2018

PROGRAM and PROCEEDINGS THE NEBRASKA ACADEMY OF SCIENCES 1880-2018 Including the Nebraska Association of Teachers of Science (NATS) Division Nebraska Junior Academy of Sciences (NJAS) Affiliate and Affiliated Societies

Nebraska Academy of Sciences

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PROGRAM
and
PROCEEDINGS
THE NEBRASKA ACADEMY
OF
SCIENCES
1880-2018
Including the
Nebraska Association of Teachers of Science
(NATS) Division
Nebraska Junior Academy of Sciences
(NJAS) Affiliate
and
Affiliated Societies

138th Anniversary Year

One Hundred-Twenty-Eighth Annual Meeting

April 20, 2018
OLIN HALL OF SCIENCE - NEBRASKA WESLEYAN UNIVERSITY
LINCOLN, NEBRASKA
THE NEBRASKA ACADEMY OF SCIENCES, INC.
302 Morrill Hall, 14th & U Streets
Lincoln, Nebraska 68588-0339
neacadsci.org

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

GENERAL INFORMATION

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 46 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.
PROGRAM AT-A-GLANCE

FRIDAY, APRIL 20, 2018

7:30 a.m.  REGISTRATION OPENS - Lobby of Lecture Wing, Olin Hall

8:00  Aeronautics and Space Science, Session A - Olin 249
      Aeronautics and Space Science, Session B - Olin 224
      Collegiate Academy; Biology, Session A - Olin 111
      Collegiate Academy; Biology, Session B - Olin B

8:30  Biological and Medical Sciences, Session A - Olin 112
      Biological and Medical Sciences, Session B - Smith Callen Conference Center

8:35  Chemistry and Physics; Chemistry - Olin A

8:45  Collegiate Academy; Chemistry and Physics, Session A - Olin 324

8:50  Chemistry and Physics; Physics – Planetarium

9:00  “Learn to Print 3-D Models for Your Classroom” Workshop – 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: THOMAS CLEMENTE - OLIN B
      Scholarship and Friend of Science Award announcements

12:00 p.m. LUNCH – WESLEYAN CAFETERIA
      “Round-Table Discussion: How can NAS Best Support Science Teaching and Research in Nebraska” led by Brian Couch

12:00  Aeronautics and Space Science Lunch - Prairie Wolf A/B

12:45  Anthropology - Olin 111

1:00  Applied Science and Technology - Olin 325
      Biological and Medical Sciences, Session C - Olin 112
      Biological and Medical Sciences, Session D - Smith Callen Conference Center
      Chemistry and Physics; Chemistry - Olin A
      Chemistry and Physics; Physics - Planetarium
      Collegiate Academy; Biology, Session B - Olin B
      Collegiate Academy; Chemistry and Physics, Session B - Olin 324
      Earth Science - Olin 249
      Environmental Sciences - Olin 110
      Teaching of Science and Math - Olin 224

4:30  BUSINESS MEETING - OLIN B
NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)

The 2018 Fall Conference of the Nebraska Association of Teachers of Science (NATS) will be held at the Younes Conference Center, Kearney, NE, September 20 – 22, 2018.
President: Jodi Bahr, Harvard Public School, Harvard, NE
President-Elect: Betsy Barent, Norris Public Schools, Firth, 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://www.nebraskageologicaPsociety.org
   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 Junior Academy of Sciences
   Web site: http://www.nebraskajunioracademyofsciences.org/

8. Nebraska Ornithologists’ Union
   Web site: http://www.noubirds.org/

9. Nebraska Psychological Association
   http://www.nebpsych.org/

10. Nebraska-Southeast South Dakota Section Mathematical Association of America
    Web site: http://sections.maa.org/nesesd/

11. 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
*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

<table>
<thead>
<tr>
<th>Time</th>
<th>Paper Title</th>
<th>Authors</th>
<th>Affiliations</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>MODULATION OF THE NEURAL BASES OF ATTENTION BY RHYTHMIC VISUAL ENTRAINMENT.</td>
<td>Alex Wiesman and Tony Wilson, Department of Neurological Sciences</td>
<td>University of Nebraska Medical Center, Omaha, NE 68198</td>
</tr>
<tr>
<td>8:10</td>
<td>IN VITRO QUANTIFICATION AND VALIDATION OF MECHANICALLY-INDUCED OSTEOCYTE STRAIN.</td>
<td>Travis McCumber and Satera Nelson, Department of Genetics, Cell Biology, and Anatomy</td>
<td>University of Nebraska Medical Center, Omaha, NE 68198</td>
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<tr>
<td>8:20</td>
<td>CAN PLANTAR VIBRATION HELP ASTRONAUTS ADAPT NEW ENVIRONMENT.</td>
<td>Jung Hung Chien, Zhuo Wang, and Ka-Chun Siu, Department of Physical Therapy Education</td>
<td>University of Nebraska Medical Center, Omaha, NE 68198</td>
</tr>
<tr>
<td>8:30</td>
<td>INFLUENCE OF FOOT-GROUNDED TRACTION ON GAITS USED IN REDUCED GRAVITY.</td>
<td>John Kotsalis, Cory Frederick, Mukul Mukherjee, and Kota Takahashi,</td>
<td>Department of Biomechanics, University of Nebraska at Omaha, NE 68182</td>
</tr>
<tr>
<td>8:40</td>
<td>RELATIONSHIP BETWEEN GAIT VARIABILITY AND OBSTACLE AVOIDANCE.</td>
<td>Vivien Marmelat, Austin Duncan, and Danial Jaravata, Department of Biomechanics</td>
<td>University of Nebraska at Omaha, Danish Bhatti, Department of Neurological Sciences, University of Nebraska Medical Center, Omaha, NE 68198</td>
</tr>
<tr>
<td>8:50</td>
<td>EFFECT OF THE USAGE OF HANDRAILS ON GAIT DYNAMICS IN PEOPLE WITH PARKINSON’S DISEASE.</td>
<td>Daniel Jaravata and Vivien Marmelat, Department of Biomechanics</td>
<td>University of Nebraska at Omaha, Danish Bhatti, Department of Neurological Sciences, University of Nebraska Medical Center, Omaha, NE 68182</td>
</tr>
<tr>
<td>9:00</td>
<td>PROTOTYPING AND FABRICATION OF A VARIABLE SURFACE TREADMILL.</td>
<td>Nick Jaton, Travis Vanderheyden, and Kota Takahashi, Department of Biomechanics</td>
<td>University of Nebraska at Omaha, NE 68182, Jacob Bloomberg, Neuroscience Laboratories, NASA- Johnson Space Center, Houston, TX 77058</td>
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<tr>
<td>9:10</td>
<td>BREAK/POSTER PRESENTATIONS</td>
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<td>9:30</td>
<td>CRITERION VALIDATION OF A MOBILE MOTION CAPTURE SYSTEM IN SPACE FOR ANALYSIS OF JOINT ANGLES.</td>
<td>Zhuo Wang*, Jung Hung Chien, and Ka-Chun Siu, Department of Physical Therapy Education</td>
<td>University of Nebraska Medical Center, Omaha.</td>
</tr>
</tbody>
</table>
9:40  9. THE EFFECT OF MODERATE-TO-HIGH INTENSITY EXERCISE ON COGNITIVE FUNCTION. Mary Elizabeth Yeh, Department of Neuroscience, Creighton University, Omaha.

9:50  10. NEUROMUSCULAR AND HYPERTROPHIC ADAPTATIONS AS A RESULT OF BLOOD FLOW RESTRICTION RESISTANCE TRAINING. Ethan Hill*, Terry Housh, Cory Smith, Joshua Keller, Richard Schmidt, and Glen Johnson, Department of Nutrition and Health Sciences, University of Nebraska, Lincoln.

10:00 11. STRUCTURAL INVESTIGATIONS INTO THE RADIO-PROTECTIVE SUPEROXIDE DISMUTASE ENZYMES. Jahaun Azadmanesh*, William Lutz, Scott Trickel, Carol Kolar, and Gloria Borgstahl, Eppley Institute for Research in Cancer and Allied Diseases, University of Nebraska Medical Center, Omaha.

10:10 12. INHIBITION OF RAD52-BASED DNA REPAIR FOR CANCER THERAPY. Mona Al-Mugotir, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha.

10:20 13. SOFTWARE-BASED TEACHING OF BIOMECHANICS TO ENGAGE UNDERGRADUATE STUDENTS. TeSean Wooden* and Angel Gonzalez, Department of Health, Physical Education, and Recreation, Amelia Lanier and Kota Takahashi, Department of Biomechanics, Michelle Friend, Anne Karabon, and Nealy Grandgenett, Department of Teacher Education, University of Nebraska at Omaha, Sidney Baudendistel, Department of Applied Physiology and Kinesiology, University of Florida, Gainesville.

10:30 BREAK/POSTER PRESENTATIONS

10:50 14. SENSORIMOTOR CORTICAL OSCILLATIONS ASSOCIATED WITH THE PRODUCTION OF A HAND MOTOR ACTION. Rashelle Hoffman* and Max Kurz, Department of Physical Therapy, Munroe-Meyer Institutes, Tony Wilson, Department of Neurological Sciences and College of Medicine, University of Nebraska Medical Center, Omaha.

11:00 15. VISUAL MT/V5 CORTICAL OSCILLATIONS ARE ASSOCIATED WITH VISUOMOTOR TASK PERFORMANCE. Jacy VerMaas-Hannan* and Max Kurz, Munroe-Meyer Institute, Tony Wilson, Center for Magnetoencephalography, University of Nebraska Medical Center, Omaha.

11:10 16. TESTING QUASAR OUTFLOW MECHANISMS WITH ACCRETION DISK SIMULATIONS AND SDSS SPECTRA. Mason Rhodes* and Jack Gabel, Department of Physics, Creighton University, Omaha.

11:20 17. A STUDY OF VARIABILITY OF AGNs THROUGH DATA ANALYSIS FROM CRTS AND SDSS. Shrey Ansh* and Jack Gabel, Department of Physics, Creighton University, Omaha.
11:30 18. OTOLIN-1a AS A BIOMARKER FOR VESTIBULAR DYSFUNCTION FOLLOWING MICROGRAVITY EXPOSURE IN ZEBRAFISH. Kevin Thiessen*, Emily Supe’, and Kenneth Kramer, Department of Biomedical Sciences, Creighton University, Omaha.

11:40 19. DEVELOPMENT AND TESTING OF 3D PRINTED PROSTHESES, ORTHOSES, AND ASSISTIVE DEVICES FOR CHILDREN AND ADULTS. Walker Arce* and Andrew Butler, Department of Electrical Engineering, University of Nebraska at Omaha.

11:50 20. TOWARDS NEW SOL-GEL FEEDSTOCKS FOR 3D PRINTABLE GLASS INK FORMULATIONS. Joel Destino, Department of Chemistry, Creighton University, Omaha.

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. UNL ROBOTICS MINING COMPETITION TEAM 2017/2018. Ethan Brush, Department of Mechanical and Materials Engineering, University of Nebraska, Lincoln.

8:10 2. AUTONOMOUS FLIGHT AND OBJECT TRACKING FOR UNMANNED AERIAL VEHICLES. Daric Teske* and Elliot Sandfort, Department of Computer Science and Engineering, University of Nebraska, Lincoln.

8:20 3. DEVELOPMENT OF A DEPLOYABLE AND RETRACTABLE BOOM AND SOLAR PANEL ARRAY FOR SPACE PLATFORMS. Amy Price*, Elizabeth Balerud, Michael Cox, Zach Bonick, Kyle Fitch, Ryan Green, Nate Jensen, Ethan Krings, Augie McClanahan, Brandon Warren, and Renick Wilson, Department of Materials and Mechanical Engineering, Andrew Reicks, Michael Fay, and Daniel Van Kirk, Department of Electrical and Computer Engineering, Alexa Aikens, Department of Information Science and Technology, Torri Osantowski, Department of Economics, Megan Pamperin, Department of Biological Systems Engineering, University of Nebraska, Lincoln.

8:30 4. DEVELOPMENT OF A 3-LEG 6-DOF ROBOT IN RRRS CONFIGURATION. Nathan Jensen* and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska, Lincoln.

8:40 5. RASPBERRY PI ROVER. Christopher Armstrong, Department of Information Technologies, Western Nebraska Community College, Scottsbluff.

8:50 6. INFLUENCING ROBOT SWARMS VIA EXTERNALLY INJECTED ROBOTIC AGENTS. Ryan Lankin, Department of Computer Science, University of Nebraska at Omaha.

9:00 7. INFORMED PATH PLANNING FOR MULTIPLE ROBOTS UNDER COMMUNICATION CONSTRAINTS. Brad Woosley* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
9:10  BREAK/POSTER PRESENTATIONS

9:30  8. IMPROVED REWARD ESTIMATION FOR EFFICIENT ROBOT NAVIGATION USING INVERSE REINFORCEMENT LEARNING. Olimpiya Saha* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.

9:40  9. TOWARDS ROBUST CLASSIFICATION IN ADVERSARIAL LEARNING USING BAYESIAN GAMES. Anna Buhman* and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.

9:50  10. SUPERPOSITIONING WITH HIGH POWER LASERS FOR MID-AIR IMAGE FORMATIONS. Auston Viotto, College of Engineering, University of Nebraska at Omaha.

10:00  11. INTERFACIAL ION TRANSPORT UNDER NANOCONFINEMENT IN ENERGY CONVERSION DEVICES USED FOR SPACE SHUTTLE APPLICATIONS. Shudipto Konika Dishari, Department of Chemical and Biomolecular Engineering, University of Nebraska, Lincoln.

10:10  12. CONDUCTIVE CONCRETE ELECTRICAL FILTER FOR ANECHOIC CHAMBER APPLICATIONS. Mikayla Schlegel*, Emiliano Montemayor, and Lim Nguyen, Department of Electrical and Computer Engineering, University of Nebraska, Lincoln.

10:20  13. GEOLOGICAL PROPERTIES OF ROCK ANALOGS FOR THE MARS 2020 ROVER MISSION. Miles Chasek* and Michael Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.

10:30  BREAK/POSTER PRESENTATIONS

10:50  14. SAND TABLE HURRICANE EXPERIMENT. Rebecca Kraxberger* and Jolee Smith*, Department of Education, Jeremy Weremeichik and Ann Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron.

11:00  15. SPACE MATERIALS SCIENCE MENTOR-INTERN PAIR EXPERIENCE. Madison Royse*, Department of Chemical Engineering, Jowe Tombi, Department of Electrical Engineering, Audrey Vega and Julianna Rodriguez, Department of Bio Systems Engineering, University of Nebraska, Lincoln.

11:10  16. USING NASA-BASED TOOLS TO STUDY ADAPTATION, RESILIENCE AND SUSTAINABILITY IN NATURAL AND SOCIAL SYSTEMS IN THE NEBRASKA SANDHILLS. Mary Ann Vinton*, Department of Biology and Environmental Science, James Leighter, Department of Communication Studies and Sustainability Studies, Creighton University, Omaha.

11:20  17. USING SATELLITE IMAGERY TO CHARACTERIZE LAND COVER CHANGE IN THE DISMAL RIVER HEADWATERS REGION OF THE NEBRASKA SANDHILLS. Chris Meehan* and Mary Ann Vinton, Department of Environmental Science, Creighton University, Omaha.
11:30  18.  DOES WILDLIFE BEHAVIOR CHANGE IN RESPONSE TO A SOLAR ECLIPSE? 
Robert Ritson*, Nate Bickford, and Dustin Ranglack, Department of Biology, University 
of Nebraska at Kearney.

11:40  19.  REGOLITH SIZE SORTING IMPROVES PLANT GROWTH IN MARTIAN 
SIMULANT SOIL. Marc Albrecht, Department of Biology, University of Nebraska at 
Kearney.

11:50  20.  CURRICULAR AND CO-CURRICULAR ACTIVITIES TO INCREASE STUDENTS’ 
ENTHUSIASM IN NEW ENVIRONMENTAL SUSTAINABILITY MINOR. Ganesh 
Naik, Department of Chemistry, 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

COMPUTATIONAL FLUID DYNAMICS ON FLOW SEPARATION IN BOUNDARY LAYER. 
Elizabeth Spaulding*, Department of Mathematics, Jae Sung Park, Department of Mechanical and 
Materials Engineering, University of Nebraska, Lincoln.

THE EFFECT OF FATIGUE ON JUMPING PERFORMANCE AND BIOMECHANICS. Chelsea 
Klemetson, Department of Physical Therapy, Creighton University, Omaha.

A COMPARISON OF BALANCE IN SMOKERS AND NEVER-SMOKERS. Robert Barber*, Jennifer 
Yentes, and Danae Dinkel, Department of Biomechanics, Adam Rosen, School of Health, Physical 
Education, and Recreation, University of Nebraska at Omaha, Terry Grindstaff, Department of Physical 
Therapy, Creighton University, Omaha.

COMPUTATIONAL FLUID DYNAMICS ON DRAG REDUCTION IN TURBULENT FLOWS 
VIA BODY FORCES. Thomas Hafner* and Jae Sung Park, Department of Mechanical and Materials 
Engineering, University of Nebraska, Lincoln.

A MULTIDECADAL ANALYSIS OF ABOVEGROUND BIOMASS DECLINES AND 
CONTROLLING VARIABLES FOR THE KEYSTONE SALT MARSH SPECIES, SPARTINA 
ALTERNIFLORA, IN COASTAL GEORGIA. John P. O’Donnell* and Nicholas Nealy, John F. 
Schalles, Department of Environmental Science, Trek Mizoguchi, Department of Biology, Creighton 
University, Christine M. Hladik, Department of Geology and Geography, Georgia Southern University, 
Statesboro.

USING LANDSAT IMAGERY TO ESTABLISH BASELINE DATA FOR THE HEALTH OF AN NSF 
LTER FRESHWATER TIDAL FOREST SENTINEL SITE IN COASTAL GEORGIA. Jennifer Mucci* 
and John Schalles, Department of Environmental Science, Creighton University, Omaha.
COMBINED COHERENT ANTI-STOKES RAMAN SCATTERING AND TWO-PHOTON EXCITATION MICROSCOPY: LABE-FREE VISUALIZATION OF MICROBE-MINERAL MIXTURES. Anthony Kohtz* and Karrie A. Weber, School of Biological Sciences, Xi Huang, Yongfeng Lu, Department of Electrical Engineering, University of Nebraska, Lincoln.

INCOMPARISON SOIL WATER CONTENT MEASUREMENTS USING SMAP REMOTE SENSING AND PROBE-BASED DATA. Erika Bowman, Department of Biological Systems Engineering, University of Nebraska, Lincoln.

