midge (Chironomidae). Midges are responsive to nitrogen toxicity in field studies and in ecotoxicology research. Herein we summarize past work that focused on the nitrosylation of proteins in midges. Midges were treated with varying concentrations of peroxynitrite, a byproduct of NO_x compounds, in order to determine the lethal dosage, as well as to determine if exposure to ONOO- caused nitrosylation of tyrosine residues in proteins. Very low concentrations showed little effect on midge mortality and very high concentrations were lethal. Intermediate amounts of ONOO- resulted in the nitrosylation of tyrosine residues. After treatment midges were individually stored and frozen at -20°C and subsequently lysed and homogenized. The homogenate was put through a series of tests to determine protein concentration and presence of nitrotyrosine in proteins. These preliminary results were promising, but we strive to further characterize

the nitrosylated proteins. We will present results from Western blot (WB) probed with nitrotyrosine antibodies and using a chemiluminescent substrate. We will use these data to identify molecular weights of major nitrosylated proteins, and eventually identify the type of proteins affected by ONOO-. Midges are a food source for higher trophic levels in streams and their impairment by nitrogen toxicity affects the entire food web. Our results may eventually be used to develop field assays for nitrosylation of midges in streams of Nebraska.

SUSTAINABLE GRASSLAND MANAGEMENT: AN EXPLORATORY STUDY OF PROGRESSIVE RANCHERS IN NEBRASKA

Stephanie Kennedy, School of Natural Resources, University of Nebraska–Lincoln, NE 68583

Well-managed grasslands provide numerous ecosystem services. Ranchers that employ sustainable grazing practices limit grassland conversion and conserve critical habitats. This phenomenological study explored the grassland management decisions of progressive ranchers in Nebraska. Each individual interviewed for this study is proactive about the state of their grasslands, whether they be motivated by financial or conservation factors. Throughout the evolution of their business, these ranchers have taken steps to improve their management techniques and continue to employ new strategies while planning for the long-term productivity of their grasslands. For policy makers and educators seeking to help improve some of the grassland management decisions of landowners, building trusting interpersonal relationships may improve the acceptance of recommendations. Because progressive ranchers' livelihoods are connected to the land, and they are long-term goal oriented, they closely scrutinize, yet are open to advancing grassland management practices that will benefit their cash flow, their pastures, their animals, and their families.

DEFAULT OPTIONS' EFFECT ON GRID PARITY

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Grid parity, considered to be the point at which a large scale change in generation from conventional to alternative (green) power sources occurs, ignores two important factors: marketplace choice and defaults. As more communities offer a choice between home energy suppliers, a default – a preselected option received if the consumer does not explicitly specify otherwise – can affect whether customers choose conventionally or sustainably produced energy. The purpose of this study was to determine the relationship between defaults and grid parity. Specifically, we sought to determine if marketplace choice in the presence of defaults impacts consumer's decisions, in a conventional vs. green energy scenario in which grid parity exists. Study participants were offered hypothetical situations in which they chose between a conventional and green home energy provider. In one condition, the green energy source was given as the default. In another, the default choice was the conventional energy source. The final, neutral condition offered no default. Manipulation checks confirmed participants generally were aware that the green provider was intended to be seen as environmentally friendly and the conventional as not. As hypothesized, participants in the conventional default condition chose conventional energy more often than in any of the other conditions. Given that greenhouse gas concentrations need to be lowered, conventional energy production default effects could adversely affect the implementation of green energy sources as they arrive at grid parity. The presence of a gray default will most likely affect consumer's choices even when price is inconsequential. Also, because of this default effect, designating a sustainably produced energy provider as the default could lead to an increase in investment as people act on the default.

UNDERSTANDING RANCHERS' PERCEPTIONS OF HETEROGENEITY IN THE NORTHERN GREAT PLAINS

Maggi Sliwinski, Mark Burbach, Larkin Powell and Walter Schacht, School of Natural Resources, University of Nebraska–Lincoln, NE 68583

Theory suggests that most management on private lands is leading to increasingly homogenous grassland landscapes, which is problematic for wildlife, habitat, and ecosystem services. We are studying ranchers' perceptions of management techniques that promote grassland heterogeneity and thus support healthy grassland ecosystems, such as patch-burn grazing or using a wider variety of stocking rates. The intent of my research is to better understand how state, federal, and non-profit organizations may engage with ranchers to support common goals of maintaining both grasslands and the ranching industry through innovative management techniques. To complete this project, we will interview ranchers in three states to explore management techniques and incentives using a qualitative research approach. Findings from the qualitative research will be used to develop a survey that will be sent to ranchers in the Northern Great Plains to gauge interest in and attitudes towards various management options and strategies that enhance heterogeneity, which will help to improve the ecological function of grassland systems. Results from this research will provide information on how to encourage management for heterogeneity on millions of acres of native grasslands in the Great Plains.

THE IMPACT OF PLACE ATTACHMENT ON FARMER LAND SUCCESSION PLANNING: A MIXED METHODS STUDY

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Agricultural land succession planning is a process to allow landowners to pass farmland on to the next generation without incurring a potentially debilitating tax liability for the heirs. The purpose of this study was to determine the influence of place attachment on land succession planning of farmers. This exploratory sequential mixed methods research involved farmers who have a land succession plan (i.e. a will) and farmers who do not have a land succession plan, and are both within 10 years of retirement (at least 52 years of age). The qualitative portion explored how farmers with and without a succession plan described their place attachment to their land following Raymond, Brown, and Weber's (2010) five elements of place attachment: place identity, place dependence, nature bonding, family bonding, and friend bonding. Ten themes emerged from the qualitative analysis of farmers with a will. Eight themes emerged from the qualitative analysis of farmers without a will. Only two themes were held in common. Both groups saw a positive side to living on their farm, but the reasons were dramatically different. The non-will group seemed to appreciate isolation from others and the freedom to make choices in the present on how to maintain their property in their own way. Futuristic maintenance of their land was not discussed. Management decisions seemed to be in the present tense only and for monetary gain. The will group seemed to be more forward thinking, wanting to maintain their farms and their surroundings for future generations and less concerned about the present. The will group discussed being stewards of the soil for the present and future. They want their children and future generations to be able to enjoy and witness wildlife. They also acknowledged that their current actions effect the state of the land, so they need to leave the land in a better state than they received it. These differences are explained in part by results of the quantitative portion of the study. Farmers with a will had significantly higher place identity, place dependence, nature bonding, and overall place attachment than farmers without a will. The results of this study indicate that policies and programs that draw upon place attachment to encourage succession planning may be quite effective with some farmers but not all.

NEW VOLUNTEER MONITORING PROTOCOLS FOR STREAMS AND WETLANDS OF NORTHEAST NEBRASKA

Barbara Hayford and Mark Hammer, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Citizen science is characterized by public participation in scientific research and discovery. Volunteer stream and lake monitoring has been an effective tool in engaging citizen scientists in environmental studies. Participants have often provided valuable scientific information for natural resource managers. We have hosted volunteer monitoring projects for over 15 years investigating stream, lake, and prairie ecosystems in Northeast Nebraska. One focus of these activities has involved monitoring macroinvertebrate communities, however most volunteer monitoring protocols have not been designed for the aquatic habitats in the Great Plains. We have designed protocols that are specific for lakes, wetlands, and streams in Northeast Nebraska. The protocols are more sensitive to environmental change in Northeast Nebraska based on data from existing studies. We tested the new protocols for volunteer stream and wetland monitoring by students at Wayne State College. The resulting index values were higher when compared to index values generated by earlier studies using other protocols. Even so, most sites had unacceptable ecological conditions. Future studies should involve monitoring of study sites with more acceptable conditions to determine whether the new protocols are effective in differentiating between more subtle differences in ecological condition.

HISTORY AND PHILOSOPHY OF SCIENCE

A “POOR MAN’S ATOMIC BOMB”: ONE HUNDRED AND ONE YEARS OF CHEMICAL WARFARE

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One hundred and one years ago, a dark precedent in modern war—a white cloud of poisonous gas—rolled over the fields of Flanders in the First World War. The history and chemistry of gas warfare and defense in the Great War will be described, and its influence on the development and use of chemical agents during war and peace in the century following examined.

TEACHING OF SCIENCE AND MATH

USING ASSESSMENTS BASED UPON PHYSICS EDUCATION RESEARCH (PER) TO INFORM CURRICULUM DESIGN

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In this talk, I will discuss two examples of PER-based assessments that I have used at Wayne State College and how they can be used to inform decisions about curriculum design. 1) Research has shown that although a student may remember witnessing a lecture demonstration, it is common for students to misremember the result of the demonstration. The pedagogical practice of using Interactive Lecture Demonstrations (ILDs) was designed to help remediate this issue. In an ILD, students complete a worksheet that can be collected by the instructor. I am using these worksheets to help me decide how much additional attention to spend on the topic demonstrated in the subsequent class. 2) The Force Concept Inventory (FCI) is a widely-administered standardized conceptual survey designed to assess the degree to which the survey participant has mastered introductory mechanics (is a “Newtonian

thinker”). Research has shown that classes using interactive engagement techniques, such as Open Source Tutorials developed by the University of Maryland College Park’s Physics Education Research Group, show greater student gains on this survey than traditional lecture-based courses. I administered the FCI to my introductory mechanics course which I taught in a predominantly traditional manner and measured the student gain to be disappointingly low. I am using this data to inform future changes to the course curriculum.

A SIMPLE APPARATUS FOR DETERMINATING THE RELATIONSHIP BETWEEN PRESSURE AND TEMPERATURE OF GASES

Neil L. Heckman and Elizabeth D. Tidwell*, Department of Chemistry, Hastings College, Hastings, NE 68901

Nearly every high school and first-year college chemistry and physics course presents the topic of the gas laws. However, there are very few experiments effectively demonstrate the relationship between pressure and temperature of gases with a fixed volume, often referred to as the Gay-Lussac Law. This simple and cost effective apparatus is designed to allow students a hands-on experience when studying this concept. The apparatus consists of a pressurized stainless steel sphere connected to a pressure gauge. Testing of the apparatus determined that sphere sizes greater than 5.1 cm had significantly less error than smaller sizes. Sphere sizes between 6.4 and 11.4 cm had no statistical difference between them and had percent error values less than 4%. This apparatus could be an effective means of providing a hands-on exercise to demonstrate the Gay-Lussac Law in an introductory chemistry course.

TEACHING THE SCIENTIFIC METHOD AS A MICROCOSM OF SCIENCE

Phyllis Higley, Department of Biology, College of Saint Mary, Omaha, NE 68106

When asked what science is and how it is done, students responded with the list of “make observations, pose and test a hypothesis, and make conclusions”. In a one-credit semester-long course for primarily first-year students I strove to expand that perception of science by creating a microcosm of the scientific process. Specifically, we talked about what science is and how it is done. The students were given opportunities to design experiments and peer review the proposals. They learned how to access and read scientific papers. Then they were given an example of pseudoscience found in the media and were asked to design an experiment to scientifically test the question. The students peer reviewed each other’s proposals, conducted their experiments, and presented their findings as oral presentations. I will share the activities used in the class and discuss their benefits and limitations.

BRICKLAYER CODING AS A VEHICLE FOR LEARNING MATH

Betty Love, Department of Mathematics; Victor Winter, Computer Science Department; and Davina Faimon, Department of Mathematics, University of Nebraska at Omaha, NE 68182

Academic success in mathematics and computer programming has long been highly correlated. Almost fifty years ago the mathematician Seymour Papert designed LOGO, the first programming language specifically for children. Since then studies have shown that use of LOGO in educational settings results in improvement in many areas of math. Given the current ubiquity of computers in schools as well as the rapidly growing emphasis on K-12 computer science education, now is a prime time to explore how coding can be used to improve math learning and perceptions. We will introduce a free programming environment, Bricklayer; that was designed to teach coding to people of all ages and

coding backgrounds. When executed, Bricklayer programs produce Lego artifacts that are displayed in the Lego Digital Designer software. Bricklayer programming ranges from the very simple (recreating a pixel art figure) through various levels of mathematical complexity starting with a simple two-dimensional coordinate system and extending to a plethora of geometric concepts such as lines, circles, cubes, spheres, and even fractals.

DOES COMPUTER SIMULATION OF CELL MEMBRANES WITH VIRUS-SPECIFIC RECEPTORS SHOW AN IMPROVED OUTCOME FOR VIRAL IMMUNE RESPONSES?

Brigette Corder, Bryan College of Health Sciences, Lincoln, NE 68506

Viral infections are a pressing issue in the medical community. There are many treatments for bacterial infections but there are few effective ways to treat viral infections. Because of this, patients must rely heavily upon their own immune systems to fight viral infections. A typical virus will bind to a certain receptor on a cell, enter the cell, replicate its genetic material, and rupture the cell membrane as the new viruses leave the cell. The body has multiple immune cells which will attack these viruses or target the infected cells for degradation. This computer simulation model tests how artificially generated cell membranes with virus-specific receptors may aid in immune responses. Inside these cell membranes are lysosomes which can break down and inactivate the virus. When the virus binds to the receptors, it will enter the cell and be broken down. This will decrease the number of active viruses and allow the immune system to mount a response quicker than without these “decoy” cell membranes.

COMPUTER SIMULATION OF THE PROGRESSION OF MACULAR DEGENERATION

Nicole Yosten, Ali Stark and Josef Kren, Bryan College of Health Sciences, Lincoln, NE 68506

Our purpose of this simulation is to show the effects of environmental and genetic factors on the progression of macular degeneration. Macular degeneration is a degenerative disease of the central portion of the retina that results primarily in loss of central vision. Age-related macular degeneration (AMD) is a leading cause of visual impairment and blindness in the elderly whose etiology remains largely unknown. Through computer simulations we are showing the rate of progression of macular degeneration based on variables, both genetic and environmental, that are aggravating factors of AMD. Individuals with fewer genetic and environmental factors may be at a lower risk of getting macular degeneration or slowing the progression of it. Individuals with multiple variables have a higher risk of developing macular degeneration or accelerating the progression of the disease.

COMPUTER SIMULATION OF THE EFFECTS OF NON-VACCINATION ON MEASLES INCIDENCE

Nancy Shook and Trisha Kaup, Bryan College of Health Sciences, Lincoln, NE 68506

According to the World Health Organization, “measles is one of the leading causes of death among young children even though a safe and cost-effective vaccine is available.” Vaccination against this deadly disease began in the early 1800s. By the mid-1800s exemptions were allowed for parents who had an objection, based on conscience, to the vaccinations. Anti-vaccination groups have continued into the 21st century. They are highly visible today. This simulation exhibits the potential long term consequences of the increasing popularity of the anti-vaccination movement. We have developed models to compare the incidence of measles between the communities with the highest and lowest vaccination rates in the United States. These models could be used for education of parents and health care workers on the importance of vaccinations.

MODELING OF GLUCOSE LEVELS OF TYPE 2 DIABETIC PATIENTS AND THE EFFECTS ON THE HOMEOSTASIS OF ORGAN SYSTEMS

Landi Peregrine and Kayla Piper, Bryan College of Health Sciences, Lincoln, NE 68505

Type 2 diabetes mellitus is a chronic condition, affecting how the body metabolizes sugar. The pancreas is able to produce some insulin, however, not enough to maintain stable glucose levels. Healthcare professionals are able to look at A1C levels in diabetic patients, which gathers the average glucose levels over the past three months. This simulation demonstrates the consumption of nutrients in relation to the effect on glucose levels, in turn affecting homeostasis of the body, such as nerves, the cardiovascular system, kidneys, the pancreas and liver. This simulation shows a stable glucose level with the recommended A1C level in a diabetic in comparison to a high glucose level and the debilitated function on certain body systems. The audience will understand how un-regulated glucose levels will impair the health of the patient.

CLINICAL APPLICATIONS OF DRUG IONIZATION. A COMPUTER MODEL

Laurel Ahlman and Josef Kren, Bryan College of Health Sciences, Lincoln, NE 68506

Drugs used in medicine must pass through cell membranes in order to access their site of action. Most drugs behave in solution as weak acids and/or weak bases. The state of drug ionization will affect the rate at which the compound is capable of diffusing across the phospholipid bilayer of a cell. The pKa of a drug has an effect on lipophilicity, solubility and permeability, which is affecting pharmacokinetic properties such as absorption, distribution, metabolism and excretion. We are modeling the effects of a range of pKa and pH values on ionization of specific drugs used to treat commonly occurring disorders. This model might benefit students of pharmacokinetics to help them to understand the physiological outcomes of drugs application.

COLLEGIATE ACADEMY BIOLOGY

CLIMATE CHANGE EFFECTS ON RESPIRATION RATES OF BLUE CRAB (*CALLINECTES SAPIDUS*) FROM THE PATUXENT RIVER, CHESAPEAKE BAY

Annie M. Nyffeler, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504; and Thomas Miller, Chesapeake Biological Laboratory, Solomons, MD 20688

A rise in atmospheric CO₂ induces a greenhouse effect that also causes ocean temperatures and CO₂ levels to rise. These environmental changes may represent an additional energetic cost for blue crabs (*Callinectes sapidus* M. J. Rathbun) because they rely on the concentration of CO₂ in the water to deposit calcium carbonate in their shells. We conducted a respiration experiment to measure the effect of climate change on crab metabolism. Crabs were collected from the Chesapeake Bay and exposed to different heated and acidified conditions. After crabs had been exposed to the environmental conditions in the chambers for two molts, they were placed in respiration chambers to measure rates of oxygen consumption. Results indicated different trends in respiration rates between the treatments, although the patterns were not statistically significant. Crabs exposed to higher temperatures showed elevated respiration rates, while crabs exposed to high CO₂ demonstrated decreased respiration rates. The two factors of climate change (high temperature and high CO₂) did not demonstrate the highest respiration rate, but rather the crabs exposed to high temperatures and ambient CO₂ showed the highest mean respiration rate. These data suggest that crab metabolism may not change as much as expected due to climate changes.

INFLUENCE OF SUBSTRATE TYPE ON TERRESTRIAL LOCOMOTION IN THE ORNATE ROPEFISH (*POLYPTERUS ORNATIPINNIS*)

Brandi Turner and Gary W. Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

There are as many as 26 genera of bony fishes capable of breathing air and leaving the water to actively move on land. These fishes utilize either axial undulation, appendicular rotations, or a combination of both to generate the force needed for forward propulsion. Previous studies have focused on emergent behaviors of various species or have examined the morphological and kinematic variables that result in terrestrial movements in different species. Few, if any, studies have investigated the role of substrate type on terrestrial performance. In terrestrial vertebrates that use axial undulations to generate force (e.g. snakes), substrate has a large impact on speed and kinematics because of differences in available push points. This study quantified terrestrial locomotor performance in the ornate ropefish (*Polypterus ornatipinnis*), which uses axial undulation for propulsion, on different ecologically-relevant substrates. Secondly, substrates tested were hypothesized to be similar to potential substrates available to early tetrapodomorph fishes and early tetrapods that began leaving the water 370 million years ago. We found that the amount of lateral bending tended to be negatively related to speed on most substrates. The amount of bending used to move did not differ between substrates. However, we did find that terrestrial speeds were faster on gravel and dirt/mud substrates compared to carpet or moss substrates. Our results suggest that this species does not modify lateral bending to optimize movement on different substrates like snakes. Moreover, our results shed some light on the importance of substrate type on how well early tetrapods moved and survived on land.