OPTIMIZATION OF EX SITU SULFIDIATION OF Cu2ZnSnS4 (CZTS) THIN FILMS FOR USE AS COUNTER ELECTRODES IN DYE-SENSITIZED SOLAR CELLS. John Sunderland, Department of Physics, Creighton University, Omaha.

ENVIRONMENTAL MONITORING THROUGH NATIVE PRAIRIE RESTORATION. Aleisa LaBelle*, Cornelia Farley Widow, Lorraine Smith, Shelley Kosola, and Marcus Redwing, Department of Math & Science, Nebraska Indian Community College, Santee.

“A COMPARISON OF TWO SENSORS FOR ATMOSPHERIC DATA COLLECTION ON DRONES” – UNO GRADUATE STUDENT RESEARCH THROUGH THE “EDUCATING STUDENTS TO LINK GROUND-BASED MEASUREMENTS TO DTA REMOTELY SENSED BY DRONES AND NASA SATELLITES” PROJECT. Christopher Glueck* and Carol Engelmann, Department of Biology, University of Nebraska at Omaha.

ROLE OF EMPATHY ON A SOCIAL DECISION-MAKING TASK RELEVANT TO NASA SPACE MISSIONS. Janelle N. Beadle* and Abi Heller, Department of Gerontology, University of Nebraska at Omaha.

HEALTHY YOUNG CAN FLEXIBLY SWITCH POSTURAL SWAY WITH DIFFERENT STIMULI. Zachary Motz, Takashi Sado*, and Mukul Mukherjee, Department of Biomechanics, University of Nebraska at Omaha.

SKELETAL MUSCLE mRNA RESPONSE TO HYPOBARIC AND NORMOBARIC HYPOXIA AFTER EXERCISE. Robert Shute*, Caleb Ross, Brent Ruby, and Dustin Slivka, Department of Health and Kinesiology, University of Nebraska at Omaha.

INTELLIGENT AND HUMAN-AWARE DECISION MAKING FOR SEMI-AUTONOMOUS HUMAN REHABILITATION ASSISTANCE USING MODULAR ROBOTS. Anoop Mishra* and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.

MULTI UAV’S BASED STRUCTURAL INSPECTION PATH PLANNING USING VIEWPOINT SELECTION. Sai Tarun Battula* and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.

DEVELOPMENT OF A PLANAR MICROGRAVITY SIMULATOR. Benjamin Bradley*, Nathan Jensen, Katherine Johnson, and Nathan Borcyk, Department of Mechanical and Materials Engineering, University of Nebraska, Lincoln.
ANTHROPOLOGY
Co-chairs: Wayne Babchuk and Erik Schulz
Department of Anthropology, University of Nebraska–Lincoln
Olin Hall 111

12:45 WELCOME AND INTRODUCTION. Erik Schulz and Wayne Babchuk, Co-Chairs, Anthropology Section, Nebraska Academy of Sciences.

1:00 1. BONE FLESHERS AS SYMBOLS OF PRESTIGE: EXAMINING A FEMALE GENDERED ACTIVITY IN CHACO CANYON. Sara Anderson and Carrie Heitman, Department of Anthropology, University of Nebraska-Lincoln

1:15 2. INCREASING RATES OF CHILDHOOD OBESITY: A CONCEPTUAL MODEL OF ARCTIC INDIGENOUS YOUTH HEALTH OUTCOMES. Maia Behrendt, Department of Sociology, University of Nebraska

1:30 3. DIGITIZING PLANT DATA TO EXPLORE ANCIENT COPAN’S CHANGING LANDSCAPE. Megan Campbell and Heather Richards-Rissetto, Department of Anthropology, University of Nebraska-Lincoln

1:45 4. MAPPING THE HISTORICAL CEMETERIES AND BURIAL GROUNDS OF DOVER, NH, USA. Ellis Codd* and Matthew Palczynski, Department of Anthropology, University of Nebraska-Lincoln

2:00 5. MORAL DOMAINS OF NEBRASKA FISHING-PERMIT HOLDERS: IMPLICATIONS FOR PARTICIPATION IN OUTDOOR RECREATION. Nicholas Cole, Christopher J. Chizinski, and Kevin Pope, School of Natural Resources, University of Nebraska-Lincoln

2:15 6. MODELING SIGHT AND SOUND IN ANCIENT MAYA CITIES: MOVING TOWARDS A SYNTHETHETIC EXPERIENCE USING GIS & 3D SIMULATION. Graham Goodwin, Heather Richards-Rissetto, Kristy E. Primeau, and David E. Witt, Department of Anthropology, University of Nebraska-Lincoln

2:30 7. DECIDUOUS TOOTH GROWTH AND RESORPTION IN PAN TROGLODYTES AND PAN PANISCUS. Chase Horn and Emily Hammerl, Department of Anthropology, University of Nebraska-Lincoln

2:45 BREAK

3:00 8. SUBSISTENCE HUNTING AND INDIGENOUS RIGHTS OF THE KALAHARI SAN. Emily Jensen, Wayne Babchuk, and Robert Hitchcock, Department of Anthropology, University of Nebraska-Lincoln

3:15 9. HIGH RESOLUTION SFM MODELING AND VIRTUAL REALITY INTEGRATION. Cole Juckette and Heather Richards-Rissetto, Department of Anthropology, University of Nebraska-Lincoln
DIGITAL ARCHAEOLOGY THROUGH HISTORICAL PHOTOGRAPHS OF ROUTT NATIONAL FOREST. Andrea Kruse, Department of Anthropology, University of Nebraska-Lincoln

AHPA vs. THE PROPOSED BORDER WALL: USING GIS TO CONSIDER THE POTENTIAL DISTURBANCE OF KNOWN ARCHAEOLOGICAL SITES. Katy Likely, Department of Anthropology, University of Nebraska-Lincoln

REVALUATING DATA: HOMESTEADING “FACTS” AND DATA VISUALIZATIONS. Amy Neumann, Department of Anthropology, University of Nebraska-Lincoln

THE MULTI-VOCALTRAILSCAPE OF THE NATCHITOCHES TRACE: A TRAIL OF TEARS, TRADE, AND TRANSFORMATION. Jade Robison, Department of Anthropology, University of Nebraska-Lincoln

THOUGHT-THROUGH TRAVEL: THE IAIN C.G. CAMPBELL ARCHIVE & TOURISM ANTHROPOLOGY. Rebecca Salem and Effie Athanassopoulos, Department of Anthropology, University of Nebraska-Lincoln

PHARMACIES AND MEDICINAL PRODUCTS IN LINCOLN, NEBRASKA AT THE TURN OF THE 20TH CENTURY Erik Schulz and Effie Athanassopoulos, Department of Anthropology, and Mark Griep, Department of Chemistry, University of Nebraska-Lincoln, NE 68588-0368

APPLIED SCIENCE AND TECHNOLOGY

Chairperson: Mary Ettel
Wayne State College, Wayne
Olin Hall 325

LEARN TO PRINT 3-D MODELS FOR YOUR CLASSROOM DROP-IN WORKSHOP. Michelle Howell and Karin van Dijk, Department of Biochemistry, University of Nebraska-Lincoln, Lincoln, NE

OPENING REMARKS

PROBING RNA STRUCTURE IN THE 5’ UNTRANSLATED REGION OF COXSACKIEVIRUS B3 GENOMIC RNA William E. Tapprich, Bejan Mahmud, Quinn Nelson*, Sara Smith and Jamie Luhr, Department of Biology, University of Nebraska-Omaha, Omaha, NE

PSEUDOMONAS AERUGINOSA STRAIN 14 BIOFILM ATTACHMENT ON SLIPPERY BMA-EDMA SURFACE Bailey Brigham* and Brett Schofield, Department of Biology; and Christina Wilson, Jasmin Sandoval, Michael Kangas and Andrea E. Holmes, Department of Chemistry, Doane University, Crete, NE
THE DEVELOPMENT OF A COLORIMETRIC ARRAY TO DETECT VOLATILE ORGANIC MOLECULES IN CANDIDA ALBICANS Nicholas Stolze*, Najee Mustafaa, Christina Wilson, Arin Sutlief, Michael Kangas and Andrea E. Holmes, Department of Chemistry, Doane University, Crete, NE

QUALITY CONTROL OF A NEW COLORIMETRIC SENSOR ARRAY TO DETECT QUORUM SENSING MOLECULES Najee Mustafaa*, Nicholas Stolze, Andrea E. Holmes, Arin Sutlief and Michael Kangas, Department of Chemistry, Doane University, Crete, NE

EVALUATION OF TARTARIC ACID IN WINE Joseph Benes, Valerie Fousek, Tyler Housh, Kristian Menard, Katelyn Wobken, Eric Pfeifer*, Jasmine DeMonte* and Darius Agoumba, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE

BIOLOGICAL AND MEDICAL SCIENCES
Chairperson: Annemarie Shibata
Department of Biology, Creighton University

SESSION A
Session Chairperson: Dr. Lynn Dieckman, Creighton University
Olin 112

MAPPING THE BINDING SITES FOR CHROMATIN ASSEMBLY FACTOR 1 ON PROLIFERATING CELL NUCLEAR ANTIGEN Robyn Scott* and Dr. Lynne Dieckman, Chemistry Department, Creighton University, Omaha NE 68178

IDENTIFICATION OF AN ALLOSTERIC TWISTER RIBOZYME FOR USE AS A SYNTHETIC GENETIC SWITCH Samantha Stoupa* and Dr. Juliane K. Soukup, Chemistry Department, Creighton University, Omaha NE 68178

STAPHYLOCOCCUS AUREUS TOLERANCE TO ANTIMICROBIAL PEPTIDES Alexis Page*, Kaitlyn Oppliger, Kim Carlson and Austin Nuxoll, Department of Biology, University of Nebraska at Kearney, NE 68849

EFFECTS OF GLUTAMATE METABOLISM ON ANTIBIOTIC TOLERANCE IN STAPHYLOCOCCUS AUREUS Megan Ingalls* and Austin Nuxoll, Department of Biology, University of Nebraska at Kearney, NE 68849

PHARMACOLOGICAL PRIMING AGENTS MODULATE NON-VIRAL GENE DELIVERY TO MULTIPLE CELL TYPES Alec McCarthy*, Andrew Hamann, and Angela Pannier, Department of Biological Systems Engineering, University of Nebraska – Lincoln, NE 68583

BREAK
6. EXTRACELLULAR SUPEROXIDE DISMUTASE ENZYMATIC ACTIVITY PROMOTES PROTEIN TYROSINE PHOSPHATASE 1B ACTIVITY Madison Lange*¹, Brandon Griess², Melissa L. Teoh-Fitzgerald², Douglas Christensen¹, Shawn Pearcy¹, Department of Life Sciences, Wayne State College, Wayne, NE 68787¹, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha, NE 68198²

7. GENERATION OF HUMAN CELL LINES THAT CAN BE INDUCED TO EXPRESS EPI TOPE TAGGED ARGONAUTE PROTEINS Daniel Gutzmann*, Douglas Christensen, Shawn Pearcy, Department of Biology, Wayne State College, NE 68787; and Audrey Atkin, Department of Biological Sciences, University of Nebraska-Lincoln, NE 68588

8. OPTIMIZING ALGAL CULTIVATION FOR BIOFUELS USING LOW VALUE SUGARS AND WASTEWATER Amiera Rayyan* Sydney Robertson and, John Kyndt Bellevue University, 1000 Galvin Road South, Bellevue, Nebraska 68005

9. DAY TO DAY AND LEG TO LEG VARIATION IN GENE EXPRESSION Zohal Alizai* and Dustin Slivka, University of Nebraska at Omaha, Omaha, NE

10. DEGENERATION OF A NUCLEAR rRNA GROUP I INTRON IN THE LICHEN TELOSCHISTES CHRYSOPHTHALMUS Audrey Codina* and Dawn M. Simon, Department of Biology, University of Nebraska Kearney, NE 68849; and Jolanta Miadlikowska, Ester Gaya, and François Lutzoni, Department of Biology, Duke University, Durham, NC, 27708

11. VIRAL DISCOVERY IN THE SOUTH AFRICAN BAT FLY (EUCAMPSIPODA AFRICANA) Matthew Martens*, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha, NE 68182

12. EFFECT OF NORA VIRUS INFECTION OF GERM-FREE DROSOPHILA MELANO GASTER ON LONGEVITY Makayla Nemecek*, Rebecca Best, Shelby Peters, Carlie Prososki, Lesley Towery, Darby J. Carlson, & Kimberly. A. Carlson, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

MAIBEN MEMORIAL LECTURE - OLIN HALL B

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

1. THE PREVALENCE OF BORRELIA LONESTARI IN CENTRAL NEBRASKA Clarissa Fitzgerald*¹, Caitlin Ingram¹, Travis Bourret², Brandon Luedtke³, and Julie Shaffer¹ 1. Department of Biology, University of Nebraska at Kearney, NE 68849 2. Department of Medical Microbiology and Immunology, Creighton University School of Medicine, NE 68178
2. SCREENING AND EVALUATION OF EXPERIMENTAL COMPOUND U21 AGAINST ACUTE *TOXOPLASMA GONDII* INFECTION  Austin Sanford* and Paul H. Davis, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha NE 68182

3. COMBATING CHRONIC *TOXOPLASMA GONDII* INFECTION USING COMBINATION GROUPS OF FDA DRUGS Elizabeth A. M. Ramler* and Paul H. Davis, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha NE 68182

4. ELUCIDATING THE MECHANISM OF ACTION OF EXPERIMENTAL COMPOUNDS THROUGH DOUBLE CHEMICAL MUTAGENESIS OF *TOXOPLASMA GONDII* Sean Watson*, Department of Biology, University of Nebraska at Omaha, NE 68182

5. CHEMICAL ATTRACTION OF TICKS (*PARASITIFORMIS: IXODIDAE*) TO DECOMPOSING ANIMAL REMAINS Mirtha Gutierrez*, Ashley Tagart, Iris Munoz-Ortiz, Kathleen Chance, Lisa Cuba, Shabnam Waheed, Amanda Roe Ph.D., Biology Program, College of Saint Mary, Omaha, Nebraska, 68106

6. POLLEN TUBE DEVELOPMENT IN WATER-POLLINATED *STUCKENIA PECTINATA* Emma C. Baker*, Sabrina D. Dumond, Christie L. Dang, Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha, NE 68178

7. CHARACTERIZATION OF THE PROGAMIC PHASE IN *RUPPIA MARITIMA* Dayton Oki*, Richard Nguyen, and Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha, NE 68178

8. POLLEN TRANSFER AND RECEPTION IN THE AQUATIC PLANT SPECIES *RUPPIA MARITIMA* Richard Nguyen*, Dayton Oki and Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha, NE 68178

9. INTEGRATION OF POLLEN DATA FROM LOCAL SOURCES AND SPECIMENS BELONGING TO THE HIGH PLAINS HERBARIUM IN CHADRON, NEBRASKA, INTO THE NEBRASKA POLLEN DATABASE Brittany Soukup*, Steven Rolfsmeyer, and Johnica J. Morrow, Palynology and Pathoecology Laboratory, Department of Physical and Life Sciences, Chadron State College, Chadron, NE

10. CHARACTERIZATION OF THE MICROBIAL COMMUNITY IN THE GLACIER CREEK PRESERVE Haleigh Salsbury*, Department of Biology, College of Saint Mary, Omaha, NE 68106

11. POLYMICROBIAL INTERACTIONS LEAD TO INCREASED ANTIBIOTIC TOLERANCE Kennedy Kluthe*, Seoyoung Song, Dan Nabb, Justine Pitzer, and Austin Nuxoll. Department of Biology, University of Nebraska at Kearney, NE 68849
10:35 12. ANALYZING COXSACKIEVIRUS B3 RNA BY SITE DIRECTED MUTAGENESIS  Sara Smith*, Bejan Mahmud, Quinn Nelson, and William E. Tapprich, Department of Biology, University of Nebraska at Omaha, Omaha, 6001 Dodge St., Omaha, NE 68182

SESSION C
Session Chairperson: Annemarie Shibata, Creighton University
Olin 112

1:00 1. THE ROLE OF INTERFERON REGULATORY FACTOR 3 IN CELLULAR RESPONSES TO GROWTH FACTOR DEPRIVATION Shawn Freed* and Tyler Moore, Bellevue University, 1000 Galvin Road, Bellevue, NE 68005

1:10 2. CURCUMIN INHIBITS THE GROWTH OF TRIPLE NEGATIVE BREAST CANCER CELLS THROUGH THE NF-kB PATHWAY Gabrielle Brumfield*, Shoichi Arai, and Ann Buchmann, Life and Physical Sciences Department, Chadron State College, 1000 Main St, Chadron, NE 69337

1:20 3. DYSREGULATION OF POLYAMINES WITH DIABETES IN BREAST CANCER CONDITIONS Caleb Capellen¹*, Jose Ortega¹*, M. Jane Morwitzer², Matthew Dunworth³, Robert A. Casero, Jr.³ and Surabhi Chandra¹ 1. Department of Biology, University of Nebraska-Kearney, Kearney, NE-68849 2. Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha, NE 68198 3. Department of Oncology, Johns Hopkins University School of Medicine, Baltimore, MD 21287 (*authors contributed equally, both will present at the meeting)

1:30 4. DEVELOPMENT OF NOVEL VCAP CELL LINE PROGRESSION MODEL FOR STUDYING CASTRATION-RESISTANT PROSTATE CANCER Marlene Djidjoho*, Dr. Ming-Fong Lin, Matthew Ingersoll, Dannah Miller, Department of Biology, College of Saint Mary, Omaha, NE 68106

1:40 5. TRACKING THE DIFFERENCES IN GENE EXPRESSION CORRELATION NETWORKS AMONG CANCER STAGES. Qianran Li* and Dr. Kathryn Cooper, University of Nebraska at Omaha, Omaha NE

1:50 BREAK

2:05 6. EVALUATION OF PLGA-ANTIRETROVIAL NANOPARTICLES ON CELLS OF THE CENTRAL NERVOUS SYSTEM Delaney Wilton¹* Subhra Mandal², Christopher Destache², and Annemarie Shibata¹ 1. Department of Biology, Creighton University, Omaha, NE 68178, 2. School of Pharmacy and Health Professions, Creighton University, Omaha, NE 68178

2:15 7. THE EFFECTS OF GRAPHENE FAMILY NANOPARTICLES ON DANIO RERIO EMBRYOS  Peyton E. VanWinkle, Hastings College, Hastings NE 68901

2:25 8. LINGUAL NERVE DAMAGE INDUCES A TRANSIENT IMMUNE RESPONSE IN THE TONGUE Jacquelyn Davis Omelian* and Suzanne I Sollars, Department of Psychology and Neuroscience, University of Nebraska Omaha, Omaha NE
9. LEARNING LEAGUE OF LEGENDS: AN EXPLORATION OF NEURAL ACTIVITY RELATED TO PC GAMING. Gabrielle Brumfield*, Peterson, G., Soukup, B., and Morrow, J.J. Department of Physical and Life Sciences, Chadron State College, Chadron, NE

10. EFFECTS OF STRIKE FORCE AND EPOE ALLELES ON DEVELOPMENT OF CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE) IN DROSOPHILA MELANOGASTER Shyanna Neu*, Kinsley Mason*, and Ann Buchmann Department of Physical and Life Sciences, Chadron State College, Chadron, NE

11. EFFECTS OF ENVIRONMENTAL TEMPERATURE AND EXERCISE ON MITOCHONDRIAL QUANTITY AND QUALITY H. Keller *, R. Shute, D. Slivka, University of Nebraska Omaha, Omaha NE

12. CHARACTERIZATION OF STAPHYLOCOCCUS LUGDUNENSIS BIOFILMS Justine Pitzer*, Sydney Keckler, and Austin Nuxoll, Department of Biology, University of Nebraska at Kearney, NE 68849

13. PRE-TREATMENT OF ARABIDOPSIS ROOTS WITH HEAT-KILLED PSEUDOMONAS AERUGINOSA TO PREVENT BIOFILM GROWTH Josiah Oyebefun* and Dr. Tessa Durham Brooks, Doane University 1014 Boswell Avenue, Crete, NE 68333

SESSION D
Session Chairperson: Patricia Soto, Creighton University
Smith Callen Conference Center

1:00 1. EFFECT OF SEQUENCE POLYMORPHISMS ON THE RESIDUE NETWORK CONNECTIVITY OF PRION PROTEINS: A COMPARATIVE STUDY Noah Yoshida*, Patricia Soto, Physics Department Creighton University, Omaha NE 68178

1:10 2. ENERGETICALLY FA VORABLE ORIENTATIONS OF PRPC MONOMERS AND DIMERS WITH A MODEL MEMBRANE India Claflin¹, Frances Morden¹, Patricia Soto² 1. Department of Biology, Creighton University, Omaha, Nebraska 2. Department of Physics, Creighton University, Omaha, Nebraska

1:20 3. DETERMINATION OF ATTACHMENT BY PSEUDOMONAS AERUGINOSA STRAIN PAO1 TO A SILICA-LIKE LAYER USING SURFACE ENHANCED RAMAN SPECTROSCOPY Brady Stuhmer*, Dr. Chris Huber, Department of Chemistry, Doane University, Crete NE 68333

1:30 4. PERSISTER FORMATION IN STAPHYLOCOCCUS EPIDERMIDIS CLINICAL ISOLATES Amber Menard*, Seoyoung Song, and Austin Nuxoll. Department of Biology, University of Nebraska at Kearney, Kearney, NE

1:40 5. THE CROSS-GENERATIONAL EFFECTS OF ANTIBIOTIC EXPOSURE ON THE MICROBIOTA, A CASE STUDY OF D. MAGNA. Jessica Hotovy*, Sarah Tjards, Reilly Cooper, Clayton Cressler, University of Nebraska- Lincoln
6. A SCREEN OF VERTEBRATE CHROMATIN ARCHITECTURAL PROTEINS FOR INSULATOR ACTIVITY. Lauren Doane* and Brett Schofield, Doane University 1014 Boswell Avenue, Ste #255, Crete, NE 68333

7. LATENT TOXOPLASMOSIS CYST VARIABILITY IN THE MURINE MODEL: A REVIEW OF METHODOLOGIES AND SPECIFIC CHALLENGES Gabrielle F. Watson* and Paul H. Davis, Department of Biology, University of Nebraska at Omaha, NE 68182

8. A PUTATIVE TOXOPLASMA GONDII TRANSCRIPTION FACTOR BINDING SITE DRIVES DIFFERENTIATION BY INDUCING EARLY BRADYSOITE-SPECIFIC TRANSCRIPTS Harim I. Won*, Lakshmi-Prasad Potluri, and Paul H. Davis, Department of Biology, University of Nebraska at Omaha, Omaha, NE 68182

9. DYNAMIC MODELING AND STOCHASTIC SIMULATION OF METABOLIC NETWORKS. Emalie J. Clement, Ghada A. Soliman, PhD, Beata J. Wysocki, PhD, MEngSc, Paul H. Davis, PhD, Tadeusz A. Wysocki PhD, DSc, MEngSc, Senior Member, IEEE, University of Nebraska at Omaha, Omaha, NE

10. IN VITRO AND IN VIVO LOCALIZATION OF CBU_1651 FROM COXIELLA BURNETII Keegan McGill* and Dr. Brandon Luedtke, Department of Biology, University of Nebraska at Kearney, NE 68849

11. PREVALENCE OF COLORECTAL CANCER AMONG THE LATINO COMMUNITY IN OMAHA AREA Francisco Duran-Lopez* and Gul Ahmad, Department of Natural Sciences, School of Arts & Sciences, Peru State College, Peru, NE

12. A NETWORK-BASED COMPARTMENTAL MODEL FOR THE SPREAD OF WHOOPING COUGH IN NEBRASKA Hakimeh Ameri* and Kathryn Cooper, College of Information Science and Technology, University of Nebraska at Omaha, Omaha, NE

13. DETERMINING THE EFFECTS OF ATRAZINE ON DANIO RERIO EMBRYONIC DEVELOPMENT Michelle Ross, Department of Biology, Hastings College, Hastings, NE 68901

14. SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL EVALUATION OF 2-FLUORENYL-SUBSTITUTED TRIAZOLIUM SALTS Connor A. Lejcher* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

CHEMISTRY & PHYSICS
CHEMISTRY SECTION
Chairperson: Joshua Darr
Chemistry Department, University of Nebraska at Omaha
Olin LH-A

8:35 WELCOME
1. DOCKING STUDIES ON ISOFORM-SPECIFIC INHIBITION OF JANUS KINASE 3 (JAK3). Suliman Almahmoud¹* and Haizhen A. Zhong²; 1. College of Pharmacy, University of Nebraska Medical Center, Omaha, 2. Department of Chemistry, University of Nebraska at Omaha.

2. AN EFFICIENT SYNTHESIS OF NΠ PROTECTION OF 4-L-PHENYLSPINACINE AND ITS HYDROGENOLYSIS TO THE CORRESPONDING HISTIDINE. Brice Tsao*, Department of Chemistry, Creighton University, Omaha.

3. SOLID STATE CHARACTERIZATION AND ANTIOXIDANT STUDIES OF CURCUMIN AND RESVERATROL BINARY/TERNARY POLYMER COMPLEXES. Melissa Mosbrucker*, Mary Morris, and Dunesh Kumari, Department of Chemistry, College of Saint Mary, Omaha.

4. SOLID STATE CHARACTERIZATION AND ANTI-OXIDANT ACTIVITY OF CURCUMIN AND PIPERINE COMPLEXES. Mary Morris*, Melissa Mosbrucker, and Dunesh Kumari, Department of Chemistry, College of Saint Mary, Omaha.

5. DEVELOPING 3D PRINTED DEVICES TO CONCENTRATE DNA FOR GENOME ANALYSIS. Cody Masters*, Jocelyn Dolphin, April Maschmann, and Kristy L. Kounovsky-Shafer, Department of Chemistry, University of Nebraska at Kearney.

6. UTILIZING A PULSED WAVEFORM TO ELUTE DNA MOLECULES IN 3D PRINTED DEVICES FOR GENOME ANALYSIS. Molly Kohlbek*, Bryant Menke, Laura Stoner, April Maschmann, and Kristy L. Kounovsky-Shafer, Department of Chemistry, University of Nebraska at Kearney.

7. EXAMINATION OF ORNITHINE DECARBOXYLASE ANTIZYME RNA STRUCTURE AND FUNCTION FOR THE DEVELOPMENT OF ANTIBILOGICAL AGENTS. Zach Frevert*, Korey Krutsinger, Logan Baumburger, and Julie Soukup, Department of Chemistry, Creighton University, Omaha.

8. 1-(4-NITROPHENYL)-1H-1,2,3-TRIAZOLE-4-CARBALDEHYDE: A USEFUL SYNTON FOR SOLUTION- AND SOLID-PHASE 4-FORMYL-1,2,3-TRIAZOLE PREPARATIONS. Rebecca K. Zawistowski* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

9. ELUCIDATING THE PA01 ATTACHMENT MECHANISM ON SILICA AND POLYSTYRENE SURFACES VIA SURFACE ENHANCED RAMAN SPECTROSCOPY. Christopher Huber*, Brady Stuhmer, Jaysa Hoins, and Tanner Harsin, Department of Chemistry, Doane University, Crete.

10. RING-DEGENERATE REARRANGEMENTS OF 1-SUBSTITUTED-4-IMINO-1,2,3-TRIAZOLES. Joseph A. Christensen, Matthew D. Hanson, Rebecca K. Zawistowski and James T. Fletcher*, Department of Chemistry, Creighton University, Omaha.
2:00 BREAK

2:15 11. STUDIES OF AMINO ACID MUTATIONS IN DRUG RESISTANCE OF THE SMO PROTEIN. Eunice Winton*a and H. Andy Zhong, Department of Chemistry, University of Nebraska at Omaha.

2:35 12. USING MACROCYCLIC CAVITANDS FOR REACTION SELECTIVITY AND SUSTAINABLE CHEMISTRY. Treyvon Bokoskie*, Akshay Kashyap, Wuilian Martinez, and Mahesh Pattabiraman, Department of Chemistry, University of Nebraska at Kearney.

2:55 13. EXPANDING THE CAVITAND-MEDIATION APPROACH FOR PRODUCING STEREO- AND REGIOSPECIFIC SUBSTITUTED CYCLOBUTANES FROM CINNAMIC ACIDS. Akshay Kashyap*, Wuilian Martinez, and Mahesh Pattabiraman, Department of Chemistry, University of Nebraska at Kearney.

3:15 14. COLORIMETRIC SENSOR ARRAYS FOR THE DETECTION OF WARFARE ANALYTES. Andres Mora*, Dr. Michael Kangas, and Dr. Andrea Holmes, Department of Chemistry, Doane University, Crete.

3:25 BUSINESS MEETING

CHEMISTRY AND PHYSICS
PHYSICS SECTION
Chairperson: Adam N. Davis
Wayne State College
Planetarium

8:50 WELCOME

9:00 1. B-MODE IMAGING USING GAMPT ULTRASOUND EQUIPMENT Wes Anderson, Physics Department, Hastings College, Hastings, NE 68901

9:20 2. FORCE SENSITIVE RESISTORS AS A SUPPLEMENTAL TOOL DURING WEIGHT BEARING REHABILITATION Tyler Lowry, Physics Department, Hastings College, Hastings, NE 68901

9:40 3. DESIGN, ASSEMBLY AND ANALYSIS OF AN UNMANNED AERIAL VEHICLE Chris Perez, Physics Department, Hastings College, Hastings, NE 68901

10:00 4. FABRICATION AND TESTING OF CARBON FIBER REINFORCED POLYMER WITH STRUCTURAL APPLICATIONS TO AN EXPLORATION ROVER Brian Puckett, Physics Department, Hastings College, Hastings, NE 68901

10:20 5. FUNCTIONAL REACTIVE PROGRAMMING FOR CONTROL OF AN UNMANNED AERIAL VEHICLE Amanda Romero, Physics Department, Hastings College, Hastings, NE 68901
6. SOIL MOISTURE ESTIMATION USING SURFACE TEMPERATURE AND OTHER METEOROLOGICAL DATA Jessie Johnson, Physics Department, Hastings College, Hastings, NE 68901

11:00 MAIBEN LECTURE

7. DEVELOPMENT OF HIGH VOLTAGE SUPPLY CONTROLS FOR THE STAR EXPERIMENT AT RHIC Samuel Ruiz, Jiro Fujita, Creighton University Department of Physics, Omaha, NE

1:00 8. FEASIBILITY STUDY FOR THE OBSERVATION OF INCOHERENT PHOTOPRODUCTION OF PHI MESONS IN RELATIVISTIC PB-PB COLLISIONS IN THE ALICE DETECTOR AT THE LHC Amrit Gautam, Department of Physics, Creighton University, Omaha, NE

1:15 9. OPTOELECTRONIC MODULATION OF QUANTUM DOTS BY BIOLOGICAL CELLS Bong Han Lee, Sindhuja Suresh, Andrew Ekpenyong, Creighton University, Omaha, NE

1:30 10. MATHEMATICAL MODELLING OF CELLULAR BIOIMPEDANCE FOR PHYSICS OF CANCER Andrew Walther, Anh Vo and Dr Andrew Ekpenyong, Creighton University, Omaha, NE

EARTH SCIENCE
Chairperson: Irina Filina
Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln
Olin 249

1:00 WELCOME

1:05 1. THE POSSIBLE EFFECTS OF MOBILIZED EOLIAN SAND ON SOIL FORMATION IN PEORIA LOESS, SOUTH-CENTRAL NEBRASKA, USA Jeremy S. Dillon, Ryan May, Dylan Nichol, and David Urban, Department of Geography, University of Nebraska at Kearney, Kearney, NE 68849

1:20 2. IMPACT OF AN EXTREME FLOOD EVENT ON STREAMBANK RETREAT ON CEDAR RIVER, NEBRASKA Naisargi Dave and Aaron Mittelstet, Biological Systems Engineering Department, University of Nebraska-Lincoln, NE 68583

1:35 3. SYNOPTIC ANALYSIS OF THE 1888 “CHILDREN’S BLIZZARD” Judson Buescher, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, NE 68588

5. ORIGIN OF VOIDS IN CLIFF EXPOSURES OF COLORADO PLATEAU SANDSTONES David Loope, Department of Earth & Atmospheric Sciences, University of Nebraska-Lincoln, NE 68588-0340

6. DETERMINANTS OF MAGMA TRANSPORTATION AND EMPLACEMENT AT SPREADING RIDGES Yitong Lyu and Lynne Elkins, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, NE 68588

7. GEOLOGIC HISTORY OF THE NEW CALEDONIA BASIN, WITH IMPLICATIONS FOR THE GEODYNAMIC HISTORY OF ZEALANDIA Claire Richardson, Caroline Burberry, and Irina Filina, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, NE 68588

8. SUBSURFACE FAULTS RELATED TO MIDCONTINENT RIFT IN NEBRASKA FROM INTEGRATED GEOPHYSICAL ANALYSIS Kris Guthrie, Irina Filina, Mindi Searls, and Caroline Burberry, Earth and Atmospheric Sciences Department, University of Nebraska-Lincoln, Lincoln, 68588

9. INVESTIGATING MECHANISMS OF HYDRAULIC CONDUCTIVITY TRANSIENCE IN SANDY STREAMBEDS Wilhelm Fraundorfer and Jesse Korus, School of Natural Resources, University of Nebraska – Lincoln, NE 68583

10. CRITICAL WEDGES AND PENETRATIVE STRAIN: HOW DOES PENETRATIVE STRAIN ALTER THE CONCEPT OF CRITICAL WEDGE? Nicole Smith and Caroline Burberry, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, NE 68588

11. PENETRATIVE STRAIN RELATED POROSITY LOSS IN CLASTIC RESERVOIR UNITS OF THE DENVER-JULESBURG BASIN Marques Hatfield and Caroline Burberry, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, 126 Bessey Hall, Lincoln, NE 68588

12. INTEGRATED ANALYSIS OF GEOLOGICAL AND GEOPHYSICAL DATA IN THE NORTHEASTERN GULF OF MEXICO Mei Liu and Irina Filina, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, NE, 68588

13. SUBSURFACE STRUCTURE IN SOUTHEASTERN GULF OF MEXICO FROM INTEGRATED GEOPHYSICAL ANALYSIS Lucas Hartford and Irina Filina, Department of Earth and Atmospheric Science-University of Nebraska-Lincoln, 1815 N 31st St Lincoln, Ne 68503

POSTER SESSIONS (CONT.)
1:00 OPENING REMARKS

1:15 1. INVERTEBRATE COLLECTIONS AT WAYNE STATE COLLEGE: SUMMARY AND A REVIEW OF CONSERVATION NEEDS Barbara L. Hayford, Department of Life Sciences, Wayne State College, Wayne, NE, 68787

1:30 2. RATES OF ATTACHMENT AND MODIFICATION OF VARIOUS GRASS PROPAGULES TO BISON FUR Megan Royal, Biology, Wayne State College, 1111 Main St. Wayne, NE 68787

1:45 3. THE IMPACT OF LAND USE ON NITRATE-N MOVEMENT AND STORAGE IN THE VADOSE ZONE OF THE HASTINGS’ WHPA Craig Adams, Daniel Snow, and Chittaranjan Ray, University of Nebraska at Lincoln, NE 68583

2:00 4. BIOREMEDIATION OF ATRAZINE CONTAMINATED WATER WITH ARTHROBACTER AURESCENS TC1 Hunter Kleinschmidt, Dr. Arin Sutlief, Dr. Michael Kangas, Dr. Christina Wilson, and Dr. Andrea Holmes, Doane University, Crete, NE

2:15 5. IMPLICATIONS FOR HUMAN HEALTH OF NITROSYLATION OF CYTOLOSIC AND MEMBRANE PROTEINS OF CHIRONOMUS DILUTUS Kristy Hansen, Bobby Hansen, and Barbara Hayford, Department of Life Sciences; and Gustavo Zardeneta, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

2:35 6. CHALLENGES TO ENVIRONMENTAL EDUCATION IN HAITI Debra S. Baker and Dr. Donald Huggins, Kansas Biological Survey, University of Kansas, Lawrence, KS 66047

2:55 7. PRESENCE OF MOSQUITO SPECIES IN PHYTOTELMATA: PUBLIC HEALTH INITIATIVES Meghan Krajicek, Dr. Barbara Hayford

3:05 8. INSECT PRESENCE AND BIRD VOCALIZATIONS DURING A TOTAL SOLAR ECLIPSE Kristy Hansen and Mark Hammer, Department of Life Sciences, Wayne State College, Wayne, NE 68787

3:25 9. ANALYSIS OF MEDICAL PLANTS BY REGION AND THE BACTERICIDAL PROPERTIES OF MORUS ALBA Emily Gartin and Mark Hammer, Department of Biology, Wayne State College, NE 68787

3:35 10. A BRYOPHYTE SURVEY OF THE NEBRASKA PINE RIDGE: IMPLICATIONS FOR ASSESSING SPECIES RICHNESS OF, AND THREATS TO, THE STATE’S BRYOFLORA Steven Rolfsmeier, High Plains Herbarium, Department of Physical and Life Sciences, Chadron State College, Chadron NE 69337
TEACHING OF SCIENCE AND MATH
Chairperson: Josef Kren
Bryan College of Health Sciences, Lincoln
Olin 224

1:00  WELCOME

1:05  1. TREATING PLANT BLINDNESS. Phyllis Higley, Biology, College of Saint Mary, Omaha.