KINEMATICS OF SUCTION FEEDING IN THE AFRICAN LUNGFISH (*PROTOPTERUS ANNECTENS*)

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Feeding is a crucial task performed by all animals. The efficiency of feeding has been shaped by natural selection in nearly all clades in order to provide specific animals with the most energetically efficient way to feed. One important factor that has influenced the evolution of feeding systems is whether feeding occurs on land or in water. In aquatic vertebrates, such as fish and larval amphibians, suction feeding is utilized because it is energetically efficient and relatively safe when consuming potentially dangerous prey. Most cartilaginous and bony fishes possess a hyomandibular element attached to the back of the jaws (palatoquadrate) to permit jaw protrusion that enhances suction. Other species, such as lungfishes, possess a hyomandibula that lacks a connection to the jaws making suction feeding more difficult. Despite this disparate skeleto-muscular jaw connection, lungfishes are still capable of both suction feeding and using the jaw to directly grab food items in a way that is similar to terrestrial vertebrates. The current study aimed to quantify the mechanics of suction feeding in the African lungfish (*Protopterus annectens*). Using high speed video recorded at 300 frames per second, we quantified variables such as top and bottom vertical jaw displacement, speed of jaw opening, distance to food when suction began, speed of food item entering mouth, etc. in one individual adult lungfish. Variables were also recorded during feeding of two food types differing in size and shape. This data was used to compare to that of other fish species that have been previously studied. This descriptive study is the first, to our knowledge, to quantify suction feeding in a sarcopterygian fish.

PHYLOGENETIC ANALYSIS OF *STREPTOMYCES* AND RELATED BACTERIAL SPECIES

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Streptomyces aureofaciens Duggar, 1948 is an actinomycete that is used in industry to produce tetracycline, an antibiotic used to treat acne and skin infections; however, not much is known about the evolutionary relatives of *S. aureofaciens*. For this reason, a sample of *S. aureofaciens* was sequenced and a few of its genes analyzed. The genes used were: rpoB, recA, gyrB, 16S rRNA, 23S rRNA. Based on the Multi-Locus Sequence Typing database, these genes were determined to be best for identification of a sample based on the gene sequences provided. The objectives of this experiment were: to find these genes in other bacterial species, compare alignment methods, and reconstruct phylogenies using a maximum likelihood method. A pipeline was developed, using Python programming language, to perform these searches, allowing for an increased rate in species match identification from BLAST searches. BLAST searching was used to find similar sequences, and the Python coding was able to filter through sequences to find similar species names among the results. Multiple alignment software programs were used to determine effectiveness of each software. Finally, raxmlHPC and FigTree were used to make and view the phylogenies. Some notable results included: new outgroup candidates were identified for future experiments with this species; there was phylogenetic consistency among individual gene trees (save one); and, based on 16S rRNA analysis an unknown bacterium clone was determined by phylogenetic analysis. Most notably, *S. aureofaciens* was found to be closer to *Kitasatospora*, and multiple genes are needed for any complete phylogenetic analysis.

OCCUPANCY OF FROGS AND TOADS IN THE WETLANDS OF YORK AND SEWARD COUNTIES IN NEBRASKA

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Amphibian populations have been on the decline for the last two decades. Multiple environmental factors may contribute to this decline, such as loss of habitat, pollution, ultraviolet B radiation, climate change, and disease. Frog call surveys were conducted of five species to assess the occupancy of frogs at twenty sites in the Rainwater Basin in York and Seward counties in Nebraska. Call surveys are a means of sampling and aid in conservation decisions by assessing species presence and absence in order to better understand population size through occupancy modeling. Occupancy modeling acknowledges that detection is imperfect and attempts to address this flaw by incorporating survey-specific detection variables, or covariates. The covariates studied in this experiment were temperature, wind speed, time, and the day of the year. The results suggest that wind speed affects the detectability of Western Chorus Frogs, and that temperature affects the detectability of Plains Leopard Frog and the physical presence of Cope's Gray Treefrog. The models built for the other two species, Woodhouse's Toad and Northern Cricket Frog, were inconclusive.

COMPARING THE TROPHIC STATE OF LAKES IN DIFFERENT ECOREGIONS OF NEBRASKA

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The Environmental Protection Agency and the Commission for Environmental Cooperation designates three ecoregions in Nebraska: Sandhills, South Central Semi-Arid Prairies, and Temperate Prairies. Ecoregions are large areas of land that have similar natural environments. Lakes in different ecoregions may differ in the algae content, or trophic state. Comparing the trophic state of the lakes may give clues about how the ecoregions affect the eutrophication of lakes. Eutrophication is the process of a lake's nutrient levels increasing, causing algal blooms and other physical, chemical, and biological concerns. Water quality data obtained from The Nebraska Department of Environmental Quality, Surface Water Division was used to analyze and compare data from 98 lakes across the three regions. These data span the months of May through September of 2010 to 2013. In this report, the data are analyzed in a few different ways to explore the differences in trophic states between these ecoregions. Trophic states were determined using four main parameters: chlorophyll a, phosphorous, nitrogen, and Secchi depth as described by Brown and Simpson (2001). Results of the analyses will be discussed.

EVALUATION OF CAPSID PROTEIN GLYCOSYLATION FROM ANTIGENIC MUTANTS OF THE *CHLOROVIRUS* PBCV-1

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Paramecium bursaria chloroella virus (PBCV-1) is a prototype phycodnavirus in the genus *Chlorovirus* that infects the freshwater eukaryotic green algae *Chlorella variabilis*. Unlike all other known viruses, which use host machinery for glycosylation, the Chlorovirus PBCV-1 encodes most or all of its own machinery that glycosylates its major capsid protein, Vp54. Because of this novelty, further understanding of the role of the PBCV-1 virus in its own glycosylation process is of interest and is the focus of this project. Previous studies have revealed that some or most of the glycosylation of the Vp54 major capsid proteins is due to a specific gene, *a064r*. The *a064r* gene encodes the A064R protein, which has at least 3 domains. Seventeen identified antigenic mutants of the PBCV-1 virus isolated through antibody studies were available to help with the analysis of the A064R protein's role in glycosylation. The genomes of eleven mutants have been sequenced and analyzed. The purpose of this investigation was to sequence and analyze the *a064r* gene of four antigenic mutants that had not been genomically sequenced: E1L3, EPA6, P9L6, and P9L15. Domain 2 has been successfully sequenced and analyzed for all four antigenic mutants; two of the mutants, P9L6 and P9L15, contain mutations in the genic region that encodes domain 2, while EPA6 and E1L3 do not. Domains 1 and 3 are still under investigation. These analyses are helping to further understand the role of the A064R protein domains in glycosylation of the major capsid protein of PBCV-1.

ROLE OF SURFACE BACTERIA IN THE DECOMPOSITION OF MICE

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Decomposition, the biological process that breaks down complex organic molecules into simpler organic and inorganic molecules, contributes to the maintenance of all ecosystems. This process is carried out by invertebrates, fungi, and bacteria which consume and decompose dead tissues so that organic materials can be naturally recycled. The goal of this research is to identify the roles and interactions of surface contaminating microbes on mice in the decomposition of skeletal tissues. Surface microbes from mice were removed and then added back onto surface sterilized and non-sterilized mice. The degree of decomposition and bacterial counts were assessed.

THE EFFECTS THAT COVER CROPS HAVE ON THE GENERAL POPULATION OF PARASITIC AND NON-PARASITIC NEMATODES IN NEBRASKA

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Nematodes are found everywhere on this planet and affect a wide range of different organisms. The focus of this experiment was to monitor the population throughout the year of both plant based parasitic and non-parasitic nematodes in crop production fields. For their management, different types of cover crops were planted to see whether they could be used as an alternative to nematicides and two hypothesis were formed: 1. That the cover crops used would decrease the total population of both parasitic nematodes and non-parasitic (free living) nematodes. 2. That the cover crops would increase the total population of both parasitic nematodes and non-parasitic (free living) nematodes. Our study indicated an increase in all nematodes, both in the parasitic and non-parasitic populations when cover crops were present.

TRAUMATIC BRAIN INJURY ALTERS TAU PATHOLOGY IN AN ALZHEIMER'S DISEASE MOUSE MODEL

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Neurofibrillary tangles (NFTs) have been found in brains affected with Alzheimer's Disease (AD). NFTs are produced by hyperphosphorylation of tau proteins found on microtubules in neurons. AD has been associated with individuals who previously had a traumatic brain injury (TBI). Using immunohistochemistry, tau proteins were marked in young Htau mice with TBIs to determine if phosphorylation was consistent with mice who were older. Young Htau mice with TBIs and older uninjured Htau mice share similar tau pathology consistent with the development of NFTs, which have the potential to lead to AD.

DOES INCREASING BODY LENGTH ENHANCE PERFORMANCE AND MINIMIZE TRADE-OFFS AMONG LOCOMOTOR MODES IN SNAKES?

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Being limbless, snakes have a counter-intuitive advantage of being capable of moving in a variety of different ways and multiple types of substrates (e.g. above-ground, below ground, in trees, and in water). The elongated body form in conjunction with lateral bending possessed by snakes permit many options for force production and balance. However, some studies have found that performance via some locomotor are inversely related to others due to hypothesized differences in biomechanics. Moreover, previous work has hypothesized that increases in body length increase performance capabilities across all locomotor modes because it provides more surface area for force production and gripping. We tested this idea by quantifying locomotor speeds of an elongated species, rough green snake (*Ophedrys aestivus* L.), during different locomotor modes. We measured the locomotor capabilities of snakes while swimming, performing concertina, lateral undulation, and arboreal movements on three different branch sizes (3, 6, and 10 cm diameter). The goal was to determine if 1.) any inverse relationships (i.e. trade-offs) exist among modes and 2.) green snakes performed better across modes compared to shorter species relative to size. We found no significant inverse relationships among any mode. Arboreal speeds were similar to those found in other species that have been

investigated. Average maximal concertina speeds were slightly lower than found in other species. In contrast, green snakes exhibits maximal speeds that were 25-40% and 10-20% higher than that of other relatively shorter species for terrestrial lateral undulation and swimming, respectively. Our results do not support our hypotheses, suggesting that increasing body length itself does not increase performance for all locomotor modes. Increased length does enhance modes that do not involving gripping for stop-and-go movement.

SITE-DIRECTED MUTAGENESIS OF THE *CHLAMYDIA TRACHOMATIS* A/HAR-13 SEROTYPE A MOMP GENE TO ALLOW FOR PROTEIN PURIFICATION OF POTENTIAL VACCINE

Nathan Hatch, Kira Hannon, and Douglas Christensen, Department of Life Sciences; and Gustavo Zardeneta, Department of Physical Science, Wayne State College, Wayne, NE 68787

When it comes to infectious diseases, Trachoma holds the title of causing the most cases of preventable blindness in the world. Trachoma is caused by the bacterium *Chlamydia trachomatis*, and is currently the cause of 8 million cases of visual impairment across the globe, with an additional 84 million active cases where permanent blindness can still be prevented. Due to subpar health care systems in the 57 countries where this disease is considered an endemic, it has been extremely difficult to treat and educate the public. Our goal is not to fight the established infections, but instead to prevent future infections altogether through vaccination. The protein we selected to use as a vaccine is referred to as MOMP (Major Outer Membrane Protein) which is a protein that is highly expressed on the surface of *Chlamydia trachomatis*. However, due to the chemistry of this protein, isolation can be very difficult. The disulfide bonds that are formed by cysteine interactions are the most problematic. Here we demonstrate the successful site-directed mutagenesis of several cysteine to serine residues in various combinations. Additional research is also being conducted involving isolation attempts of altered versions of MOMP. This publication was made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

PARTIAL PURIFICATION OF THE MAJOR OUTER MEMBRANE PROTEIN FROM *CHLAMYDIA MURIDARUM*

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Chlamydia is one of the most prevalent sexually transmitted infections and is often asymptomatic. If left untreated, conditions such as infertility and pelvic inflammatory disease can occur. According to the Center for Disease Control, there were about of 1.1 million cases reported in the USA in 2014. A vaccine is the best way to prevent infection and subsequent sequelae; Mice studies have shown that the major outer membrane protein (MOMP) of *Chlamydia muridarum* effectively immunizes mice against this bacteria. A vaccine for humans is currently not feasible since MOMP cannot be produced in bulk and attempts to fold recombinant MOMP (rMOMP) have proven unsuccessful, perhaps due to the disulfide bonds present in the protein. Using site-directed mutagenesis we have created an rMOMP mutant where Cys¹⁵¹, Cys¹⁶³, Cys⁶⁰¹, and Cys⁶⁰³ were changed to Serines in order to avoid error disulfide crosslinks and perhaps allow for the folding of this rMOMP. rMOMP was overexpressed and isolated from *E.coli* (E.Clon Express BL21 DE 3). Results show that some of the MOMP was present in the cytoplasm but a more pure protein was present in and extracted from the *E. coli*'s inclusion bodies. Purification of rMOMP involved lysis of *E. coli* in the presence of protease inhibitors, chaotropic agents

and detergents. The lysed cell pellet was treated to isolate inclusion bodies by centrifugation and use of detergents. Finally, the detergent, Sarkosyl, was used to isolate MOMP from the inclusion bodies. Recovered protein from the supernatants and from inclusion bodies was analyzed by SDS-PAGE. rMOMP was observed in both samples but a highly purified protein band (~95%) was observed at 42 kDa only in the inclusion body fraction. This band represents the MOMP monomer. Before attempting to fold MOMP into its native trimer conformation, we will purify MOMP to homogeneity by gel filtration chromatography. This publication was made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

EPSTEIN-BARR VIRUS AND THE ROLE OF MDM2 IN VIRAL TRANSFORMATION

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Epstein-Barr virus (EBV) is a double stranded DNA herpesvirus involved in the development of a number of human cancers. How EBV transforms normal cells into cancerous ones is unknown. The goal of this project was to infect cells with EBV in order to better understand how viruses facilitate oncogene expression. MDM2 is an oncogene involved in many cancer developments. EBV-infected B lymphocytes had higher levels of MDM2 than their uninfected counterparts as evidenced by western blotting. The critical protein, p53, is involved in cancer development and is a major activator for MDM2. Our results indicate that EBV-infection causes an increase of MDM2 in absence of the p53. Therefore, our conclusion is that EBV activates MDM2 in a p53 independent manner. These results may help to understand how EBV transforms normal cells into cancerous ones. This study may shed new light on the treatment of EBV-associated cancers.

EXOME SEQUENCING SCREENING FOR DOMINANT PROGRESSIVE HEARING LOSS CAUSES

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Hearing loss is the most common sensory disorder, effecting 70 million people worldwide. Over 60% of U.S. cases, primarily in children with prelingual hearing loss, have genetic causes. About 20-30% of nonsyndromic hearing losses are autosomal dominant cases, and there are 31 known autosomal dominant genes affecting hearing loss. The goal of our research is to find the genetic causes of dominant progressive hearing loss (DPHL) in families using exome sequencing. PCR amplification of coding DNA was used to verify mutations in affected individuals in comparison to unaffected individuals. We found a heterozygotic mutation in exon 3 of the ACTG1 gene, which is known to be pathogenic for DFNA20/26, an autosomal dominant nonsyndromic mutation. This mutation, K118M, changes the amino acid at this location from lysine to methionine, and has been described in families with DPHL from the US, Spain, and Japan. This publication was made possible by grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

THE YEARLY DISTRIBUTION OF *PRATYLENCHUS* NEMATODES IN CORN PLANTS OF NEBRASKA

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Lesion nematodes are microscopic, parasitic round worms that belong to the genus *Pratylenchus*. Around 70 species exist all over the world and can parasitize 400 species of crop plants. They are endoparasites, meaning they enter the root, extract nutrients, and damage tissues of the corn plant. In this experiment, lesion nematodes were collected from two locations (Battle Creek, NE and West Point, NE) in soil and root samples at depths of four and eight inches. The lesion nematodes were extracted from the soil and root samples and counted each month. This process took place for a calendar year and then calculated to see what percent decrease took place from the harvest season in the fall months to the following spring months. The hypothesis was that the decrease in population of lesion nematodes would be 50 percent. After calculating the percent decrease from each depth and both fields, the overall percent decrease of lesion nematodes was 67.7 percent. This is more than the original hypothesis of 50 percent, and this data will act as baseline data for future experiments similar to this one.

CHARACTERIZATION OF ALKALINE PHOSPHATASE IN MICE LACKING THE HEPATOCYTE ASIALOGLYCOPROTEIN RECEPTOR DURING INFLAMMATORY LIVER INJURY

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It is known that liver inflammation can be caused by lipopolysaccharides (LPS) in the liver. LPS is a cell wall component of bacteria that reside in the intestine. In an alcoholic, leaky gut syndrome can develop, leading to the leakage of LPS into the blood stream. This LPS ultimately makes its way to the liver where it causes inflammation. In healthy livers, the enzyme alkaline phosphatase is responsible for detoxifying LPS through de-phosphorylation. Alkaline phosphatase is produced in the intestine, liver, bone and placenta. In the liver, the enzyme is placed on cell membranes by the asialoglycoprotein receptor (ASGPR) for optimal activity. In an alcoholic, it has been shown that there are defects in the ASGPR. There are not as many receptors and they do not work as efficiently. It is hypothesized that if the ASGPR is damaged, alkaline phosphatase will not be trafficked correctly in liver cells. LPS will not be detoxified and will continue to cause inflammation. A treatment for LPS toxicity is the administration of alkaline phosphatase to the patient. In an alcoholic, treatment with alkaline phosphatase might be ineffective because of the defects in the ASGPR. These initial studies use an ASGP receptor deficient mouse model to simulate the damage caused by alcohol consumption. Wild-type (WT) and receptor-deficient (RD) mice were subjected to LPS or saline injections. After 8 hours, the mice were sacrificed and livers removed. Serum levels of alanine aminotransferase (ALT) and tumor necrosis factor (TNF) were measured to assess liver damage and inflammation. Real-Time PCR was performed to measure alkaline phosphatase mRNA levels. Tissue sections were stained and analyzed for structural defects, presence of alkaline phosphatase and alkaline phosphatase activity. The results of this work demonstrated that RD mice treated with LPS had an increase in overall liver damage and inflammation when compared to WT mice. Several measurements showed that there are decreases in mRNA and protein levels of alkaline phosphatase in the liver. Alkaline phosphatase activity levels seemed to contradict that above results. RD mice showed higher alkaline phosphatase activity in an optimized activity assay but the de-phosphorylation of LPS specifically was not measured. RD mice might not have the ability to dephosphorylate LPS because of the lack of ASGPR. Structural analysis

of the tissue showed that WT and RD livers are not structurally different suggesting problems at the enzymatic level. General staining for alkaline phosphatase activity showed differences between WT and RD tissue suggesting that the ASGPR is important for enzyme activity. The data presented indicates that when the asialoglycoprotein receptor is missing, more liver inflammation occurs. Alkaline phosphatase is present in cells lacking the ASGPR, but it is unable to detoxify LPS leading to liver inflammation. The same condition might be happening in alcoholics because the receptor is defective in these individuals. Treating alcoholic patients with alkaline phosphatase might not be effective against LPS toxicity. Key Words: Alkaline phosphatase, asialoglycoprotein receptor, lipopolysaccharide, Real-Time PCR, alanine aminotransferase, tumor necrosis factor, leaky gut syndrome