1:20  2. THE EFFECT OF A FOCUSED SUPPORT PROGRAM FOR UNDERREPRESENTED STUDENT SCIENCE RESEARCHERS. Justin Andersson*, Career Center, Omaha Public Schools, Omaha, NE, and Dan Sitzman, Omaha, NE.

1:35  3. TENSILE STRENGTH, TIEABILITY, AND HYDROLYZABILITY OF ABSORBABLE POLYESTER SUTURES: DEVELOPING A SOPHOMORE ORGANIC CHEMISTRY LABORATORY. Martin Hulce, Department of Chemistry, Creighton University, Omaha.

1:50  4. EDUCATIONAL GAME DESIGN AS A VEHICLE FOR INTEGRATING STATISTICS INTO BIOLOGY COURSES: A PRELIMINARY STUDY. Kyle B. Johnson, Concordia University, Seward, NE.

2:05  5. MINDMUP SOFTWARE IN PROMOTING COLLABORATIVE AND CRITICAL THINKING LEARNING. Mark Jones* and Josef Kren, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.

2:20  BREAK

2:30  6. A COMPUTER MODEL OF ACQUIRED ANTIBIOTIC RESISTANCE. MaKayla Coan* and Alexia Morales, Department of Biomedical Sciences, Bryan College of Health Science Lincoln, NE.

2:45  7. COMPUTER SIMULATION OF INFLUENZA EPIDEMIC. Holly Didier* and Josef Kren, Department of Nursing and Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.

3:00  8. COMPUTER SIMULATION OF PATIENT/COST BENEFIT IN ROBOTIC BARIATRIC SURGERY: THE DAVINCI VS. OPEN PROCEDURE. Tessa Kingsley, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.

3:15  9. COMPUTER MODELS AS A TOOL TO GUIDE CLINICIANS IN THE NEUROSURGICAL INTERVENTION OF INTRACRANIAL HEMORRHAGE. Haley Liberty* and Jamie Stewart, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.

3:30  10. INVESTIGATION OF α-KETOGLUTARATE UTILIZATION IN UROPATHOGENIC E.COLI USING COMPUTER MODELING. Ana Martinez-Hottovy, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.
11. MODELING THE PHARMODYNAMICS OF ATTENTION DEFICIT HYPERACTIVITY DISORDER MEDICATIONS. Jamie Stewart* and Haley Liberty, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.

12. A COMPUTER SIMULATION OF THE EFFECTS OF LIFESTYLE ON HUMAN HEALTH. Alexia Morales* and MaKayla Coan, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.

13. ADVANTAGES OF TAKING PATHOPHYSIOLOGY AND PHARMACOLOGY COURSES SYNERGISTICALLY IN NURSING CURRICULUM. Emily Klein* and Josef Kren, Department of Nursing and Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE.

COLLEGIATE ACADEMY
BIOLOGY
Chairperson: Therese McGinn
Nebraska Wesleyan University, Lincoln

SESSION A
Olin 111

8:00 1. LASSA VIRUS VACCINATION FROM RECOMBINANT VSV Pamela Fawns, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

8:12 2. ROLE OF ARSENIC (3) METHYLTRANSFERASE IN REACTIVE OXYGEN SPECIES ACCUMULATION AND CELL PROLIFERATION Joseph Roper* and Koren Mann, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

8:24 3. A BPH COMPARISON OF WOODRUFF AND SIKORA BUFFER IN DETERMINATION OF LIME REQUIREMENTS IN SOIL PH Riley Taylor, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

8:36 4. GENETIC ANALYSIS OF ESCHERICHIA COLI STRAINS ISOLATED FROM HOSPITALIZED PATIENTS Nicole Liske* and D. Michael Olive, PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

8:48 5. ISOLATING THERAPEUTIC BACTERIOPHAGES TO DEVELOP AN ANTIMICROBIAL AGAINST CRE-RESISTANT KLEBSIELLA PATHOGENS Nicole Carbajal and D. Michael Olive PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

9:00 6. CONFIRMATION OF THE cDNA ENCODING FKBP, A REGULATORY PROTEIN, IN A SUITABLE EXPRESSION VECTOR FOR MALIGNANT HYPERTHERMIA (MH) RESEARCH Eliza Fallick* and Kathryn Stowell, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

9:12 7. UTILIZATION OF CREATED PLASMID MET30DUT-GFP IN PDM304 TO IDENTIFY THE LOCATION OF DUTPASE ENZYME, A POTENTIAL TARGET FOR ANTI-CANCER DRUGS Dan Mai, Department of Biology, Nebraska Wesleyan University, Lincoln, NE
8:00  1.  CHARACTERIZATION OF A NOVEL MITOCHONDRIAL PLASMID IN BRASSICA Mackenzie Strehle, Minnetrista, MN

8:12  2.  HABITAT AREA OF DELPHINUS CAPENSIS, TURSIOPS ADUNCUS, AND SOUSA CHINENSIS WITHIN MOSSEL BAY, SOUTH AFRICA Emily Schumacher, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

8:24  3.  GENETIC VARIANTS OF SURFACTANT PROTEIN A2 (SP-A2) AFFECTS AIRWAY EPITHELIAL RESPONSE TO INTERLEUKIN 13 (IL-13) Collin Pieper*, Dave Francisco, Akash Manne, Daniel Lucas, Julie Ledford, Monica Kraft, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

8:36  4.  EFFECTS OF MEAL CONSUMPTION ON ARBOREAL LOCOMOTION OF CORN SNAKES Connor Springman* and Dr. Gary Gerald, Department of Biology, Nebraska Wesleyan University, Lincoln, NE
5. METABOLIC CYCLES IN LOXODONTA AFRICANA Kaden Schopp* and Kari Morfeld PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

6. NOTCH 3 IS OVEREXPRESSED IN THE LUNG TISSUE OF MARFAN SYNDROME MOUSE MODEL Katherine J. Schulte*; William J. Hausmann: Trevor Meisinger, BS; Matthew P. Fitzgerald, MD; Timothy Baxter, MD, Biology Department, Nebraska Wesleyan University, Lincoln NE 68504 and Department of Surgery, University of Nebraska Medical Center, Omaha, NE 68198

7. MYCN EXPRESSION AND NEURAL DIFFERENTIATION IN NEOBlastoma CELL LINES Olivia Sharp*, Jason Sughroue, Erin McIntyre, Gracey Alexander, Timothy McGuire, John G. Sharp, Don Coulter, Rongshi Li, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

8. THE USE OF COMBINED PATTERN RECOGNITION RECEPTOR AGONISTS ALLOWS FOR FINE-TUNING OF DENDRITIC CELL IMMUNE RESPONSES Jacey L. Hain¹*, Anna T. Lampe², and Deborah M. Brown³ 1. Nebraska Wesleyan University, 5000 St. Paul Ave., Lincoln, NE 68504, 2. Univ. of Nebraska, Lincoln, 142 Morrison Center, Lincoln, NE 68583

9. CHARACTERIZATION OF STAPHYLOCOCCUS AUREUS STRAINS ISOLATED IN A UNIVERSITY SETTING Jennifer Keenan*, D. Michael Olive PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

9:48 BREAK

10. EXPERIMENTAL DETERMINATION OF AN EMPIRICAL ATTACHMENT MODEL FOR PSEUDOMONAS AERUGINOSA BIOFILMS GROWN ON POLYCARBONATE Jeniffer M. Caballero¹*, Arin L. Sutlief² and Christopher D. Wentworth³, 1. Department of Biology, 2. Department of Chemistry, and 3. Department of Physics & Engineering, Doane University, Crete, NE 68333

11. CHARACTERIZATION OF APOPTOTIC ACTIVITY OF BUGGY CREEK VIRUS Benjamin Ryan*, Troy Rowan, Carol Fassbinder-Orth, Creighton University, Omaha NE

12. EXOSOMES ENHANCE CHEMORESISTANCE IN EWING’S SARCOMA Christina Ternent*, Matthew Kling, Shantaram Joshi, College of St. Mary, Omaha NE

13. DESIGNING A DNA VACCINE AGAINST TOXOPLASMA GONDII Rosalie C. Warner* and Paul H. Davis, Department of Biology, University of Nebraska at Omaha, NE 68182

11:00 MAIBEN LECTURE

1:00 ANALYZING SUGAR COMPOSITION OF CORN ROOT EXUDATE TO IDENTIFY BIOMARKERS OF COLD TOLERANCE USING NMR SPECTROMETRY Lance Lucas*, Connor Long, and Dr. Tessa Durham Brooks, Department of Biological Sciences, Doane University, Crete, NE 68333
1:12  15.  EXAMINATION OF VARIOUS MEDIA'S IMPACT ON CANDIDA ALBICANS FILAMENTATION Patricia Harte-Maxwell, University of Nebraska at Omaha, NE 68182

1:24  16.  TOWARDS THE VISUALIZATION OF PERSISTER CELLS IN BIOFILMS. Marco Perez*, Sharmin Sikich, Andrea Holmes, Christina Wilson, Arin Sutlief, Department of Chemistry, Doane University, Crete, NE 68333

1:36  17.  PSEUDOMONAS AERUGINOSA ATTACHMENT TO DIFFERENT SUBSTRATES Jaysa Hoins*, Brady Stuhmer, and Tanner Harsin, Dr. Chris Huber, Department of Chemistry, Doane University 1014 Boswell Ave., Crete, NE 68333

1:48  18.  BIOCHEMICAL COUNTER-REGULATION OF B CELL FUNCTION BY IL-10 AND IFN-Γ Madison Stock*, Nirmal Dutta, Angela Pack, Rahul Vijay and Noah S. Butler, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

2:00  19.  DEVELOPMENT OF A FLUORESCENT BIOSENSOR FOR GAMMA HYDROXYBUTYRIC ACID (GHB), A DATE RAPE DRUG Gwennan Plouzek* and D. Michael Olive PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

2:12  20.  THE EFFECT OF SHEAR STRESS ON THE MORPHOLOGY OF PSEUDOMONAS AERUGINOSA BIOFILMS Helena Valquier-Flynn¹*, Arin L. Sutlief¹, and Christopher D. Wentworth², 1. Department of Chemistry, 2. Department of Physics & Engineering, Doane University, Crete, NE 68333

2:24  BREAK

2:36  21.  DETERMINING THE EFFECTS OF SEED SIZE ON THE PRODUCTION OF AMINO ACIDS IN ROOT EXUDATES OF CORN Michael Tross*, and Dr. Tessa Durham Brooks, Department of Biological Sciences, Doane University, Crete, NE 68333

COLLEGIATE ACADEMY
CHEMISTRY AND PHYSICS
Chairpersons: David Treichel and Nathanael Fackler
Nebraska Wesleyan University, Lincoln

SESSION A
Session Chairperson, Nathanael Fackler
Olin 324

8:45  1.  WORK TOWARDS AN ELECTROGENERATED CHEMILUMINESCENCE-DNA BIOSENSOR LABELED WITH A RUTHENIUM COMPLEX. Hannah E. Durant*, Austin Jantrakul, Kenneth N. Hipp, Rebecca Y. Lai and Erin M. Gross, Department of Chemistry, Creighton University, Omaha.

9:00  2.  INVESTIGATION OF THE EFFECT OF ALANINE ON THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AEROSOLS. Mohammed Alfarra*, Dillon Woods, Salvatore Gottuso, and Joshua Darr. University of Nebraska at Omaha, Omaha, NE, 68116.
9:15  3.  STEREOSELECTIVE SYNTHESES AND REDUCTION OF 3-ALKENYL-2-CYCLOALKENONES. Brianna Callahan* and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178.

9:25  4.  UPGRADES TO TTL SPLITTER AND DISPLAY AT THE STAR EXPERIMENT SLOW CONTROLS AT BROOKHAVEN NATIONAL LABORATORY. Joseph D'Alesio*, Department of Physics, Creighton University, Omaha NE, 68178.

9:40  5.  SOFTWARE UPDATES FOR THE TPC AND TOF GAS SYSTEM CONTROLS AT STAR EXPERIMENT SLOW CONTROLS AT BROOKHAVEN NATIONAL LABORATORY. Emma Dufresne*, Department of Physics Creighton University, Omaha NE, 68178.

9:55  6.  IDENTIFYING THE BINDING LOCATION OF ATRAZINE AND TWO OF ITS METABOLITES ON HSA USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. Kati Frankenberg* and Annette C. Moser, University of Nebraska at Kearney, Kearney, NE 68849.

10:05  7.  ANALYSIS OF THE EFFECT OF SERINE ON THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AEROSOLS. Megan Grove*, University of Nebraska-Omaha, Omaha, NE 68130.

10:20  8.  INTRODUCTION TO A LARGE ION COLLIDER EXPERIMENT (ALICE) AT THE EUROPEAN COUNCIL FOR NUCLEAR RESEARCH (CERN). Alexandra McMillen*, Department of Physics, Creighton University, Omaha, NE 68178.

10:35  9.  SYNTHESIS OF AN ALPHA-HYDROXY-KETONE SUGAR, TMEDA, AND ICARIDIN ADDUCT: BINDING INSECT REPELLANT TO SKIN FOR IMPROVED EFFICACY. Ralph Mendez* and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE, 68178.

1:00 10. DEVELOPMENT OF A NOVEL FLUORESCENCE LIFETIME-BASED ASSAY TO DETERMINE THE RELATIVE CONCENTRATIONS OF NICOTINAMIDE COFACTORS IN CELLULAR EXTRACTS. Paul Khoury*, Kevin Brittan, Patricia Nguyen, Brook Yang, Marifel Gabriel, Margaret Glick, Dan Pham, Katie Sotelo, Kelsey Jackson, and Michael G. Nichols, Department of Physics, Creighton University, 2500 California Plaza, Omaha, NE, 68178.
11. COMPARISON OF DUAL-WAVELENGTH AND SINGLE-WAVELENGTH PHASOR FLIM WITH UNMIXING TO DETERMINE THE RELATIVE CONTRIBUTION OF NAD(P)H AND FLAVOPROTEINS IN METABOLIC IMAGING OF SQUAMOUS CELL CARCINOMA CELLS. Katie Sotelo*, Michael Nichols, Department of Physics, Creighton University, NE 68178.

12. NOVEL SOL-GEL NANOPARTICLE FEEDSTOCKS FOR USE IN 3D PRINTABLE GLASS INKS. Alexandra Vahle*, Emilia Berni, Peter Palencia, Julia Jobanputra, and Joel F. Destino, Ph.D. Creighton University, Omaha, NE 68178-0133.

13. TWO-PHOTON IMAGING OF NAD(P)H OF SQUAMOUS CELL CARCINOMA CELLS IN VITRO REVEALS METABOLIC CHANGES FOLLOWING EXPOSURE TO UV LIGHT. Marifel Gabriel*, Katie Sotelo, Brooke Yang, Alexis Mills, Dan Pham, Michael Nichols, Department of Physics, Creighton University, NE 68178.

14. STUDY OF THE BINDING INTERACTIONS BETWEEN HUMAN SERUM ALBUMIN AND ALACHLOR AND ALACHLOR ESA USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY. Sidney Trenhaile* and Annette C. Moser, University of Nebraska at Kearney, Kearney, NE 68849.

15. AN INTRODUCTION TO THE STARLIGHT MONTE CARLO SIMULATION OF THE ULTRA-PERIPHERAL COLLISIONS OF RELATIVISTIC HEAVY IONS. Jacob Wente*, Department of Physics, Creighton University.

16. ON THE HYDROGENATION OF ALKYNES WITH ALUMINA SUPPORTED PALLADIUM. Tazah Weinmaster, Reba Mehaffey, Kenzie Enmeier, Samantha Jarman and Bruce Mattson, Department of Chemistry, Creighton University, Omaha, NE 68178.
MODULATION OF THE NEURAL BASES OF ATTENTION BY RHYTHMIC VISUAL ENTRAINMENT
Alex Wiesman and Tony Wilson, Department of Neurological Sciences, University of Nebraska Medical Center, Omaha, NE 68198

Although numerous studies have indirectly linked rhythmic brain activations to attention function using correlational analyses, it has proven difficult to establish their causal role in attention, as it is problematic to systematically modulate neural activity in-vivo in human participants. In these studies, we address these problems using adapted versions of established visual attention paradigms that incorporate stimuli flickering at distinct attention-related frequencies. Twenty-three healthy young adults completed each cognitive task during neuroimaging with magnetoencephalography (MEG). By utilizing the spatio-temporal precision of MEG, we provide causal evidence for the modulation of endogenous oscillatory rhythms by exogenous visual entrainment. These findings both robustly support the ability of entrained oscillations to modulate endogenous neural signals, and also provide causal evidence for the role of different neural rhythms in attention processing. A better understanding of the neural coding of attention in the human brain will be integral to enhancing cognition in mentally-taxing aerospace environments.

IN VITRO QUANTIFICATION AND VALIDATION OF MECHANICALLY-INDUCED OSTEOCYTE STRAIN
Travis McCumber and Satera Nelson, Department of Genetics, Cell Biology, and Anatomy, University of Nebraska Medical Center, Omaha, NE 68198

Despite strenuous exercise regimens, astronauts aboard the International Space Station still lose up to 1% of their bone mass per month, thus placing them at increased risk of bone fracture. Mechanical loading is required to maintain bone mass and strength, and osteocytes (Ot) act as the primary mechanosensory cell of the skeletal system. Ot are terminally derived and reside within a mineralized matrix which makes the study of the most abundant cell in bone tissue very difficult. A transparent culture streamer for the mechanical loading of Ot was designed and machined. The effectiveness of the streamer was determined by both Ot viability and the ability to visualize Ot under pulsating fluid flow. Future work plans to establish in vitro loading methods that more accurately resemble the strains experienced by Ot in vivo, thus advancing the study of Ot and ultimately the well-being of future astronauts.