METHODS IN ASSESSING INSULIN AND GLUCOSE LEVELS IN FEMALE AFRICAN ELEPHANTS (*LOXODONTA AFRICANA*) IN ZOOS: A COMPARISON BETWEEN METABOLIC HORMONE LEVELS IN SERUM AND URINE

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Obesity is a growing threat to the health and welfare of female African elephants (*Loxodonta africana*) housed in zoos, and has been shown to be related to reproductive acyclicity. In order to sustain zoo populations, obesity and related health issues warrant investigation before it is too late. Insulin and glucose are two crucial obesity-related markers that should be assessed in elephants because of their links to obesity in other species and the implications for female elephant reproductive health. The focus of this research was to analyze glucose and insulin levels in serum and urine samples of 25 female African elephants housed in zoos in the United States. The objective was to determine the correlation between serum and urine concentrations for both insulin and glucose. If a strong correlation is present, glucose and insulin concentrations in serum could be extrapolated from urine samples, which would make routine monitoring of these substances and the identification of at-risk elephants much more practical. Blood collections are routine procedures in most zoo-housed elephants, however blood is not always collected from young elephants or bulls. Furthermore, determining insulin and glucose concentrations in free-ranging elephants is not possible; however, urine collection is possible and would provide knowledge on these substances for comparison to zoo-managed populations. We found that no strong correlation exists for glucose between serum and urine. Insulin levels in serum and urine samples did show a relationship ($r=0.54$, $p<0.001$) that could be applied to future field research, but the evidence is only enough to provide a potential range of insulin concentrations. Through more extensive research, insulin's correlation between serum and urine could be refined and possibly utilized when studying populations.

USDA-ARS, LINCOLN NE SORGHUM PROJECT: GENETIC IMPROVEMENT OF SORGHUM FOR NON-GRAIN ENERGY USES

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Sorghum (*Sorghum bicolor*) is rapidly growing in popularity throughout the United States due to its versatility. Categorized as a C4 plant it shows characteristics of being heat and drought tolerant as well as having a rapid growth rate and a short planting rotation. Sorghum is usually grown for grain and forage production but lately it has shown potential in other ways for biofeedstock, which is renewable material that can be directly used to produce fuel. These fuels include ethanol, butanol, biodiesel, and other hydrocarbon fuels. One of the key factors to sorghum and its ability to produce efficient energy is lignin composition. Lignin has a role in strengthening and fortifying the plant cell wall allowing for

protection against specific pathogens and herbivorous insects. We targeted factors in the biosynthetic pathway and how to alter them to impact the lignin biomass, specifically the *SbCCoAOMT* gene. When overexpressed, this gene showed higher energy output than the other transgenic sorghum strains. The procedure was as follows: (1) we extracted RNA from samples from 5-6 week old plants. The overexpression lines of *SbCCoAOMT* and the wild type were compared using the Fisher's exact test. (2) We used a bomb calorimeter to measure the total energy content of biomass throughout a various strains of sorghum, which were then compared to the *SbCCoAOMT* strain. Thioacidolysis: Lignin subunit composition from mature plants was determined by using gas chromatography. Whole plant samples were washed, derivatized, and analyzed. (3) Bioinformatics analysis on the strains of *SbCCoAOMT*, *Myb*, and wild type were analyzed using the computational methods. A result of these experiments showed that an overexpression of the *SbCCoAOMT* gene in the biosynthetic pathway did in fact, produce increased levels of lignin composition, which caused a higher total energy output.

INFLUENCE OF PERCH DIAMETER AND INCLINE ON THE TRADEOFF BETWEEN SPEED AND BALANCE DURING ARBOREAL SNAKE LOCOMOTION

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Snakes have the ability to move via multiple different modes of locomotion on a variety of different substrates. Previous studies have examined the performance and biomechanics of snakes moving on terrestrial and aquatic substrates. However, studies examining various aspects of arboreal locomotion above ground have been scarce. Using a habitat generalist species (*Pantherophis guttatus*), we investigated the interactive effects of perch diameter and incline on arboreal locomotor performance and balance. Using a repeated-measures design, snakes were videotaped while traversing three diameters (3, 6, and 10 cm) on two inclines (0 and 30 degrees). We found no influence of incline on speed. There was a significant effect of perch diameter with snakes moving faster on the smallest (3 cm) diameter perches. Also, we found no influence on the number of coils used to grip the perch during movement on arboreal speeds. Snakes may have been more hesitant on larger diameter perches to prevent falling. Future studies of snake arboreal movements should incorporate side branches or pegs for added stability and steeper inclines to shed light on the potential trade-off between balance and speed.

RELATIONSHIP BETWEEN HUMAN ACTIVITY AND HOME RANGE SIZES OF FOX SQUIRRELS (*SCIURUS NIGER*) ON THE NEBRASKA WESLEYAN UNIVERSITY CAMPUS

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Optimal escape theory suggests that as more predators including humans are in the area, home ranges may become smaller. Home range and activity were studied in a group of fox squirrels (N=26) on the Nebraska Wesleyan University campus in Lincoln, Nebraska from February 2015 to December 2015. Results can be used to understand the effects of human activity on other wildlife populations. In theory we can apply them to endangered populations that experience human disturbance, which can be critical to their conservation. The home range was estimated by a minimum convex polygon from radio locations during high human activity and low human activity in areas where human presence was probable. The results of this study suggest that human activity does not play a significant role in home range size of fox squirrels in the spring, summer, or fall months. It was also found that human activity did not have a significant effect on whether the squirrels would be found on the ground or in a tree. Human activity was established well before this study was initiated which has lead the squirrels to be habituated with living in an environment that is filled with university students most of the year.

PHYLOGENETIC ANALYSIS OF 16S rDNA GENE SEQUENCES OF BACTERIAL STRAINS FOUND IN THE MICROBIOME OF THE BELLY BUTTON

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The skin is the human body's largest and most exposed organ. As such, it is host to a multitude of different bacterial communities. A variety of factors are responsible for the diversity of these microbiota, including the host environment, immunities, and the topographical location on the skin. The current project focused on the microbiome of the human navel, an easily identifiable region on the skin that is less exposed to external environmental factors. Samples were taken from volunteers, the bacteria grown in culture, and the DNA extracted for 16S rDNA amplification by PCR. After DNA sequencing microbes were identified using the BLASTn tool on GenBank. In addition, phylogenetic analysis of aligned DNA sequences was performed using the computer software programs ClustalW and MEGA6. Dominant bacteria found in the sample population were strains of *Staphylococcus*, *Bacillus* and less prominent microbes such as strains of *Dermobacter*, *Corynebacterium*, and *Micrococcus*, respectively.

ASSESSMENT OF FUMIGANT TOXICITY OF ESSENTIAL OIL EXTRACTS AGAINST NORTHERN FOWL MITES

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The Northern Fowl Mite (*Ornithonyssus sylviarum*) is an ectoparasite. It is one of the biggest threats to the nation's poultry industry. The poultry often suffer from dangerous infestations. Symptoms can include blood loss, reduced weight, decreased egg production, and when severe, death. This often leads to an economical loss. While there are currently a few inorganic treatments there are no known organic pesticides approved by the FDA to treat these infestations. Essential oils from *Humulus lupulus* and *Cannabis sativa* were extracted and tested against the Northern Fowl Mites using bioassays. The results will evaluate effectiveness of the fumigant toxicity of the essential oils based on mortality rates. The results will be assessed and the interpretations will be discussed. Results are expected to show effective miticidal activity from both essential oils against the Northern Fowl Mite. Future goals include developing an effective and safe organic pesticide for poultry population in the United States.

DIFFERENTIAL EFFECTS OF LEG AUTOTOMY ON LOCOMOTOR PERFORMANCE AND KINEMATICS IN PHOLCID SPIDERS

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The ability to self-amputate an appendage, referred to as autotomy, in order to escape a predator following capture is found in many groups of reptiles, amphibians, insects, and spiders and has obvious survival benefits in certain situations. However, the loss of an appendage can have profound negative consequences on other traits, such as reproduction, foraging abilities, and locomotor performance. We examined the influence of single leg autotomy on locomotor performance and kinematics during movements on both horizontal and inclined (45 and 90 degrees) substrates in pholcid spiders. Using a repeated-measures design, we quantified maximal speeds, stride length, and stride cycle times for

spiders before and after leg autotomy. Speed decreased with increasing incline for all spiders and speed decreased following leg removal for all incline treatments. Different incline treatments resulted in differential effects on stride kinematics on autotomized spiders. Kinematic effects are likely due to compensation in stride patterns to maintain sufficient speeds on various inclines. This study suggests that different selection pressures on traits associated with leg autotomy might occur in spiders inhabiting different microhabitats.

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS
SESSION A

INVESTIGATIONS OF LEIDENFROST LIFETIMES AND PROPELLED-LEIDENFROST DROPLETS

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A chef knows when his or her skillet is hot enough to start cooking the ingredients by dashing a bit of water on it. If it's too cold, the water will stick to the metal immediately and quickly boil away. If, however, the skillet is heated into the Leidenfrost temperature range, the water will dance around the skillet in bead-sized droplets, surviving for a much longer period of time. This effect has been observed and investigated for centuries and has been explained thoroughly by thermodynamics and fluid-motion. More recently, a new result of the Leidenfrost Effect has been observed: a ratcheted surface causes these droplets to exert a forward force on themselves. This has been dubbed the Propelled-Leidenfrost Effect, and has been under investigation for the past decade. Experiments were conducted investigating the regular Leidenfrost Effect in which droplet lifetimes were measured under several different conditions including droplet size, temperature of the surface, and type of fluid. Further experiments were done for Propelled-Leidenfrost droplets. Droplet lifetimes, in both experimental regimes, were determined using a high-speed camera. The camera was also used to measure acceleration and terminal velocity of the droplets as a number of variables were changed, such as ratchet dimensions, surface temperature, and type of fluid.