CAN PLANTAR VIBRATION HELP ASTRONAUTS ADAPT NEW ENVIRONMENT
Jung Hung Chien, Zhuo Wang, and Ka-Chun Siu, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha, NE 68198

After astronauts landed on the moon, they experienced frequent falls while stepping over the obstacles. Therefore, it is essential to understand the effect of external stimulation on the sensory systems on humans’ balance while stepping over the obstacles, and further, to develop an effective training protocol for obstacle negotiation for astronauts for future Mars mission. This study attempts to
expand the current knowledge by investigating the effect of plantar vibration while navigating multiple obstacles. Nineteen healthy young adults were instructed to step with two identical obstacles with three conditions (no, sub-threshold and supra-threshold vibration). Our result indicated that the supra-threshold vibration perturbed the strategy of obstacle negotiation and forced healthy young adults to step over obstacles like older adults. This finding was critical because if astronauts could be trained to walk with such perturbations, their adaptability for transferring between environments with different gravities might be enhanced.

**INFLUENCE OF FOOT-GROUNDED TRACTION ON GAITS USED IN REDUCED GRAVITY**

John Kotsalis, Cory Frederick, Mukul Mukherjee, and Kota Takahashi, Department of Biomechanics, University of Nebraska at Omaha, NE 68182

Reports from the Apollo missions show that astronauts adopted a skipping gait on the Moon. Simulations confirm that skipping is optimal in reduced gravity. However, it has also been suggested that the preferred gait is skipping because the lunar dust surface (regolith) offers less traction. Our aim is to investigate the influence of foot-ground traction on the biomechanics of different gaits. To measure the effects of foot-ground traction on the metabolic cost of steady state locomotion, we use footwear with low-friction Teflon outsoles. Preliminary results show that the placement of the Teflon material on the forefoot increases ankle extension at push off and increases metabolic cost, whereas placing low-friction material on the heel or the midfoot does not increase ankle extension and metabolic cost. We anticipate this research will help to inform aspects, such as optimal footwear design and kinematic strategies, to cope with slippery terrain.

**RELATIONSHIP BETWEEN GAIT VARIABILITY AND OBSTACLE AVOIDANCE**

Vivien Marmelat, Austin Duncan, and Danial Jaravata, Department of Biomechanics, University of Nebraska at Omaha, Danish Bhatti, Department of Neurological Sciences, University of Nebraska Medical Center, Omaha, NE 68198

The proposed research will address fundamental questions about the relationship between locomotor control during steady-state walking and gait kinematics during obstacle avoidance tasks. As a first step towards addressing these questions, this project will focus on subjects with Parkinson’s disease (PD), a cohort considered as a ‘model’ of high-risk fallers. We will apply sophisticated non-linear analysis to gait kinematics to test our main hypothesis that steady-state walking variability (i.e., the step-to-step variations occurring over time) reflects gait adaptability observed during more challenging conditions, in particular obstacle avoidance at preferred and fast walking speed. Our findings could facilitate the detection of gait impairments pre- and post-space mission, and provide new tools to evaluate the efficacy of preventive or rehabilitative programs for gait adaptability.

**EFFECT OF THE USAGE OF HANDRAILS ON GAIT DYNAMICS IN PEOPLE WITH PARKINSON’S DISEASE**

Daniel Jaravata and Vivien Marmelat, Department of Biomechanics, University of Nebraska at Omaha, Danish Bhatti, Department of Neurological Sciences, University of Nebraska Medical Center, Omaha, NE 68182

In young healthy participants, stride time series of walking presents a pattern of complex variability, but this complexity critically decreases in patients with Parkinson’s disease (PD). Complexity is defined as an optimal state between too much regularity and too much irregularity, allowing the locomotor system to maintain robust performances while being able to adapt to perturbations. A possible explanation is that the decrease in complex variability results from increased control mechanisms to
avoid excessive postural instability (e.g., center of mass deviations), which is already impaired in patients with PD. While treadmill walking using handrails is widely used in gait rehabilitation, its impact on gait variability is not fully understood. We hypothesize that walking on a treadmill while grasping handrails will increase the complexity of gait variability in patients with PD and be associated with reduced postural instability, reflecting the tight relationship between gait complexity and locomotor stability.

**PROTOTYPING AND FABRICATION OF A VARIABLE SURFACE TREADMILL**

Nick Jaton, Travis Vanderheyden, and Kota Takahashi, Department of Biomechanics, University of Nebraska at Omaha, NE 68182, Jacob Bloom, Neuroscience Laboratories, NASA-Johnson Space Center, Houston, TX 77058

NASA has documented astronauts facing muscular atrophy and sensorimotor alterations from their time in space. This led to the idea of creating a variable surface treadmill for training and rehabilitation purposes. This treadmill will consist of a large number of 25mm by 25mm cells, each of these cells is to be 3D printed using polylactic acid based material. Inside of each cell is a motor connected to a custom designed coupler and an elevating lead screw. In order to drive the motors a pre-built microcontroller was used during the initial design. The prebuilt microcontroller is to be replaced by a custom printed circuit board using multiple microcontrollers combined with an array of motor controllers. The system will allow the user to either create a random surface or adjust each cells value individually. Once prototype development has been completed the variable surface treadmill will be a valuable tool in neuromuscular training and rehabilitation for astronauts.

**CRITERION VALIDATION OF A MOBILE MOTION CAPTURE SYSTEM IN SPACE FOR ANALYSIS OF JOINT ANGLES**

Zhuo Wang, Jung Hung Chien, and Ka-Chun Siu, Department of Physical Therapy Education, University of Nebraska Medical Center, Omaha, NE 68198

State-of-the-art 3D motion analysis systems are suitable for large research laboratory settings because they are expensive and space consuming. Therefore, we sought to extend the functionality of the Mobile Motion Capture system, MO2CA, to automatically detect multiple bony landmarks in space using color-contrast markers. Subjects walked on a treadmill at three different walking speeds: preferred speed, fast speed, and slow speed. Two motion capture systems (a 3D 8-camera system, Qualisys, Sweden and the MO2CA using the iPhone 6, Apple Inc, USA) were used to capture the gait parameters. Paired T-tests were used to investigate the statistical difference between the data outputted from each of the motion capture methods. No statistically significant differences between two motion capture systems in any gait parameter indicates that the newly established mobile motion capture system, MO2CA, yielded accurate results when compared against the gold standard 3D Qualisys system.

**THE EFFECT OF MODERATE-TO-HIGH INTENSITY EXERCISE ON COGNITIVE FUNCTION**

Mary Elizabeth Yeh, Department of Neuroscience, Creighton University, Omaha, NE 68178

The effects of both acute and chronic exercise on cognitive processes (e.g., executive functioning (EF)) is well established in elderly, dementia of the Alzheimer’s type, Parkinson’s Disease, stroke, and ADHD populations. Of the far fewer studies examining how exercise influences language processing, some show that EF-enhancing activities (e.g. taking methylphenidate) also enhance language processing. This study examines how acute, moderate-intensity (30 minutes on a stationary ergometer bike) exercise effects on EF may influence changes in young adults’ language processing. We used English Lexicon Project data to analyze the complexity of participant-generated words from the verbal fluency task.
(VFT), which is administered before, during, and after exercise; the number Stroop task or NST (which also measures language processing) and Eriksen flanker task measure EF and occur before and after exercise. Preliminary analysis reflects significant relationships between exercise and syllable count, orthographical neighborhood, and phonological neighborhood, and NST reaction time.

**NEUROMUSCULAR AND Hypertrophic Adaptations As A Result Of blood Flow Restriction Training**

Ethan Hill, Terry Housh, Cory Smith, Joshua Keller, Richard Schmidt, and Glen Johnson, Department of Nutrition and Health Sciences, University of Nebraska, Lincoln, NE, 68588

Background. Low-intensity blood flow restriction training has been demonstrated to elicit increases in muscle strength and size comparable to training at high intensities without blood flow restriction. Compared to concentric muscle actions, however, eccentric muscle actions are a more potent stimulus to induce favorable adaptations in muscle. The purpose of this investigation, therefore, was to examine short-term eccentric blood flow restriction (Ecc-BFR) versus concentric (Con-BFR) training on muscle strength, neuromuscular, and hypertrophic adaptations. Methods. Twenty-four women volunteered to participate in this investigation and were randomly assigned to either Ecc-BFR (n = 12) or Con-BFR (n = 12). Ecc-BFR trained at 30% of their eccentric peak torque (PT) and Con-BFR trained at 30% of concentric PT. Training was performed 3 times per week for 4-wk and consisted of 75 repetitions each training session performed over 4 sets (1 × 30, 3 × 15). Each set was separated by 30-s of rest. All training and testing procedures were performed on an isokinetic dynameter at a velocity of 120°·s⁻¹. At 0-wk and after 2-wk and 4-wk of training, indices of muscle strength (eccentric PT, concentric PT, and maximal voluntary isometric contraction), neuromuscular and hypertrophic adaptation (efficiency of electrical activity via surface electromyography), and muscle size (muscle thickness via ultrasound) were assessed. Results. Muscle strength (34.9% and 31.5%, respectively) and muscle thickness (13.0% and 9.8%, respectively) increased similarly as a result of 4-wk of Ecc-BFR and Con-BFR. In addition, the increases in muscle strength as a result of the Ecc-BFR and Con-BFR were associated with similar neuromuscular (36.3% and 41.4%, respectively) and hypertrophic (63.7% and 58.6%, respectively) adaptations. Conclusions. These findings indicated that both Ecc-BFR and Con-BFR training at a low-intensity was sufficient to induce favorable adaptations to skeletal muscle strength and size. In addition, there was no additive benefits of performing Ecc-BFR versus Con-BFR on muscle strength or size. Collectively, Ecc-BFR or Con-BFR may be used to promote short-term increases in strength and skeletal muscle mass during spaceflight.

**Structural Investigations Into The Radio-Protective Superoxide Dismutase Enzymes**

Jahaun Azadmanesh, William Lutz, Scott Trickel, Carol Kolar, and Gloria Borgstahl, Eppley Institute for Research in Cancer and Allied Diseases, University of Nebraska Medical Center, Omaha, NE 68198

Superoxide dismutases (SODs) are necessary antioxidant enzymes that protect cells from radiation-generated reactive oxygen species (ROS), in which astronauts are especially susceptible to. Deleterious effects to their catalysis cause significant consequences, such as neurodegenerative diseases, cardiovascular diseases, and cancer. SODs perform their bio-protective role by converting superoxide, a ROS, into oxygen and hydrogen peroxide, which is dependent on two proton transfers. While SODs have proven to be of significant importance, the nature of their catalytic function remains elusive. Investigations have been unable to detect portions of enzymatic activity, such as superoxide binding and proton transfers. Here, we present the X-ray crystal structure of the human MnSOD-substrate analog complex. In conjunction with electrostatic calculations, a model for the binding of superoxide substrate
is provided. Additionally, protonation states have been revealed using neutron crystallography. Together, the work contributes details to how SODs perform their function, which can be harnessed for therapeutic approaches.

**INHIBITION OF RAD52-BASED DNA REPAIR FOR CANCER THERAPY**

Mona Al-Mugotir, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha, NE 68198

DNA double strand breaks (DSBs) are the most toxic form of DNA lesions and their improper repair leads to genomic instability that can manifest in different types of malignancies and neurological diseases. In eukaryotes, homologous recombination (HR) can repair DSBs by recruitment of either BRCA2 or RAD52 to the replication protein A (RPA) coated ssDNA tail. Mutations in the BRCA pathway (including BRCA1, BRCA2, and PALB2) cause improper DNA repair and increased risk for cancer. Interestingly, RAD52 knockout mice have normal phenotype and a functional HR repair implicating the RAD52 pathway is active as a backup with respect to the BRCA pathway. BRCA-deficient tumor cells were shown to survive by reliance on RAD52 activity, presenting an opportunity for targeting this pathway for selective cancer therapy. Preliminary data show that DNA annealing activity of RAD52 is directly influenced by its interaction with RPA. We hypothesize that targeting RAD52 in BRCA tumors with small molecule inhibitors (SMIs) can lead to specific cancer treatments. With this aim, we developed, optimized and conducted a high throughput screen. We screened three different libraries in addition to small peptides of our design for a total of 101,510 SMIs. Eleven SMIs were confirmed to be hits and are being subjected to a number of *in vitro* and *in vivo* tests to investigate their suitability for cancer therapeutic development.

**SOFTWARE-BASED TEACHING OF BIOMECHANICS TO ENGAGE UNDERGRADUATE STUDENTS**

TeSean Wooden and Angel Gonzalez, Department of Health, Physical Education, and Recreation, Amelia Lanier and Kota Takahashi, Department of Biomechanics, Michelle Friend, Anne Karabon, and Nealy Grandgenett, Department of Teacher Education, University of Nebraska at Omaha, NE 68282, Sidney Baudendistel, Department of Applied Physiology and Kinesiology, University of Florida, Gainesville, FL 32611

The study of Biomechanics is inherently interdisciplinary. Biomechanics may be a valuable tool in promoting STEM education within undergraduate students. At the University of Nebraska at Omaha (UNO), we have implemented software-based training to supplement traditional lecture-based teaching. We have redesigned an existing course that was initially catered to those with backgrounds in Exercise Science, Physical Education, Athletic Training, and Biomechanics. The redesigned course emphasized hands-on computer-based training to facilitate active learning within undergraduate students. We hypothesized, that following the completion of this course, students will: 1) show greater awareness of Biomechanics’ role in STEM related fields, and 2) exhibit improved self-confidence of fundamental Biomechanics’ concepts. To date, 90 students consented to participate in this study (28 from Fall 2016, 32 from Spring 2017, and 30 from Fall 2017). Following the completion of the course, students felt more comfortable in describing fundamental concepts (e.g., Newton’s Laws) (p<0.001, Figure 1).
SENSORIMOTOR CORTICAL OSCILLATIONS ASSOCIATED WITH THE PRODUCTION OF A HAND MOTOR ACTION
Rashelle Hoffman and Max Kurz, Department of Physical Therapy, Munroe-Meyer Institutes, Tony Wilson, Department of Neurological Sciences and College of Medicine, University of Nebraska Medical Center, Omaha, NE 68198

Several magnetoencephalographic (MEG) brain imaging studies have noted that the execution of a motor action involves a series of stage-like changes in the neural oscillations of the motor cortices. This includes a peri-movement beta (15-30 Hz) event related desynchronization (ERD), a gamma (>30 Hz) event related synchronization (ERS) at movement onset, and a post-movement beta rebound (PMBR). The presence of the beta ERD and PMBR have been reliably identified across several investigations; however, the gamma ERS has been less consistent. The tasks utilized in prior studies that have not seen the gamma ERS involved stimulus paradigms that provided constant feedback about when the participant should produce the motor action. In this case, the participants had prior knowledge about the timing of the motor action. This study used an alternative paradigm where participants pressed a button with the second or third digit of the right hand depending on the direction of the arrow that was displayed on the screen, which is different from its predecessors because the participant did not have insight about when each arrow would be displayed. Similar to the prior MEG studies, our results displayed a strong beta ERD during movement planning and movement execution, and a strong PMBR after movement termination (P<0.001). More importantly, our stimulus paradigm elicited a strong gamma ERS around movement execution (P<0.001). These results imply that the gamma ERS might occur more reliably when individuals are unaware of the timing of a motor action. Currently, there are limited metrics that can be used to assess the effects of long-term space flight on the neuroplasticity of the sensorimotor cortices. We propose that the movement-related brain oscillations identified in this study could be utilized as neurological indices to monitor these effects, and to optimize rehabilitative strategies that can be used to combat the effects of zero gravity during space flight.

VISUAL MT/V5 CORTICAL OSCILLATIONS ARE ASSOCIATED WITH VISUOMOTOR TASK PERFORMANCE
Jacy VerMaas-Hannan and Max Kurz, Munroe-Meyer Institute, Tony Wilson, Center for Magnetoencephalography, University of Nebraska Medical Center, Omaha, NE 68198

Cortical processing in the visual MT/V5 area is necessary for tracking movement and performing reliable visuomotor transformations. Although the role of this cortical area is well recognized, the association of this cortical area with motor control is not well understood. This study used magnetoencephalography and advanced beamforming methods to image the neural oscillations in the visual MT/V5 area as participants (N= 29) viewed a random array of coherently moving black dots. Separately, the participants also performed a visuomotor behavioral task in a game like environment. To play the game, the participant had to generate an isometric knee extension force in order to animate a frog to ascend vertically and “eat” bugs that were on the pond. The bug’s vertical positions were between 5-25% of the participant’s maximum force. Our brain imaging results revealed that occipito-temporal neural oscillations had a pattern of alternating theta/alpha (5-10Hz) event related synchronizations (ERS) and beta (15-25 Hz) event related desynchronizations (ERD) that were time locked with the moving dots. The strength of the beta ERD in the visual MT/V5 area was negatively correlated with the velocity of the force production (rho= -0.48; P=0.013) and time to match the target (rho= 0.57; P=0.002) during the frog game. These correlations implied that the participants with a stronger beta ERD in the visual MT/V5 area also had a faster force production and matched the targets sooner. Overall, these results suggest that the neural activity within the visual MT/V5 area is well linked with visuomotor task performance. Currently, we have a substantial knowledge gap in our understanding
of the effects of long-term space flight on visual processing. We propose that the simple visual MT/V5
stimulus paradigm developed for this investigation could be used to fill this knowledge gap, and may
provide a reliable neurologic marker of astronauts that need rehabilitation during a long-term space
flight.

TESTING QUASAR OUTFLOW MECHANISMS WITH ACCRETION DISK SIMULATIONS
AND SDSS SPECTRA
Mason Rhodes and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

Using optical spectra from the Sloan Digital Sky Survey (SDSS) quasar archival database,
this investigation seeks to test current models of outflow systems in order to provide a comprehensive
understanding of the mechanisms that drive accretion disk wind outflows from the black holes at the
center of quasars. Simulations of accretion disk wind models from Murray and Chiang are generated
using Python software. Predictions from these simulations will then be compared to the SDSS optical
spectra data. Parameters such as quasar orientation, velocity of accretion disk winds, and the covering
factor, will be investigated to provide an understanding of their role in contributing to the observation of
quasar outflow systems and the mechanisms that drive them.

A STUDY OF VARIABILITY OF AGNs THROUGH DATA ANALYSIS FROM CRTS AND SDSS
Shrey Ansh and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

AGN variability poses a challenging problem to theoreticians. We surveyed over a thousand
targets presented on the CRTS telescope pertaining to AGNs and sorted those targets based on their
variability. We investigated the spectroscopic properties of those targets from the Sloan Digital Sky
Survey. Our study is aimed at explaining the AGN variability and can possibly help understand the
accretion mechanism at large.