DEVELOPING METHODS OF DETECTING EXOPLANETS VIA TRANSIT OBSERVATION

Austin Bricker, Department of Physics, Nebraska Wesleyan University, Lincoln, NE 68504

Utilizing the data gathered by NASA's Kepler Mission Project, methods were developed to convert the raw photometric data gathered by the spacecraft into light flux data that can be used to determine the presence of an exoplanet around the target star. Once detection was confirmed, various dimensions of the system were determined, such as radii, orbital period, etc. Finally, the methods were adapted to become the basis for a laboratory experiment designed to be carried out by upper-level physics students.

FOCUSING SOUND WAVES IN A COMPARISON BETWEEN THE TIME REVERSAL PROCESS AND THE DELAY LAW METHOD TO ACHIEVE SUBWAVELENGTH FOCUSING

David Dobesh, Department of Physics, Hastings College, Hastings, NE, 68901

In wave physics there is a fundamental symmetry which reveals that time is invariant: consequently time can be reversed. By exploiting the time invariance, we can reverse the time variable in the wave equation to replicate a sound field at a specific point in space. The time reversal process takes advantage of the time invariance which theorizes that if time were reversed the waves would

retrace their paths and converge to the point from which they originated. This proposal will use a time reversal mirror (TRM) in the form of a linear speaker and microphone array. The focus point resolution will be compared between a free-field and a reverberant environment in an effort to produce subwavelength focusing. The time invariance symmetry will be analyzed in the audible frequency range where the effects of attenuation and dispersion are present. A comparison of the classical delay-law focusing technique to the time reversal method will be conducted with filtering and analysis done in MATLAB. The comparison will investigate the point spread functions and the sidelobe levels around a focal point.

MEASURING BINDING INTERACTIONS BETWEEN HSA AND DESETHYLATRAZINE USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY

Alyssa Blair and Annette Moser, Department of Chemistry, University of Nebraska at Kearney, NE 68849

Human serum albumin (HSA), the most abundant transport protein in blood, has the ability to bind a wide variety of solutes including herbicides. Although numerous studies have examined the interaction with drugs with HSA, very few have focused on the binding between herbicide and herbicide metabolites and HSA. Atrazine and some of its metabolites are often found to contaminate ground water and have the potential to bind HSA and be transported throughout the human body. In this study, frontal analysis, a subset of high performance affinity chromatography (HPAC), was used to measure the binding constant between HSA and desethylatrazine.

STUDY OF THE EFFECT OF MAGNETIC FIELDS ON CYCLOADDITION REACTIONS

Mariah McAfoos and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

A series of photochemical reactions are conducted in and out of a magnetic fields to determine if the molecule orientation will effect enantiomeric or diastereomeric ratios of reactions. A compact device that generates low to moderate magnetic fields was constructed to conduct the experiments. The general procedure was to mix the starting materials in a tube, place it into the magnetic field, irradiate with UV light for the reaction to proceed. The reactions studied were Paterno-Buchi [2+2] cycloaddition of a carbonyl with an olefin to give an oxetane. The optical rotations of starting materials and products were compared for reactions done in and out of magnetic fields as well as GC/MS analysis of reactions producing diastereomeric mixtures.

FERROMAGNETIC ACCELERATOR OPTIMIZATION

Jerrad McDermott, Department of Physics, Hastings College, Hastings, NE 68901

A ferromagnetic accelerator, also known as a coil gun, uses the principle that current running through a wire produces a magnetic field. When a ferromagnetic material is placed in the magnetic field it experiences a net force. Electrical potential energy from the circuit can be transferred into kinetic energy to accelerate the ferromagnetic material. By measuring the velocity of the projectile after it exited the coil the efficiency of the system was computed. Investigations into efficiency improvements involved varying starting positions, length and diameter of the object. By optimizing all three variables the maximum efficiency of the system was determined.

CHANGES IN THE UNOCCUPIED ELECTRONIC STRUCTURE OF THE SPIN CROSSOVER MOLECULE [Co(dpzca)₂]

Yang Liu, Xin Zhang, Axel Enders, Peter Dowben. Department of Physics, University of Nebraska–Lincoln, NE 68588

We have investigated the changes in the unoccupied electronic structure of the spin crossover molecule - [Co(dpzca)₂] using X-ray absorption spectroscopy (XAS) and have compared the results with magnetometry (SQUID) measurements. The studies of the variable temperature of the electronic structure of this cobalt complex with symmetric pyrazine imide ligands, -(2-pyrazylcarbonyl)-2-pyrazinecarboxamide, i.e. [Co(dpzca)₂], are consistent with density functional theory (DFT). The temperature dependence of the occupancy of the high-spin state and low-spin state molecular orbital states, the unoccupied e_g/t_{2g} ratio from XAS and high spin state to low spin state ratio from molecular magnetic susceptibility χ_{MT} indicates that the low spin state is not a zero spin state, but simply a lower moment state that would occur below the spin crossover transition of [Co(dpzca)₂].

COLLEGIATE ACADEMY CHEMISTRY AND PHYSICS SESSION B

SOLAR CELLS: CREATING CLEAN ENERGY USING SUNLIGHT

Brady Menke, Department of Physics, Hastings College, Hastings, NE 68901

As fossil fuel abundance continues to decrease, people are beginning to turn to other types of energy. One viable alternative to fossil fuels is reliance on the sun to generate clean energy. Simple solar cells are an alternative energy source that is harmless to people and the environment. Two different experiments were conducted demonstrating that the sun can generate power to replace fossil fuels. Copper and aluminum in salt water generated a current in a variety of configurations to include: material size, composition and salt concentration. Copper was also combined in layers with zinc oxide, conductive ink (carbon-based), and magnesium to produce a current with similar configuration changes.

AN INVESTIGATION OF INTERNAL FLUID FLOW USING NUMERICAL METHODS

Connor Bohlken, Department of Physics, Nebraska Wesleyan University, Lincoln, NE 68504

Problems defining fluid flow are notoriously difficult to solve, due to the complexity of the Navier-Stokes equations, but approximations can be made using many modern numerical methods. An investigation into these fluid problems was done, using both finite difference methods and finite element methods, on incompressible, viscous fluids.

BLUETOOTH LOW-ENERGY WIRELESS SENSOR NETWORKING FOR PRECISION AGRICULTURE PURPOSES

Justin Pflug, Department of Physics, Hastings College, Hastings, NE 68901

A wireless sensor network composed of Texas Instruments CC2650STK sensor tags extended with debuggers and additional Grove modules was implemented in conjunction with a CC2650 Evaluation Module coordinator to automate an irrigation system. Parameters of interest including temperature, relative humidity, barometric pressure, soil moisture, solar irradiance, and GPS location were collected by the sensing nodes and used in a Real-Time Operating System (RTOS). Using this system and the Bluetooth Low Energy protocol, an automated greenhouse system with moveable plants and sensing nodes was created to evaluate the efficiency of automated precision agriculture systems.

USING LIQUID CARBON DIOXIDE AS A SOLVENT FOR AZO-DYE FORMATION

Zachary Reisen and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

Liquid carbon dioxide is an environmentally friendly (green) solvent and has been used in a variety of applications such as removing caffeine from coffee and in dry cleaning.. Natural products like limonene previously have been extracted from orange peels in high purity and reactions such as Diels-Alder, addition of Br_2 , and reduction of ketones using NaBH_4 have also been conducted in liquid CO_2 . Here we will discuss the extension of this reaction technique to azo-dye formation between aromatic amines and phenols. Aniline and o-toluidine and m-toluidine were reacted with 2-naphthol and 9-phenanthrol (with NaNO_2 and HCl) to form the corresponding azo dyes. HPLC and UV/Vis analysis and comparison to commercial dyes such as Sudan I and IV were conducted.

PARABOLIC SOLAR COLLECTOR EFFICIENCY

Miranda Muhs, Department of Physics, Hastings College, Hastings, NE 68901

Simple geometric structures can be utilized to focus the sun's power and solve many problems, such as desalinating or distilling water. This project demonstrated the process of engineering, procuring, and constructing a parabolic solar trough collector to heat water. The project employed the principles and geometry of a parabola combined with applications of thermodynamics, optics, basic electronics, and mechanics to harness the power of the sun. With a focus on portability and using common and easily accessible tools, a trough was built, which followed the sun from east to west throughout the day. A test of the temperature increase of the output water versus that of the input water was recorded. Different flow rates were tested in an attempt to find the best efficiency.

MEASURING BINDING INTERACTIONS BETWEEN HSA AND HYDROXYATRAZINE USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY

Anthony Donovan and Annette C. Moser, Department of Chemistry, University of Nebraska at Kearney, NE 68849

Human serum albumin (HSA), the most abundant transport protein in blood, has the ability to bind a wide variety of solutes including herbicides. Although numerous studies have examined the interaction with drugs with HSA, very few have focused on the binding between herbicide and herbicide metabolites and HSA. Atrazine and some of its metabolites are often found to contaminate ground water and have the potential to bind HSA and be transported throughout the human body. In this study, frontal analysis, a subset of high performance affinity chromatography (HPAC), was used to measure the binding constant between HSA and hydroxyatrazine.

ANALYSIS OF A VIBRATING GUITAR STRING USING HIGH-SPEED PHOTOGRAPHY

Ian Tuttle, Department of Physics, Hastings College, Hastings, NE 68901

In music, the audible frequency is used to tune an instrument, but what is the significance of string frequencies for physicists? When determining the frequency of possible waveforms, guitar strings have frequencies ranging from 82.4 Hz (the low E string) to 329.6 Hz (the high E string), yet the frequency range is too rapid for the human eye to perceive. If the mind could create images at 1200 per second, humans would capture about 14.5 frames over one complete vibrational cycle of the guitar string with the lowest (82.4 Hz) frequency. Utilizing high-speed photography and imaging technology, the guitar string's position was determined at several time frames along the vibrational cycle. A calculable standing wave model was used to investigate the correlation between the high-speed data and the model results. Using the model the guitar string waveform can be represented and used to predict the physical location of the string during its vibrational cycle.

EFFECTS OF TREAD PATTERN ON SHOE FRICTION

Marco Fielder, Department of Physics, Hastings College, Hastings, NE 68901

Many surface designs in materials science are based on body part functionalities in animals. One such biologically inspired function, such as that seen in the feet of tree frogs, is a hexagonal surface pattern that increases friction between surfaces; particularly surfaces with a liquid lubricant between them such as water. A hexagonal surface pattern fabricated on a natural rubber sheet section was used to simulate a shoe tread. Different variables such as the depth and width of the channels between hexagonal protrusions were changed to observe their effect on friction between the rubber sheet section and a vinyl floor tile. The coefficient of friction was measured using a lab fabricated tribometer that recorded the normal force on the rubber sheet section and the lateral sliding friction force on the rubber sheet section during a fixed time interval. From these measurements, the average kinetic coefficient of friction was determined. The results for the different pattern designs were then compared to see which design maximizes the coefficient of friction.

BIOLOGICAL AND MEDICAL SCIENCES

EFFECTIVENESS AND TOXICITY OF EXPERIMENTAL COMPOUNDS AGAINST *TOXOPLASMA GONDII*

Austin Sanford, Ryan Hemsley, Sydney Zach, and Paul Davis, Department of Biology, University of Nebraska at Omaha

Toxoplasma gondii is an intracellular parasite that during acute infection causes ill effects in developing fetuses of first time infected pregnant mothers. Latent infection can also cause serious complications in immunocompromised individuals. Nearly 60 million individuals in the United States are infected. The aim of this research was to test the effectiveness of experimental compounds, and their derivatives, against the acute infection of *T. gondii* as well testing the toxicity of the compounds on a variety of human host cell lines including: hepatocellular carcinoma, kidney, osteosarcoma, and HFF. The most promising derivatives will be selected for use in future in-vivo experiments to test the efficacy of these experimental compounds in a living system.

NOTES

NOTES

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

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

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FRIEND OF SCIENCE AWARD TO RANDALL LIENEMANN



Randall Lienemann graduated from Hildreth High School and received his Bachelor of Science degree from Kearney State College with endorsements in Biology, Chemistry and Physical Science. He began his thirty-four years of teaching science at St. Paul Public School, Hildreth, Wilcox/Hildreth and Franklin before retiring in 2012.

He has been involved in science education activities for over forty years. Mr. Lienemann actively promotes quality science programs that involved students in doing in-depth science research projects. His students were always selected for Regional, State, National and International competitions. He had many students that received first place in their category at the International Science Fairs.

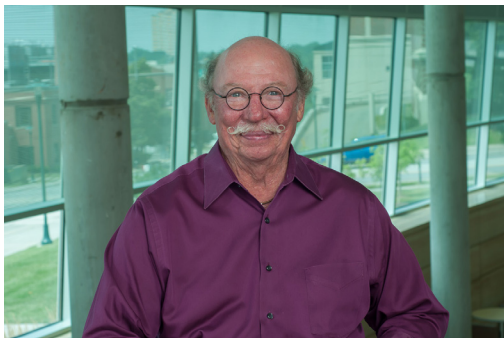
In 2001, he was selected as the International Outstanding Science Educator. He has received the Distinguished Alumni Award from the University of Nebraska-Kearney and the NTV Honorable Mention award.

Mr. Lienemann is currently the Science Fair Director of the Central Nebraska Science and Engineering Fair at the University of Nebraska School of Technical Agriculture in Curtis, NE. This is one of the two affiliated fairs with ISEF in Nebraska.

He is the Acting President of the Nebraska Junior Academy of Sciences and President-Elect of the Nebraska Academy of Sciences.

He holds membership in many professional organizations, including the Nebraska Association of Teachers of Science. He has facilitated professional development science research sessions at NATS and across the state for science teachers. He currently farms with his son south of Hildreth. He is married and has three grown children and six grandchildren.

FRIEND OF SCIENCE AWARD TO JAMES TURPEN



Jim Turpen was born in Wyoming and grew up in the suburbs of Denver Colorado. Jim was fascinated by biology, especially tadpoles and frogs, from an early age and was drawn to advanced biology classes starting in junior high school. Jim's first teaching experience was as a laboratory assistant in both biology and advanced zoology classes at Littleton Senior High School. He received his B.S. and M.S. degrees in zoology from the University of Denver and his PhD in biology from Tulane University in New Orleans, Louisiana. Jim held teaching assistant positions at both Denver University and Tulane University. Following a year as an instructor of biology at Tulane, Jim pursued postdoctoral studies in immunology at the University Rochester School of Medicine. Jim's first position as an assistant professor was at Pennsylvania State University where he taught general biology and developmental biology. Jim was recruited to the University of Nebraska Medical Center in 1983 and continued his research on the development of hematopoietic stem cells. Jim taught embryology and basic cell biology to first year medical students from 1983-2013 when his administrative responsibilities took him out of the classroom.

During his early days in graduate school, Jim worked in a laboratory that was among the first to use somatic cell nuclear transfer as an experimental tool. Jim's subsequent 30 year research career focused on stem cell biology, the development of hematopoietic stem cells in the frog embryo and stem cell-thymus interactions. Currently, Jim is Associate Vice Chancellor for Academic Affairs, Executive Associate Dean for Graduate Studies and Professor in the Department of Genetics, Cell Biology and Anatomy. Jim is also the Principal Investigator on the NIH supported Nebraska INBRE Project. This project, which is in its 15th year of NIH support, focuses on developing the research infrastructure and capacity at the primarily undergraduate institutions (PUIs) in Nebraska. INBRE funds are used to support faculty research in biomedical areas at eight PUIs. Support for faculty and their research laboratories is essential for providing opportunities for undergraduate students to have meaningful scientific research experiences during their academic years. A cornerstone of the NE-INBRE is the INBRE Scholars Program. Students on the participating campuses are selected during their sophomore year and INBRE support enables them to do full time research during their two summers in the program as well as part time research during the academic year. Over 300 Scholars have completed the program and over 75% of the Scholars have pursued careers in biomedical research, the health professions or the scientific workforce in Nebraska.

Author

Index

Symbols

A

Agrawal 12, 69
Ahlman 20, 95
Ahrens 7, 48
Alaoui, El 4, 37
Alkheraif 10, 58
Al-Mugotir 1, 25
Alwatban 12, 70
Amoussou 15, 78
Anandhan 16, 83
Anderson 12, 67
Ashton 14, 76
Askew 21, 101
Atwater 13, 16, 70, 82
Augustyn 16, 81
Azadmanesh 1, 26
Azaria 15, 77

B

Babchuk 6
Baca 3, 35
Balmat 3, 5, 18, 33, 39
Barkmeier 9, 54
Bartlett 9, 53
Bartschat 9, 53
Bartz 11, 64
Baruth 2, 9, 17, 31, 54, 86
Bashford 12, 70
Beeram 15, 77
Behn 2, 30
Behrendt 7, 47, 48
Benker 2, 32
Benz 13, 71
Bernal 3, 33
Bhalkikar 15, 78
Bi 17, 85
Bichlmeier 8, 51
Bickford 10, 60
Blair 23, 107
Blankenship 12, 68
Bohlken 24, 108
Bolten 10, 60
Boosani 12, 69
Borgstahl 1, 25, 26

Bourret 9, 55
Bowens 2, 30
Bower 3, 33
Bramman 23, 106
Bricker 22, 23, 105, 106
Broderick 15, 78
Brooks 8, 51
Brookshire 8, 51
Brown 13, 70
Bruck 14, 75, 76
Buchmann 3, 8, 10, 33, 53, 59
Burbach 18, 90, 91
Burk 10, 61
Burklund 13, 71
Burks 16, 82
Burma 13, 72
Butler 8, 53

C

Carlson 10, 13, 14, 71, 73, 74, 76
Casey 22, 102
Cernyl 16, 83
Chandra 13, 72
Chang 15, 78
Chasek 5, 39
Chaudhari 9, 55
Chavez 14, 76
Cheung 15, 78, 80
Chien 16, 81
Christensen 21, 100
Clarke 17, 85
Clausen 2, 31
Clay 4, 39
Clayton 10, 60
Coffman 5, 42
Colas 16, 81
Conceicao 15, 78
Corbett 15, 78
Corder 19, 94
Cortinas 22, 105
Creglow 8, 51
Cullen 1, 27
Cushman 3, 34

D

Dang 11, 61, 62
Daniels 3, 33
Dappen 21, 99
Darr 15, 80
Dasgupta 3, 4, 35, 36
Davis 9, 10, 14, 17, 53, 60, 88, 110
Davison 8, 52
Dennhardt 18, 88
Denton 1, 27
Dere 3, 34
Destache 11, 14, 63, 75, 76
Dobesh 23, 106

Dong 8, 50
Donovan 24, 109
Dowben 3, 8, 23, 32, 50, 108
Doyle 8, 51
Drapes 2, 17, 31, 86
Drew 9, 56
Drozda 4, 37, 38
Dussault 15, 79
Dutta 4, 36
Dziatkowski 12, 68