OTOLIN-1a AS A BIOMARKER FOR VESTIBULAR DYSFUNCTION FOLLOWING
MICROGRAVITY EXPOSURE IN ZEBRAFISH
Kevin Thiessen, Emily Supe’, and Kenneth Kramer, Department of Biomedical Sciences,
Creighton University, Omaha, NE 68178

Dislodgment or degradation of inner ear bio-crystals, called otoconia, can cause sudden feelings
of dizziness and loss of balance known as vertigo. The most common form of this vestibular disorder
among adults is Benign Paroxysmal Positional Vertigo (BPPV). Although the exact cause of BPPV is
still unknown, elevated plasma levels of a key otoconial protein, Otolin-1 (Otol1), have been proposed
to be an early clinical marker for BPPV susceptibility. We examined Otol1 levels in the blood plasma
of young, adult (3 months old) zebrafish that are genetically predisposed to vestibular defects (i.e.
carry nonsynonymous mutations in the gene tecta) following five days of exposure to low gravitational
forces. Additionally, otoconia were isolated from the inner ear and analyzed for degradation and Otol1
expression. Results suggest that Otol1 could be used to monitor risk for vestibular dysfunction in
astronauts following microgravity exposure.
Creating an easy to use interface that allows a patient to control their prosthesis with ease, while also maintaining low costs, can be increasingly difficult. Our solution to this is the implementation of the MyoBand Gesture Control Armband with a custom control board embedded in the prosthesis itself. The MyoBand enables us to allow for a few control schemes: electromyography based, ‘pose’ based, and movement based. In this implementation, we looked at using the predefined ‘poses’ of the MyoBand, which include making a fist and spreading the fingers of the hand. These two poses defined the ‘closed’ and ‘opened’ states of the prosthetic hand respectively and when interfaced with our control board, it allows the control of the motors on the prosthetic by the user. This implementation with our custom designed control board has been shown to work effectively in our prototypes and will soon be tested with our patients.

TOWARDS NEW SOL-GEL FEEDSTOCKS FOR 3D PRINTABLE GLASS INK FORMULATIONS
Joel Destino, Department of Chemistry, Creighton University, Omaha, NE 68178

Fused silica glass optics and ultralow expansion (ULE) silica-titania glass optical mounts are key components in the area of space optics. From a design perspective, much of the creative space for designing new fused silica optical components is limited by conventional processing methods which require the use of bulk melts, constraining the optical designer’s toolbox. For example, the ability to fabricate unique geometries with very fine features, or the ability to make parts with multiple compositions (i.e. silica and silica-titania). Towards this end, our research seeks to expand optical design space by developing new nanoparticle feedstocks and improving existing nanoparticle ink formulations for fabricating glass by direct ink write 3D printing. In this presentation, we report recent progress in this area.

AERONAUTICS AND SPACE SCIENCE
SESSION B

UNL ROBOTICS MINING COMPETITION TEAM 2017/2018
Ethan Brush, Department of Mechanical and Materials Engineering, University of Nebraska, Lincoln, NE 68588

The objective of the NASA Robotic Mining Competition is to design and build a mining robot that can traverse a treacherous Martian simulated terrain, mine Martian sand and ice simulant, and deposit the materials into a collection bin. Divided into subgroups, students from all majors work together to engineer a 100-pound machine. Months are spent brainstorming and prototyping different ideas before the robot is assembled and the electronics are wired to precisely control each movement. The software team is tasked with allowing the robot to be remotely controlled from another room with limited communication, so the robot must use and process data from various onboard sensors in real-time to make decisions on where to move and what tasks must be completed. Furthermore, weeks of testing are needed to refine the implementation and to ensure everything is ready for the competition or a real-world deployment.
AUTONOMOUS FLIGHT AND OBJECT TRACKING FOR UNMANNED AERIAL VEHICLES

Daric Teske and Elliot Sandfort, Department of Computer Science and Engineering, University of Nebraska, Lincoln, NE 68588

The 2017-2018 UNL Aerospace Club UAV Design Team is a design team focused on furthering the field of autonomous computing by competing in the International Aerial Robotics Competition. We will build an unmanned aerial vehicle (UAV) that detects objects and performs automatic path planning and navigation. The drone must be able to autonomously navigate a 20 by 20 meter grid, detect small externally controlled ground robots with random behavior, and guide the robots to one side of the grid through making physical contact with the robots. The drone must perform all these actions without any human influence, operating solely from pre-programmed routines. Object recognition is done through image processing of a live video stream using neural nets. The UAV also uses an array of ultrasonic sensors, cameras, optical flow sensors, inertial measurement units, and altimeters to calculate its position, as well as the positions of the robots.

DEVELOPMENT OF A DEPLOYABLE AND RETRACTABLE BOOM AND SOLAR PANEL ARRAY FOR SPACE PLATFORMS

Amy Price, Elizabeth Balerud, Michael Cox, Zach Bonick, Kyle Fitch, Ryan Green, Nate Jensen, Ethan Krings, Augie McClanahan, Brandon Warren, and Renick Wilson, Department of Materials and Mechanical Engineering, Andrew Reicks, Michael Fay, and Daniel Van Kirk, Department of Electrical and Computer Engineering, Alexa Aikens, Department of Information Science and Technology, Torri Osantowski, Department of Economics, Megan Pamperin, Department of Biological Systems Engineering, University of Nebraska, Lincoln, NE 68588

Suborbital sounding rockets carry scientific payloads above the Earth allowing observation in microgravity. Optimal sub-orbital research often involves deploying hardware a certain distance from the rocket, either to control exposure conditions or to obtain measurements free from the rocket’s interference. There is a need within the sub-orbital fleet for the capability to easily deploy and retract experiment hardware. A prototype that uses a SHEArthur-based Rollable Lenticular-Shaped and low-Stiction (SHEARLESS) boom was designed for this application. This project’s boom will also deploy a flexible solar panel array. The payload will launch on a Terrier Improved sounding rocket. At apogee, while in microgravity, the boom and solar panel array will deploy, dwell, and retract. To verify success, video and sensor data will be both stored on board and telemetered.

DEVELOPMENT OF A 3-LEG 6-DOF ROBOT IN RRRS CONFIGURATION

Nathan Jensen and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska – Lincoln, NE 68588

The use of parallel-leg robots continues to become more prevalent across a wide spectrum of fields including medicine, manufacturing, and other areas where the performance of serial manipulators is inferior. The widespread set of applications for parallel robots, however, does not free them from the need for improvement or the mitigation of relevant problems, such as limited workspace. In order to increase the scope of the workspace, a 3-leg 6-DOF robot is proposed; each leg has a similar configuration with three rotational joints and a spherical joint (RRRS). This parallel robot controls the end effector platform’s position by actuating two rotational joints at the base of each leg. The axes of these joints intersect in the center of a differential gear train that allows motors to drive the legs while remaining fixed relative to the base. A prototype of this mechanism was developed, and data describing the true workspace and motion of this manipulator was recorded and analyzed.
RASPBERRY PI ROVER
Christopher Armstrong, Department of Information Technologies, Western Nebraska Community College, Scottsbluff, NE 69361

My project idea was to create a Mars type rover robot. For the first part of my project I designed the chassis with Autocad Fusion 360 and printed the chassis and other parts of the robot with PLA filament on a MakerBot 3D printer. The second phase of the project consists of getting all the electronic parts and building the physical robot. The final phase of the project is programing and collecting environmental and video data from the Raspberry Pi powered robot.

INFLUENCING ROBOT SWARMS VIA EXTERNALLY INJECTED ROBOTIC AGENTS
Ryan Lankin, Department of Computer Science, University of Nebraska at Omaha, NE 68182

The ability to influence or manipulate the behavior of swarms is a relatively new field of research with many potential practical applications. Most commonly, this is accomplished by inserting into the swarm one or more external agents that maneuver in such a way so as to alter the behavior of a subset of the swarm. Existing literature on swarm influencing has mainly focused on swarms of simulated agents, while making limited assumptions about practical aspects of robotic systems such as finite sensing and communication ranges. In this project, we are investigating novel swarm influencing techniques on robot swarms by placing influencing “leader” robots, with varying degrees of influence, at strategic locations inside the swarm, inspired by large scale network influencing and information flow algorithms. Empirical simulations on a high-fidelity robot simulator with swarms of different sizes performing navigation in different environments are being used to validate our proposed techniques.

INFORMED PATH PLANNING FOR MULTIPLE ROBOTS UNDER COMMUNICATION CONSTRAINTS
Brad Woosley and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

In the unmanned exploration of extraterrestrial surfaces, or when collecting valuable information after disasters, teams of autonomous robots can be deployed to collect and communicate the information to a central server. The environment is often initially unknown and communications between robots are unreliable and intermittent. We propose a unified solution to this problem where each robot uses Gaussian processes (GPs) to model the distribution of information entropy and communication signal strength in the environment. The two GPs are combined into a single objective function representing the utility of different candidate locations to explore and solved as a constrained utility maximization problem. Robots periodically share their collected information and exploration locations with each other to avoid repeated exploration. Initial simulation experiments show that our proposed approach improves on the distance required to reach similar estimations of the phenomena of interest compared to an approach based on information entropy and distance alone.

IMPROVED REWARD ESTIMATION FOR EFFICIENT ROBOT NAVIGATION USING INVERSE REINFORCEMENT LEARNING
Olimpiya Saha and Raj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

Extra-terrestrial navigation and path planning have been an area of substantial interest for NASA. For completely adopting an autonomous model, improved path planning techniques need to be developed which will invoke reliable navigation in an unfamiliar environment without human
intervention, and, thus, avoid communication delays. In this work, we consider a well-known machine learning-based framework called reinforcement learning which typically uses a simple, sparse reward function to determine the optimal action for the robot in different parts of the environment. To enable the robot with faster decision-making capabilities, we utilize an advanced machine learning technique that helps the robot to estimate an appropriate reward function by adaptively adjusting the rewards associated with robot maneuvers or actions whenever it is required to perform navigation tasks in unknown complicated environments. Our experimental results illustrate that our algorithm has a higher time efficiency compared to the other state-of-the-art variants of reward function.

**TOWARDS ROBUST CLASSIFICATION IN ADVERSARIAL LEARNING USING BAYESIAN GAMES**

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

Online classifier systems (OCS) are artificial intelligence and machine learning-based software that serve as a sentinel for information that passes through them. OCS are very relevant in space-based systems including spacecraft and rovers, to ensure that incoming information from the spacecraft’s sensors to the spacecraft’s autonomous controller has not been compromised, so that the spacecraft can continue to operate as intended. However, to jeopardize the operation of a system like a spacecraft, malicious entities attempt to compromise the OCS so that it makes mistakes in validating information passed to the spacecraft, resulting in not flagging down corrupt information. In this project, we are investigating techniques that can make an OCS robust to such attacks from malicious adversaries. Recently, a framework called generative adversarial networks (GANs) was proposed that models the interaction between the OCS and the adversary as a game, called a zero-sum game. In this presentation, I will describe my ongoing work to extend the underlying game between an OCS and an adversary using a Bayesian game that allows the OCS to build a behavior model of the adversary and use it to predict what the adversary’s next move would be, while accounting for uncertainty in the adversary’s behavior.

**SUPERPOSITIONING WITH HIGH POWER LASERS FOR MID-AIR IMAGE FORMATIONS**

Auston Viotto, College of Engineering, University of Nebraska at Omaha, NE 68182

This research evaluates different methods to create voxels, 3-dimensional pixels, in air without the need for special glasses or reflections off of surfaces. Research on the advantages of superimposing or the culmination, focusing, of laser light will be conducted. The point of superpositioning/culmination will be evaluated by the brightness of the voxel due to the Rayleigh Scatter Effect. The voxel’s brightness is dependent on the laser output strength and inversely proportional to its wavelength. Once a superimposed/culminated voxel has been created in the lab the next step will be to manipulate the location of the voxel through 3-dimensional space. This research will discuss different techniques to move the voxel including the use of high-speed scanning galvanometer mirror positioning system or rotating wedge prisms to control beam steering. Once the voxel is able to be efficiently manipulated the next step will be to create a latent image, hologram, in 3-dimensional space.

**INTERFACIAL ION TRANSPORT UNDER NANOCONFINEMENT IN ENERGY CONVERSION DEVICES USED FOR SPACE SHUTTLE APPLICATIONS**

Shudipto Konika Dishari, Department of Chemical and Biomolecular Engineering, University of Nebraska, Lincoln, NE 68588

Fuel cell is one of the major components of power generation subsystems and a powerful energy conversion device for terrestrial and aerospace applications. However, fuel cells suffer from low
power density due to high hydration mediated ion transport resistance at ionomer-catalyst interfaces of the electrodes of fuel cells. However, while proton conductivity of several tens of micron thick bulk membranes are studied a lot, very little is known about the local hydration environment and its impact on ion conductivity in sub-micron thick ionomer films under confinement. This NASA-Nebraska Space Grant supported work aimed to explore the interfacial proton conductivity and local proton conduction environment in nanoconfined polymer thin films for regenerative fuel cells using fluorescence and, impedance spectroscopy. Correlating the proton conductivity values with local proton concentration and pH offered great insight into the extent of proton conduction under extremely confined state.

CONDUCTIVE CONCRETE ELECTRICAL FILTER FOR ANECHOIC CHAMBER APPLICATIONS
Mikayla Schlegel, Emiliano Montemayor, and Lim Nguyen, Department of Electrical and Computer Engineering, University of Nebraska, Lincoln, NE 68588

Conductive concrete with its electromagnetic absorption property can benefit the construction and performance of anechoic chamber for testing spacecraft antennas and structures. Electrical cables entering and leaving the chamber must pass through electrical filters that block conducted interference signals. The absorption property can be exploited to perform filtering by embedding electrical cables in a conductive concrete trench so that the configuration constitutes a lossy transmission line that attenuates conducted signals. In this NASA Mini-Grants project, a 2ft x 2ft x 10ft conductive concrete prism was cast and embedded with nine wiring configurations of shielded and bare cables for evaluation. Frequency response measurements with a Keysight E5071C vector network analyzer demonstrated for the first time that the signal attenuation was better than 100dB above 100MHz. By cascading the prism with a low-pass filter, the overall structure exceeded the mil-std-188-125 attenuation requirements, with a low frequency attenuation better than 80dB at 10MHz.

GEOLOGICAL PROPERTIES OF ROCK ANALOGS FOR THE MARS 2020 ROVER MISSION
Miles Chasek and Michael Leite, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

Workers at NASA's Jet Propulsion Laboratory (JPL) use a set of eight terrestrial rocks to test the Sampling and Caching Subsystem of the Mars 2020 rover. Referred to as the Mars Analog set, these rocks have mechanical properties which are similar to rocks that may be encountered on the surface of Mars. At JPL, information on the Mars Analog set is hosted on a series of internal wiki pages known as the Geo-Analogs Multi-User Tool (GAMUT). GAMUT has received infrequent and fragmentary updates since its creation, and as a result, it sometimes contains inaccurate and incomplete information. In order to update the information hosted on GAMUT, the geological and physical properties of the Mars Analog set were described through a series of laboratory analyses. The physical and lithological characteristics of the Mars Analog set were determined using thin-sections, grain-size distribution from sieve and pipette methods, and porosity analysis. These data can be used to increase the accuracy of information hosted in GAMUT.

SAND TABLE HURRICANE EXPERIMENT
Rebecca Kraxberger and Jolee Smith, Department of Education, Jeremy Weremeichik and Ann Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

This experiment was done with the students from a middle school in conjunction with their
early release program. The NASA grant that Chadron State College received paid for the experiment. To prepare the students for the hurricane experiments, we prepared a PowerPoint presentation on the effects of the current hurricanes, Irma and Harvey. We discussed what causes hurricanes, storm surges, hurricane categories, and the potential damage. We also showed a video of the actual damage caused by Hurricane Irma and discussed how it affected the people who lived there. We gave the students jumbo Legos, fake trees, Lincoln Logs, rocks, foam, coconut halves (could be used as boats), and a flat sand table. They were instructed to build a city anyway they wanted, using the resources provided, that could withstand a hurricane. We gave the students fifteen to twenty minutes to build their city and only asked them questions to help them build it. After that time, we turned on the sand table to the highest setting to see how their city stood up to the force. We also held up fans to be the wind that a town would experience during a hurricane. The students quickly learned that their town was not going to hold up to the effects of the hurricane. They tried to rebuild by pushing sand back up but it failed. We stopped the simulation and talked about what their town experienced and how it could be improved the next time. The students were given another chance to build their city with the changes that they made based on what they learned from the first trial. While their city still fell apart, a lot of their problems from the first trial were fixed or happened after a longer period. The students made a pathway and moats for the water to go through to help the city stay intact. They also buried their houses more into the sand to help provide a foundation for them. One of the students found a metal bowl that was in the classroom and used that as the foundation for his home. Some of the students also added rocks to the river they built for the water to make it stronger. Overall, the students had a lot of fun participating in this experiment and the hands-on experience helped them understand the effects of a hurricane.

**SPACE MATERIALS SCIENCE MENTOR-INTERN PAIR EXPERIENCE**

Madison Royse, Department of Chemical Engineering, Jowe Tombi, Department of Electrical Engineering, Audrey Vega and Julianna Rodriguez, Department of Bio Systems Engineering, University of Nebraska, Lincoln, NE 68588

Educational outreach is an initiative that benefits both the students and the educators: the educators are exposed to new scientific concepts, and the students improve their science communication and professional development skills. The tasks of the grant awarded to the Nebraska Center for Materials and Nanoscience (NCMN) at the University of Nebraska was for mentor/mentee undergraduate student teams to adapt, develop, and present new hands-on education and outreach activities focused on STEM/aerospace related materials and technology. The outreach conducted took place at two local Title 1 middle schools, both with diverse student bodies. The teams created a twelve-week program with hands-on activities presented in weekly installments for middle school students and developed new outreach kits that covered STEM/aerospace related topics. The work of this grant will be continued by conducting education programs at additional middle schools and implementing the newly developed aerospace-themed kits at future outreach events.