E

Eble 5, 42
Ekpenyong 17, 86
Enders 3, 8, 23, 32, 50, 108
Engelmann 3, 34
Epp 20, 97
Ericson 13, 14, 73, 74
Escheverria 8, 50
Ettel 8
Evans 15, 79

F

Fackler 23, 24
Faimon 19, 93
Fassbinder-Orth 9, 56
Ferguson 7, 46
Field 6, 8, 43, 51
Fielder 24, 110
Finke 16, 81
Fischer 9, 54
Fisher 15, 80
Fleegel 12, 69
Fleita 2, 30
Fountain 20, 98
Fox 21, 99
Franco 16, 83
Fujan-Hansen 1, 27

G

Gabel 5, 6, 40, 42
Garcia 9, 57
Garlapati 4, 35
Gasper 9, 57
Gerald 20, 21, 22, 96, 99, 104, 105
Giacomini 16, 81
Giffei 11, 61, 62
Glass 9, 10, 12, 52, 54, 58, 67
Gottuso 15, 80
Gould 22, 102
Gradnigo 20, 97
Grady 6, 45
Graff 11
Graft 11, 64
Grant 2, 16, 17, 31, 80, 86
Griffin 2, 30

H

Hage 12, 15, 16, 70, 77, 82, 84, 85
Hagen 9, 57
Hamblin 3, 32
Hammer 18, 92
Hammerl 6, 44
Hannon 21, 100, 101
Hansen 16, 81
Hanser 9, 57
Hargarten 13, 70
Harms 9, 55
Harrison 21, 99
Hatch 21, 100
Hayford 18, 89, 92
Heck 12, 65
Heckman 19, 93
Heeren 16, 81
Hellman 20, 97
Hemsley 14, 110
Hervert 20, 98
Higa 10, 60
Higley 5, 19, 21, 40, 42, 93, 98
Hinz 10, 58
Hittner 7, 49
Hoffman 6, 44
Hofmann 8, 15, 50, 77
Holmes 11, 13, 16, 63, 70, 82
Honaker 12, 70
Hoover 1, 28
Hormandl 2, 31
Houser 18, 89
Hove 22, 102
Huang 2, 29
Hulce 19, 92
Hull 19, 92

I

Ianno 3, 32
Ibrahim 15, 80
Ingersoll 11, 62

J

Jackson 10, 60
Johnson 12, 15, 20, 66, 80, 97
Jones 13, 70
Joshi 12, 65
Jurado 21, 99

K

Kananizadeh 15, 77
Kangas 13, 16, 70, 82
Karr 8, 51
Katsavelis 2, 29
Kaup 19, 94
Keating 21, 99

Keill 2, 28
Keit 12, 68
Kelber 8, 50
Kelling 10, 58
Kennedy 18, 90
Kerl 4, 38
King 8, 50
Kiusals 6, 43
Kleier 12, 66
Knowles 14, 74
Kodin 12, 67
Kolar 1, 25, 26
Kostal 8, 51
Kovacs 11, 62
Krajicek 3, 18, 33, 89
Kren 19, 20, 94, 95
Kube 22, 102
Kubik 22, 102
Kunert 18, 91
Kyle 5, 42

L

Labedz 2, 31
LaGarry 5, 39
Lambert 15, 79
Leddy 14, 76
Lee 2, 28
Lei 16
Leil 83
Leite 3, 5, 33, 39
Leong 13, 74
Lesiak 9, 54
Levine 22, 105
Lewis 18, 89
Li 8, 15, 51
Lin 16, 81
Lindgren 5, 40
Liu 23, 108
Lopez 13, 73
Love 19, 93
Lucas 3
Luedtke 8, 9, 55
Lukowicz 13, 16, 70, 82

M

Mandal 11, 14, 63, 75, 76
Marian 21, 99
Marin 15, 78
Marolf 22, 103
Martin 6, 45
Matsuda 16, 84
McAfoos 23, 107
McCartney 10, 60
McCown 13, 71

McCumber 1, 27
McDermott 23, 107
McDonald 3, 32
McFarland 10, 60
McGill 10, 58
McLean 8, 53
McVicker 22, 102
Menke 24, 108
Meyer 11, 63
Miller 20, 95
Moncure 18, 90
Monhollon 4, 39
Morales 15, 80
Morin 16, 84
Moriyama 12, 20, 65, 97
Morrow 6, 45
Morwitzer 13, 72
Moser 23, 24, 107, 109
Muhs 24, 109
Mukherjee 1, 28
Mullally 10, 61
Murphy 10, 60
Myer 13, 73, 74

N

Naik 5, 9, 42, 57
Nastasi 8, 50
Nelson 2, 4, 10, 17, 29, 31, 37, 39
, 60, 86
Neville 10, 60
Nguyen 16, 21, 82, 83, 98
Nichols 17, 86
Nimmagadda 21, 101
Ning 17, 86
Nyffeler 20, 95

O

Oates 22, 103
Okuom 11, 63
Oleynikov 2, 29
Olmedo 14, 76

P

Page 14, 74
Pattabiraman 16, 82, 83
Pattee 6, 43
Pauley 3, 33
Peev 15, 77
Peitz 23, 24, 107, 109
Peregrine 20, 95
Petersen 8, 50
Peterson 7, 47
Petrykowski 3, 34
Pfaunmiller 15, 77
Pflug 24, 108

Pham 14, 75, 76
 Pickrel 21, 101
 Piper 20, 95
 Poole 3, 33
 Post 16, 82
 Potluri 9, 53
 Pounds 7, 49
 Powell 18, 91
 Powers 16, 83
 Prathivadhi 17, 86
 Prokupek-Pickett 20

Q

Quint 4, 39

R

Ragatz 10, 59
 Ramamurthy 4, 37
 Reddy 10, 58
 Rehbein 17, 86
 Reinhard 6, 45
 Reisen 24, 109
 Remsza 1, 25
 Renken 3, 33
 Rezych 14, 75, 76
 Riekhof 9, 57
 Rodriguez 15, 16, 77, 84
 Ronspies 4, 39
 Rose 14, 76
 Roth 4, 17, 37, 87
 Roundtree 14, 74
 Rowan 9, 56
 Ruiz 17, 87

S

Saavedra 5, 40
 Sabatka 11, 63
 Saha 4, 36
 Salem 7, 46
 Sandoval 11, 63
 Sanford 14, 110
 Sarmiento 21, 100
 Schacht 18, 91
 Schlessinger 16, 81
 Schneider 2, 31
 Schubert 15, 77
 Schulz 7, 47
 Schumacher 22, 104
 Schwabe 9, 57
 Segal 5, 41
 Sekora 15, 77
 Shadoin 12, 65
 Shaffer 9, 13, 55
 Shavlik 8, 51
 Shea 9, 57
 Shearer 17, 87
 Sheridan 15, 78

Shibata 8, 11, 13, 14, 63, 73, 74,
 75, 76
 Shook 19, 94
 Shukla 12, 65
 Shute 5, 41
 Simeone 14, 74
 Simon 12, 13, 66, 71
 Siu 2, 29
 Slivka 5, 41
 Sliwinski 18, 91
 Smith 2, 5, 18, 21, 29, 42, 90, 101
 Sobotka 7, 48
 Soto 11, 64
 Soukup 9, 53
 Springer 12, 67
 Spurgeon 3, 4, 34, 37
 Stains 17, 85
 Stark 19, 94
 Stauch 21, 99
 Steffensmeier 15, 80
 Stewart 4, 39
 Stoller 16, 84
 Struble 1, 25, 26
 Sutton 10, 59
 Swanger 8, 51
 Swanson 8, 50
 Swedberg 3, 33

T

Takahashi 1, 28
 Takamizawa 9, 54
 Tappata 11, 63
 Tapprich 12, 68
 Tarry 1, 5
 Taylor 10, 11, 61, 62
 Ternent 22, 104
 Thomas 16, 81
 Thompson 22, 105
 Thrailkill 12, 70
 Tidwell 19, 93
 Topliff 10, 58
 Torez 5, 42
 Treichel 23, 24
 Trickel 1, 26
 Truong 17, 85
 Turner 20, 96
 Tuttle 24, 110
 Twigg 10, 12, 59, 67

U

Uhlir 3, 33

V

Vance 1, 25
 Vanderheyden 1, 28
 VanDerslice 18, 89

Vargas 15, 16, 77, 84
 Varghese 11, 63
 Vennerstrom 10, 60
 Vietz 14, 76
 Villeneuve 21, 99
 Volle 4, 38
 Vu 17, 85
 Vuppuluri 3, 35

W

Wagoner 6, 44
 Wang 10, 60
 Wankmuller 10, 61
 Wass 20, 96
 Webb 19
 Wellman 7, 49
 Wentworth 3, 33
 West 9, 57
 Whipple 5, 42
 White 2, 29
 Whiteford 13, 73, 74
 Widmer 6, 42
 Wiens 5, 41
 Wiese 9, 56
 Wild 6, 46
 Wilson 5, 8, 41, 50
 Winter 19, 93
 Wong 2, 17, 31, 86
 Woo 11, 64
 Woosley 4, 36
 Wright 10, 60
 Wrinn 22, 105

X

Y

Yackley 13, 73, 74
 Yentes 1, 27
 Yosten 19, 94

Z

Zach 10, 14, 60, 110
 Zahirri 2, 29
 Zak 5, 41
 Zardeneta 18, 21, 89, 100
 Zeng 18, 88
 Zhang 17, 21, 23, 85, 101, 108
 Zhao 17, 85
 Zheng 16, 82
 Zieba 14, 74
 Ziegenbein 22, 105
 Zuniga 2, 3, 29, 34
 Zur 16, 81