**USING NASA-BASED TOOLS TO STUDY ADAPTATION, RESILIENCE AND SUSTAINABILITY IN NATURAL AND SOCIAL SYSTEMS IN THE NEBRASKA SANDHILLS**

Mary Ann Vinton, Department of Biology and Environmental Science, James Leighter, Department of Communication Studies and Sustainability Studies, Creighton University, Omaha, NE 68178

The Sandhills region of Nebraska is one of the most unique biophysical systems in North America. The largest area of stabilized sand dunes in the western hemisphere, the Sandhills contain unfragmented grassland habitat and unparalleled ground water resources. Due to the inherent fragility of soils, the region escaped large scale conversion to row crop agriculture and instead cattle ranching
on native grasslands comprises 95% of the land use. We are using NASA-supported tools to explore questions about the adaptation, resilience and sustainability of the natural and social systems in this region in the face of stressors like weather extremes (e.g. drought) with associated declines in soil stability, biodiversity and productivity. In addition, stressors to the social system include population decline, single industry dependency, public service scarcity and consolidation, urban pressure, and diminishing local governmental control. Initial efforts revolve around using satellite imagery and drone photography to study landscape change in wet vs. dry years. In addition, we are interviewing residents and using ethnographic analyses to study the understanding of and response to drought and other challenges to livelihoods. We present preliminary results which highlight the response of different parts of the landscape (e.g. dunes vs. wet meadows) to drought and the ways landowners speak about and conceptualize adaptive response to environmental change.

**USING SATELLITE IMAGERY TO CHARACTERIZE LAND COVER CHANGE IN THE DISMAL RIVER HEADWATERS REGION OF THE NEBRASKA SANDHILLS**

Chris Meehan and Mary Ann Vinton, Department of Environmental Science, Creighton University, Omaha, NE 68178

In 2017, we began a study on biodiversity and landscape change in the Dismal River headwaters region in the Nebraska Sandhills. The Dismal River headwaters has been designated as a “biologically unique landscape” by the Nebraska Natural Legacy Project, based on the existence of native species, at-risk species, and natural communities in native grasslands used for cattle grazing. We did preliminary field surveys of plant species and analyses of 33 years of LANDSAT imagery and 10 years of NAIP imagery to study change through time and responses to variation in precipitation. In addition, we are using imagery to detect responses of different portions of the landscape (dry dunes vs. wet meadows) to variation in rainfall. Preliminary results suggest that grasslands in this region have high biodiversity, perhaps due to the inherent heterogeneity of the landscape. Further, preliminary results suggest that vegetation cover (indexed by NDVI in imagery) varies spatially and temporally, with some indications of especially sharp decreases in low rainfall years on dune surfaces. Our results are important in assessing the degree to which the Nebraska Sandhills contribute to conservation of biodiversity and ecosystem function in native grasslands.

**DOES WILDLIFE BEHAVIOR CHANGE IN RESPONSE TO A SOLAR ECLIPSE**

Robert Ritson, Nate Bickford, and Dustin Ranglack, Department of Biology, University of Nebraska at Kearney, NE 68849

A total solar eclipse is a rare occurrence that has inspired scientific curiosity for centuries. Research opportunities provided by this unique event are not limited to astronomy, but wildlife behavior as well. Unusual wildlife behaviors in response to these events have been documented intermittently for centuries. However, the infrequency of these events make quantifying behaviors difficult. The eclipse over North America on August 21, 2017 offered a unique opportunity to connect the movements of celestial bodies to those of wildlife. Here, we compare patterns of movement speed and distance for a variety of wildlife species for the day of the eclipse with the weeks before and after, using data contributed by numerous institutions across the path of the 2017 solar eclipse, with the ultimate goal of identifying if wildlife behaviors change as a result of the solar eclipse and to what extent. The outcomes of this study will provide a baseline for future behavior studies of animals during solar eclipse events and identify particular species or behaviors of interest for future studies.
Growing crops on Mars may be important for future explorers there. Some crops are not amenable to hydroponic systems. Our previous work with Orbitec Martian soil simulant soil showed that the addition of water to the material created a hard, solid aggregate that appeared to inhibit both water penetration and plant growth. In this experiment we sorted the Martian soil simulant by particle size. We then tested if the sorting the material by size provided for better plant growth. We created simulant soil particle sizes classes of: >0.71 mm, 0.71 - 0.50 mm, 0.50 - 0.25 mm, and < 0.25 mm. Observations indicate almost all size fractions improved plant growth compared to unsorted. There also appears to be plant biomass differences between size fractions. This type soil treatment could readily be done by Martian astronauts, ameliorating the need to lift heavy (and thus expensive) soil amendments to Mars.

At College of Saint Mary (CSM), we developed a new 18-credit hour academic minor in Environmental Sustainability and it allows students from various majors to develop a broad understanding of sustainability, including how environmental concerns intersect with economic and social justice issues. The project goal was to increase students’ understanding of sustainability issues through activities such as classroom education, seminar lectures and sustainability awareness events, hands-on activity workshops, field trips, and community garden/composting projects. The project also helped local elementary teachers as environmental education materials were used in CSM’s Elementary Science Teachers Outreach workshops. The project helped to increase students’ and teachers’ awareness on climate change, minimalism and sustainable living.

As part of a long-term theoretical and computational study of wake turbulence, the boundary layer theory has been closely examined starting at the simplest cases. First, the case of a laminar boundary layer flow at a zero pressure gradient on a flat surface, for which the Blasius solution, a solution derived from the Navier-Stokes equations, was investigated. A numerical code was developed to simulate flows using the Blasius solution. Second, the Falkner-Skan equations, which represent a flow across a non-flat surface, were studied, and a subsequent numerical code was produced. The next step in the project will be to begin to study a turbulent boundary layer flow as well as flow separation, in order to simulate wake turbulence.

Purpose/Hypothesis: To determine the effects of fatigue on jumping performance and lower extremity biomechanics. Subjects: Individuals with a history of ACL-R and matched healthy controls.
Materials/Methods: This study is cross-sectional in design. Prior to data collection subjects completed three patient-reported outcome measures (IKDC, KOOS, and ACL-RSI). The dominant limb (the leg use to jump off for maximal height) or uninvolved limb was tested first. Subjects performed six single leg forward hops for distance (cm) followed by a fatigue protocol and three forward hops. Lower extremity kinetics and kinematics were collected using motion capture and embedded force plates. Changes in hip, knee, and ankle angles and moments were compared before and after the fatigue protocol. Results/Conclusion: This study is currently undergoing data collection. We hypothesize fatigue will impact jumping performance and cause biomechanical changes in the lower extremities. The study has clinical relevance in determining return to sport criteria following ACL-R.

A COMPARISON OF BALANCE IN SMOKERS AND NEVER-SMOKERS.
Robert Barber, Jennifer Yentes, and Danae Dinkel, Department of Biomechanics, Adam Rosen, School of Health, Physical Education, and Recreation, University of Nebraska at Omaha, Terry Grindstaff, Department of Physical Therapy, Creighton University, Omaha, NE 68178.

Cigarette smoking has been shown to have negative effects and cause numerous chronic conditions. One condition of note is chronic obstructive pulmonary disease (COPD), which is known to have adverse conditions outside of the respiratory system, such as deficits in balance. Smoking has also been shown to produce ultrafine particles, which when inhaled produce an inflammatory response in the pulmonary system. Astronauts are at risk for inhalation of ultrafine particles during spaceflight, which illicit inflammatory processes much like smoking. The purpose of this study is to compare balance between smokers and never-smokers and assess deficits. Fifteen current smoking and fifteen never-smoking adults complete clinical and laboratory balance tests that tease out the visual, vestibular and somatosensory systems, which control balance, and determine deficits based on those systems. Data collections for this research project are still ongoing.

COMPUTATIONAL FLUID DYNAMICS ON DRAG REDUCTION IN TURBULENT FLOWS VIA BODY FORCES
Thomas Hafner and Jae Sung Park, Department of Mechanical and Materials Engineering, University of Nebraska, Lincoln, NE 68588

Our research focuses on the effect of an external body force on turbulent flows. More specifically, we investigate the effect of a body force on the levels of drag reduction in a turbulent flow. Drag reduction in a turbulent flow contributes to reductions in energy consumption. In general, the body force has four adjustable variables. They are the magnitude of force, penetration depth, time period of oscillation and wavelength. We conducted a number of simulations to study the effect of changing the values of these variables on the drag reduction. The end goal of our research is to discover how to optimize these variables and the body force to lead to the maximum drag reduction and energy savings. All of this research was done computationally through turbulent flow simulations.

A MULTIDECADAL ANALYSIS OF ABOVEGROUND BIOMASS DECLINES AND CONTROLLING VARIABLES FOR THE KEYSTONE SALT MARSH SPECIES, SPARTINA ALTERNIFLORA, IN COASTAL GEORGIA
John P. O’Donnell, Nicholas Nealy, and John F. Schalles, Department of Environmental Science, Trek Mizoguchi, Department of Biology, Creighton University, Omaha, NE, 68178, Christine M. Hladik, Department of Geology and Geography, Georgia Southern University, Statesboro, GA 30458

We studied aboveground biomass dynamics and spatial patterns of Marsh Cordgrass, Spartina
*altermiflora*, on the Central Georgia Coast. This keystone species accounts for 98% of the aerial extent of salt marshes in Georgia and comprise about 33% of all salt marsh on the U.S. Western Atlantic Coast. Geospatial techniques were used to scale up *in situ* biomass measurements within the NSF Georgia Coastal Ecosystems research domain on the Central Georgia Coast to landscape scale estimates using 290 Landsat 5 TM scenes from 1984 to 2011. Climate and hydrological variables were then used to explain variations in aboveground production for each of the three height classes of *S. alterniflora*. River discharge, total precipitation, minimum temperature, and mean sea level had positive relationships with and best explained biomass variation for all dates. Over the 28-year study period we documented biomass declines of 31.6 %, 33.4 %, and 38.7% for tall, medium, and short *S. alterniflora* height classes. These biomass declines were linked to increased drought severity and frequency over the last half of our study period. We then applied a larger, synoptic scale approach to riverine and tidal watersheds containing 620 square kilometers of *S. alterniflora* marshlands on the Georgia Coast (Savannah River to St Simon’s Sound) and found similar inter and intra-annual biomass patterns. Importantly, *S. alterniflora* biomass production was greatest in areas closest to larger inputs of freshwater and high precipitation. We infer that these areas of high production, especially in the Lower Altamaha River Watershed, were better buffered against drought stress, including soil salinization, and also experienced greater nitrogen loading rates. Overall, this much larger study area experienced a 20.6% average decline, representing a reduction of about 108,000 MT in aboveground live carbon biomass. This loss in marsh production affects valuable ecosystem services, including wetland soil carbon sequestration, and organic matter export (both particulate and dissolved). Thus, declines in marsh production may significantly reduce nutritional support to food webs and carbon biogeochemical cycling, as well as commercial fish and shellfish production, in Georgia’s estuaries and coastal ocean ecosystems. Finally, we are carrying our analyses forward using newer Landsat 8 OLI imagery.

**USING LANDSAT IMAGERY TO ESTABLISH BASELINE DATA FOR THE HEALTH OF AN NSF LTER FRESHWATER TIDAL FOREST SENTINEL SITE IN COASTAL GEORGIA**

Jennifer Mucci and John Schalles, Department of Environmental Science, Creighton University, Omaha, NE 68178

Beginning in 2014, monitoring for sea level rise impacts began at the westernmost site of the NSF Georgia Coastal Ecosystems Long Term Ecological Research Project (Station GCE 11, a freshwater tidal swamp forest). GCE 11 serves as a sentinel site for measuring long term changes in salinity, water depth, and temperature (Seabird Sonde placed at Lewis Creek on the Lower Altamaha River) and swamp forest health (*in situ* measurements of tree growth with dendochronometers, forest litter-fall, and net sedimentation rates). Early evidence of tree decline along coastal plain rivers exists for individuals and small stands of cypress at several sites, including the mouth of the Altamaha River, the nearby Darien River, and the Ogeechee and Savannah Rivers further north. Using remote sensing techniques, our lab’s goal is to establish a baseline for changes in vegetation that predates and is also synchronous with monitoring at GCE 11. We are currently using 240 Landsat 5 TM images (path & rows 16/38 and 17/38) collected between 1984 and 2011 and Landsat 8 OLI images (2013- present). Our primary focus is assessment of seasonal changes in vegetation canopy in delineated swamp forest stands and longer-term, interannual changes in vegetation density and health within these stands. Our monitoring stands were selected as geo-referenced polygons with varying hydrologic regimes and vegetation composition, using the USFWS National Wetland Inventory GIS database. We are using ENVI 5.4 (Environment for Visualizing Images, Harris Inc.) forest health vegetation indices to consistently extract polygon-delineated pixels for each stand in order to answer our primary research questions: (1) Are directional changes present in seasonal phenologies and, or inter-annual patterns of forest health, and, if present, (2) are these changes relatable to patterns in NOAA tide gauge data for Georgia, USGS discharge data for the Lower Altamaha River, and GCE Site 11 field monitoring data?
COMBINED COHERENT ANTI-STOKES RAMAN SCATTERING AND TWO-PHOTON EXCITATION MICROSCOPY: LABE-FREE VISUALIZATION OF MICROBE-MINERAL MIXTURES
Anthony Kohtz and Karrie A. Weber, School of Biological Sciences, Xi Huang, Yongfeng Lu, Department of Electrical Engineering, University of Nebraska, Lincoln, NE 68588

Development of rapid, specific, and label-free methods for visualizing microbial interactions provides the opportunity to rapidly observe microbial-mineral interactions in environmental samples. Combined Coherent Anti-stokes Raman Scattering (CARS) and Two-photon excitation (TPE) offer unique label-free methods for rapidly probing microbial-mineral interactions in environmental samples. CARS microscopy visualizes the vibrational contrast of C-H/O-H bonds between the non-resonant background and our sample. TPE allows for excitation of the auto-fluorescent properties of our cells and can be combined with fluorophore labels. Here, we utilized CARS/TPE microscopy to rapidly visualize two cell types, a bacterium and archaem (Escherichia coli and Methanosarcina acetivorans, respectively), and a mineral (CaCO3). Results were verified against DNA stained sample replicates. A methanogenic microbial enrichment grown in the presence of carbonate minerals was also investigated with CARS/TPE methods. This method allowed for differentiation between cells and the carbonate minerals. Thus, CARS/TPE methods are promising for label/stain-free visualization of mineral-microbe interactions.

INCOMPARISON SOIL WATER CONTENT MEASUREMENTS USING SMAP REMOTE SENSING AND PROBE-BASED DATA
Erika Bowman, Department of Biological Systems Engineering, University of Nebraska, Lincoln, NE 68588

On January 31, 2015, NASA launched the Soil Moisture Active Passive (SMAP) spacecraft that collects global surface soil moisture data (depth of 5 cm) at a resolution of 5.6 miles. The mission has the potential to provide more widespread data collection for soil moisture, a key variable in many water, biochemical, and energy cycles and also inherently spatiotemporal variable in nature. However, it is important to validate the SMAP data with soil moisture data collected on the ground. The motivation for this project to perform a comparative analysis between the SMAP observational and in-situ soil moisture data while considering variable components such as evapotranspiration, soil type (moisture storage capacity), and vegetation cover. If the SMAP data has proven accuracy, then advancements in hydroclimatology can be made by having a consistent data supply to act as an input for climate change predictability models. This project uses the Variable Infiltration Capacity (VIC) hydrologic model to compare neutron probe data from Nebraska fields with SMAP data at the Level 4 model data. By analyzing the water content at each soil depth, this project shows the difference in model data.

OPTIMIZATION OF EX SITU SULFIDATION OF Cu2ZnSnS4 (CZTS) THIN FILMS FOR USE AS COUNTER ELECTRODES IN DYE-SENSITIZED SOLAR CELLS
John Sunderland, Department of Physics, Creighton University, Omaha, NE 68178

My prior research investigated the ex situ sulfidation synthesis of copper sulfide (CuS) thin films for optoelectronic applications. Those promising results yielded phase-pure CuS films with optimized properties. This same ex situ sulfidation process was applied to synthesize Cu2ZnSnS4 (CZTS) thin films for 3rd generation photovoltaic applications, namely as a counter electrode in dye-sensitized solar cells (DSSCs). DSSCs are widely appreciated as a promising candidate for high-efficiency, semi-transparent, flexible photovoltaic devices, and CZTS is a viable candidate to replace other, more expensive materials, as a counter electrode. The constituents of this material are very earth abundant and low-cost, replacing
key elements of current DSSCs like platinum and indium. The aim of this investigation was to optimize the synthesis process for this new material. I will discuss the reaction conditions to determine the protocols that will yield the highest quality CZTS thin films.

ENVIRONMENTAL MONITORING THROUGH NATIVE PRAIRIE RESTORATION
Aleisa LaBelle, Cornelia Farley Widow, Lorraine Smith, Shelley Kosola, and Marcus Redwing, Department of Math & Science, Nebraska Indian Community College, Santee, NE 68760

This long-term research project will collect weather data, to compare with biological markers. The biological markers we plan to use will be: satellite images (3 x year), weekly time lapse photography, plant inventories (3 x year), micro-rhizome root development analysis (2 x year) and chemical analysis of soils (2 x year). A timely four-plot annual rotation management plan will be implemented consisting of burning, mowing, grazing, and rest. A fifth plot will have no management and will act as our control. We hope to gain knowledge about how weather effects native prairie restoration under these management techniques.

“A COMPARISON OF TWO SENSORS FOR ATMOSPHERIC DATA COLLECTION ON DRONES” – UNO GRADUATE STUDENT RESEARCH THROUGH THE “EDUCATING STUDENTS TO LINK GROUND-BASED MEASUREMENTS TO DATA REMOTELY SENSED BY DRONES AND NASA SATELLITES” PROJECT
Christopher Glueck and Carol Engelmann, Department of Biology, University of Nebraska at Omaha, NE 68182

The “Educating Students to Link Ground-based Measurements to Data Remotely Sensed by Drones and NASA Satellites” project engages University of Nebraska at Omaha (UNO) graduate and undergraduate students in environmental monitoring. This project is developing and testing unique UNO research experiences for students whereby students design and implement their own research projects using remotely sensed data from drones or NASA satellites. This poster demonstrates the science behind a student research project where one goal was to identify and test sensors that can both fly on a drone and accurately collect atmospheric data. A second goal was to determine which sensor provided data in a format that can effectively support undergraduate and high school students conducting their own environmental research using drones.

ROLE OF EMPATHY ON A SOCIAL DECISION-MAKING TASK RELEVANT TO NASA SPACE MISSIONS
Janelle N. Beadle and Abi Heller, Department of Gerontology, University of Nebraska at Omaha, NE 68182

Despite the significant demands of space missions on human sociality, empathy may foster higher quality social decision making. We investigated the role of empathy on a task relevant to social interaction during space missions. Participants included 57 healthy adults 19-89 years (M=64.81). On a social decision-making task, participants decided how to allocate $10 to two different people (actually confederates). In the empathy context, participants read a note from a person experiencing emotional suffering, whereas the control context was a note from a second person describing non-emotional information. Questionnaires assessed empathy and personality. Participants allocated greater monetary resources in the empathy context (p<.001), and empathy was positively associated with monetary allocation [r(57)=.3, p=.01]. Trait agreeableness positively correlated with monetary allocation in the control context [r(57)=.3, p=.02]. Our results may be relevant to crew resource allocation during NASA missions because we find a positive relationship between resource allocation and empathy.
HEALTHY YOUNG CAN FLEXIBLY SWITCH POSTURAL SWAY WITH DIFFERENT STIMULI
Zachary Motz, Takashi Sado, and Mukul Mukherjee, Department of Biomechanics, University of Nebraska at Omaha, NE 68182

One of the major concerns facing astronauts is postural adaptations that occur due to their time in space. The ability to couple with changing environments provides insights into the astronaut’s ability to adapt, however, the ability to ‘uncouple’ has yet to be explored. Uncoupling with a stimulus allows an individual to recalibrate the sensorimotor control of posture in dynamic environments and could be used as a measure of adaptability. The purpose of this study was to develop a paradigm to assess the ability of flexibly switching postural entrainment capacities from one stimulus structure to another. Medial-lateral postural sway was used to track a visual stimulus. The three stimuli used in this protocol were: periodic, chaotic, and random. Current results show healthy young adults can flexibly switch between stimuli. Future directions will be to add more subjects for statistical power and to test this paradigm with different patient populations.

SKELETAL MUSCLE mRNA RESPONSE TO HYPOBARIC AND NORMOBARIC HYPOXIA AFTER EXERCISE
Robert Shute, Caleb Ross, Brent Ruby, and Dustin Slivka, Department of Health and Kinesiology, University of Nebraska at Omaha, NE 68182

Aim: To determine the effects of recovery in hypobaric hypoxia (HH), normobaric hypoxia (NH), and normobaric normoxia (NN) after exercise on gene expression related to mitochondrial biogenesis, myogenesis, and proteolysis. Results: SpO2 was lower in HH (76.02 ± 0.58%) than NH (79.45 ± 0.56%, p<0.001), which were both lower than in NN (96.3 ± 0.17, p<0.001). Heart rate was higher in HH (82 ± 2 bpm) than NH (77 ± 1 bpm, p<0.001), which were both higher than in NN (67 ± 1 bpm, p<0.001). TFAM was unaltered in normobaric normoxia (p=0.465) but increased after HH (p=0.037) and NH (p=0.006) exposure with no differences between HH and NH (p=0.501). MSTN decreased from pre- to post-exercise (p<0.001) in all conditions and was lower in HH compared to NH (p=0.036) and NN (p=0.017). No other differences were noted in genes related to mitochondrial biogenesis, myogenesis, or proteolysis (p>0.05). Conclusion: Recovery in HH after exercise appears to have a greater effect on muscle oxygen transport (SpO2 and heart rate) than NH. Furthermore, MSTN tends to be further attenuated in HH than NH. Caution should be used when translating data obtained in a NH environment to a HH environment.

INTELLIGENT AND HUMAN-AWARE DECISION MAKING FOR SEMI-AUTONOMOUS HUMAN REHABILITATION ASSISTANCE USING MODULAR ROBOTS
Anoop Mishra and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

Modular Self-reconfigurable Robots (MSRs) are robots that can adapt their shape and mobility while performing their operations. We are developing an MSR called MARIO (Modular Robots for Assistance in Robust and Intelligent Operations) to assist patients with spinal cord injury in performing daily living tasks. In this research, we are investigating computational techniques that will enable MARIO to autonomously adapt its shape while performing an assistive task, and, while remaining aware of the human user’s satisfaction in receiving assistance from MARIO. We are developing autonomous decision-making techniques within a computational framework called shared autonomy that will adapt MARIO’s movements in real-time in response to the human user’s actions and haptic feedback to MARIO, while reducing the time and energy expended to perform the currently assigned task. Our
techniques will be validated within simulation as well as on physical MARIO hardware within daily living environments such as kitchens and bathrooms.

**MULTI UAV'S BASED STRUCTURAL INSPECTION PATH PLANNING USING VIEWPOINT SELECTION**

Sai Tarun Battula and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

Autonomous unmanned Aerial Vehicles are being used extensively in structural inspection tasks to inspect bridges, buildings and other structures. The main objective of a UAV in a structural inspection task is to completely cover the exposed surface of the structure, while collecting information from the surface through its on-board sensors including camera, LIDAR, laser, etc. Using a single UAV for autonomously covering a large 3D structure such as a bridge might not be feasible owing to battery limitations of the UAV. To address this problem, we propose a multi-UAV, viewpoint based approach where, first, a set of points around the structure is identified so that the entire structure can be covered while visiting these set of points. Subsequently, the set of points is divided among a team of UAVs so that each UAV visits a subset of the points, while ensuring that the UAVs do not collide with each other and the effort (energy) expended by the UAVs for visiting the points is balanced across the UAVs.

**DEVELOPMENT OF A PLANAR MICROGRAVITY SIMULATOR**

Benjamin Bradley, Nathan Jensen, Katherine Johnson, and Nathan Borcyk, Department of Mechanical and Materials Engineering, University of Nebraska, Lincoln, NE 68588

CubeSats are a popular standardized platform enabling research institutions and space agencies to develop low-cost space missions. The possibility of formation flying and rendezvous of small spacecraft to “construct” a large-scale structure on orbit has been a recent topic of interest. While ground based air bearing and attitude control systems (ACS) testbeds enhance the ability to develop the control algorithms for these maneuvers, these systems are often prohibitively expensive for use at some universities and research centers. A platform for ground-based low-cost planar microgravity dynamics simulation will be presented. The platform will consist of a planar air bearing to float the weight of the entire platform, and an ACS to test translation and yaw maneuvers. A CubeSat will sit on top of the platform fabricated with common Maker Space equipment and COTS parts. This will allow researchers to test how their satellites will behave in a simulated planar microgravity environment.

**ANTHROPOLOGY**

**BONE FLESHERS AS SYMBOLS OF PRESTIGE: EXAMINING A FEMALE GENDERED ACTIVITY IN CHACO CANYON**

Sara Anderson and Carrie Heitman, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Chaco Canyon, in the greater American Southwest, provides a unique setting in which to examine women and their roles in the Ancestral Puebloan past. This arid region allows for investigations of gender represented in the archaeological record due to the ideal preservation conditions. In this study, I evaluate female activities and identity through an investigation of bone fleshers associated with grave goods, skeletal remains, and ethnohistorical accounts. How can gendered activities be determined through these artifacts? And do they demonstrate signals of power and prestige of Ancestral Puebloan women? With the use of legacy data like the Chaco Research Archive, archaeologists can more closely examine the androcentric and ethnocentric biases of past interpretations. Examining the association
between these bone fleshers and female activities permits new archaeological interpretations of gendered activities and symbols of prestige in Chaco Canyon.

**INCREASING RATES OF CHILDHOOD OBESITY: A CONCEPTUAL MODEL OF ARCTIC INDIGENOUS YOUTH HEALTH OUTCOMES**

Maia Behrendt, Department of Sociology, University of Nebraska-Lincoln, NE 68588-0324

One significant area of scholarly inquiry that appears in current literature on the nature of social and behavioral processes has to do with the perceived increase in obesity among Canadian and Greenland Inuit adults and adolescents. This new material, in turn, suggests the need for a re-examination of the standard models that are widely employed for studying food insecurity and nutritional wellbeing. Research reveals that economic, social, and technological factors play important roles in influencing the dietary and nutritional wellbeing of Inuit children. Increasing emphasis is being placed on global warming as a key factor in the rise of obesity rates. For my research, I developed a theoretical and conceptual model whose aim is to enable a more accurate assessment of the impact role of global warming on social and cultural practices among Arctic Indigenous communities. In particular, my research focuses on the measurable impact of global warming on the traditional ethnic practices that play a particularly critical role in shaping Arctic youth health outcomes.

**DIGITIZING PLANT DATA TO EXPLORE ANCIENT COPAN’S CHANGING LANDSCAPE**

Megan Campbell and Heather Richards-Rissetto, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Copan, Honduras, UNESCO World Heritage Site, is one of the most important cultural and commercial sites of the ancient Maya civilization. During this academic year (2017-2018), I have been conducting research with Dr. Richards-Rissetto, Assistant Professor in Anthropology at UNL and CDRH Faculty Fellow, on her MayaCityBuilder Project. The main objective of this project is to investigate sociopolitical and ideological changes during the eighth and ninth centuries in the Copan Valley. To do this we are exploring the current and historical ecological factors of the valley, ceramic typology and usage during this timeframe, and creating 3D visualizations of different aspects in ancient life in the Copan Valley. In the Summer of 2016, I traveled to Copan to re-analyze a subset of ceramics housed at the Centro Regional de Investigaciones Arqueológicas (CRIA). This past academic year I have resumed working with Dr. Richards-Rissetto, forming and expanding the MayaCityBuilder website (mayacitybuilder.org), and conducting research on the botany of the valley that contributes to the MayaCityBuilder’s investigations. In this paper, I will present on this recent work of which I have been collecting data on plant species including average height, elevation found, photographs, and usage of each species, and discuss how these data can help us to investigate potential correlations between the sociopolitical changes and plant usage. We plan on creating both GIS data of species habitats and 3D models of each species to be integrated into a VirtualReality of the Copan Valley to further explore the potential of 3D + GIS for archaeological studies.

**MAPPING THE HISTORICAL CEMETERIES AND BURIAL GROUNDS OF DOVER, NH, USA**

Ellis Codd and Matthew Palczynski, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

This project, funded, in part, by the University of Pennsylvania Museum of Archaeology and Anthropology is part of an ongoing survey of the old family cemeteries and burial grounds located within the present boundaries of the City of Dover, New Hampshire. Dover is the oldest permanent
settlement in the state and contains many dispersed burial grounds in addition to the five main private and public cemeteries. The city has little information on the location and condition of these sites. The goals of this project are (1) to identify, locate, and assess the condition of these sites, and (2) to not only provide open access to the data to the community but actively involve it for input and use in the project. Data for this project draws heavily from the only previous survey of the area, by the late local historian Roy. A. Ackerman, who compiled notes on approximately sixty-four burial grounds in 1989. These data, which include headstone inscriptions and relative locations, do not include geographic coordinates. Data were compared to modern and historical maps and tax plots and likely locations for all sites recorded. In addition, we conducted a field survey to ground-check sites and identified sixteen of the sites listed by Ackerman. We compiled geographic coordinates and basic descriptive data at each site, along with any notes on any transcription errors, and mapped the results using Geographic Information System (GIS). From these data, we created the ESRI Story Map website. This map allows us to visualize the spatial location of verified sites alongside approximations of the remaining sites, while also providing an accessible visual database for the public to view the progress of the project. It is also a flexible medium, allowing data to be manipulated and updated as needed.

MORAL DOMAINS OF NEBRASKA FISHING-PERMIT HOLDERS: IMPLICATIONS FOR PARTICIPATION IN OUTDOOR RECREATION
Nicholas Cole, Christopher J. Chizinski, and Kevin Pope, School of Natural Resources, University of Nebraska-Lincoln, NE 68583-0961

Recruitment and retention of participants to recreational activities like hunting and fishing are readily becoming the focus of many fish and game agencies to maintain conservation funds under the constraints of the North American model of conservation. Given the role that value orientation plays in the preferences and behavior of hunters and fisherman, the perceptions of how moral domains are extended among non-human species may be important to understanding participation dynamics within those activities. We segmented Nebraska fisherman based on their moral perceptions of fish and wildlife and determined the relationships between preferences for outdoor recreational activities alternative to fishing. A dichotomy exists among fisherman moral perceptions, split between anthropocentric (human-centered) and pathocentric (“higher” animal-centered) views of fish and wildlife. Further, a relationship exists between the strength of commitment to consumptive or non-consumptive activities (i.e., birdwatching, hiking) and expressing anthropocentric or pathocentric views. We suggest moral perceptions may constrain recruitment of some segments of active anglers into alternative outdoor recreational activities and moral perceptions may be a predictive latent variable to determining potential participations rates of outdoor recreational activities within distinct populations.

MODELING SIGHT AND SOUND IN ANCIENT MAYA CITIES: MOVING TOWARDS A SYNTHESTHETIC EXPERIENCE USING GIS & 3D SIMULATION
Graham Goodwin, Heather Richards-Rissetto, Kristy E. Primeau, and David E. Witt, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Archaeological analyses have successfully employed 2D and 3D tools to measure vision and movement within landscapes; however, few have investigated sound. Studies that have examined sound tend to focus on non-urban landscapes. In contrast, our research examines both sight and sound in the Ancient Maya city of Copán. For the Ancient Maya the interplay of sound and vision with architecture played a role in shaping the experience of ritual performances. Using Geographic Information Systems (GIS), 3D Modeling, and virtual reality (VR) in combination with archaeological data we are exploring the interplay of sound and vision with architecture in order to interpret locations of performance and the placement of performers in relation to the environment. In particular, we seek to understand how
changes in Copan’s urban fabric from the mid-eighth to the late eighth century influenced everyday experiences within the city. To delve into this issue, we have designed a process that incorporates computational and experiential methods—we apply GIS modeling including viewshed analysis and soundshed analysis using an Urban Digital Elevation Model (Urban DEM) generated from airborne LiDAR and 3D modeling data in combination with an immersive VR headset with spatial sound to facilitate an embodied experience. Together, these varied methods provide data to begin to understand how sight and sound worked in concert to choreograph differential experiences at ancient Maya.

DECIDUOUS TOOTH GROWTH AND RESORPTION IN PAN TROGLODYTES AND PAN PANISCUS

Chase Horn and Emily Hammerl, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

When attempting to reconstruct the developmental profile of our fossil ancestors, we must look to the most prominent element of the fossil record: the teeth. This project builds upon a strong field of research that demonstrates the utility of interpreting both somatic and sexual development through the dentition. Unfortunately, the field has largely ignored the deciduous (milk) teeth in analysis. As the deciduous teeth are developing and eroding during many of the crucial periods of growth where we differ the most from our closest living primate relatives, a renewed effort in collection of deciduous dental developmental data is warranted. This project seeks to identify common and unique patterns in the development of the transitional dentition within and between chimpanzees and bonobos and will focus on the period of overlap between the permanent and deciduous dentitions in order to capture the variability present during this crucial period of growth. Documenting the calcification of the deciduous dentition in chimpanzees, and comparing their pattern with that of bonobos, is a first step in better understanding the uniqueness of the human developmental condition. By documenting the pattern of integration of the permanent and deciduous teeth in two closely related higher primates, this project will provide the data necessary for more informed interpretations of the mixed dentitions of juvenile fossil primates.

SUBSISTENCE HUNTING AND INDIGENOUS RIGHTS OF THE KALAHARI SAN

Emily Jensen, Wayne Babchuk, and Robert Hitchcock, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

For nearly two decades the San of the Central Kalahari Game Reserve (CKGR) in Botswana have faced a number of difficulties brought on by their government. They have faced persecution. Illegal removal from their lands, denial of basic human rights and more, drawing the attention of multiple national and international groups concerned with human rights and the rights of indigenous people. The government's motives in many of their decisions concerning the San remain elusive, but looking at the actions and outcomes of the policies and actions carried out by the government concerning the San suggest that their motives should not be taken at face value. An in-depth analysis of Botswana's policies and actions regarding the San of the CKGR suggest a need for a significant review of their policies and actions. These policies and actions will be discussed along with various motives, statements and outcomes in order to demonstrate this need for a review by the Botswana government of their policies and actions regarding the San of their country.
HIGH RESOLUTION SFM MODELING AND VIRTUAL REALITY INTEGRATION
Cole Juckette and Heather Richards-Rissetto, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Modeling has become an increasingly popular method for visual and spatial analysis in archaeology, and SFM based photogrammetry has become one of the more affordable options compared to Laser or light scanning. Despite its comparatively low cost SFM can offer extremely high resolution models with photo realistic textures. Following rules for High-Res workflow design, highly accurate models of freestanding objects and structural facades including sculptures of jaguars and the Mayan sun god in the east court were created on a computer running adequate hardware during the summer field program in 2017, then working with the MayaCityBuilder project, models of structures and objects are formatted and ported into the Copan virtual reality program where they are displayed for users in 3D using the Oculus Rift VR headset. Doing this shows the objects connected with their contextual surroundings visually though the environment is generated instead of physical. In order to complete this task the optimum size and number of modelled objects had to be assessed and the Unity game engine had to be properly configured to work with the models. This integration offers a further use for the created models and enhances the immersive nature of the VR program. Using these visualizations we hope to understand more about the design and life of the ancient city, Copan.

DIGITAL ARCHAEOLOGY THROUGH HISTORICAL PHOTOGRAPHS OF ROUTT NATIONAL FOREST
Andrea Kruse, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Archaeology is changing from the data collection and specialized publishing to gaining deeper knowledge from past collections and sharing them to the wider public. Digital archives are now easily accessible with open source tools and the internet, which allows not only for collaboration with other researchers outside their agencies but engages a larger public with cultural heritage. This presentation describes a digital archaeology project that uses historical photographs to engage and inform the public about the Routt National Forest in Northwest Colorado. It presents the methods used to digitally archive historical materials as well as employ these materials in diverse ways in digital exhibits that include mapping and multi-media. The multiple layers of information allow the public to explore Routt in order to learn about the early years of the forest and changes in forest structure, get digital access to restricted or inaccessible sites, as well as help plan their next trip to the forest. By digitally archiving photographs and using digital tools, Forest Service employees and the public can gain a new perspective on the past landscape areas they are studying for present-day heritage projects.

AHPA vs. THE PROPOSED BORDER WALL: USING GIS TO CONSIDER THE POTENTIAL DISTURBANCE OF KNOWN ARCHAEOLOGICAL SITES
Katy Likely, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Archaeologists use Geographic Information Systems (GIS) for many purposes ranging from data management to analysis to data visualization. Another key way archaeologists use GIS is to prevent the potential disturbance of cultural sites by mapping known sites as well as predicting the locations of unknown sites. The process is required as part of Cultural Resource Management (CRM) laws, particularly the Archeological and Historic Preservation Act of 1974 (AHPA) to prevent the destruction of cultural sites during the construction of federally-funded or federally-licensed projects. The proposed construction of a wall along the border of Mexico and the United States, which been a topic of debate since the beginning of President Trump’s candidacy, also must consider the legal restrictions in regard to potentially impacted cultural resources. Using GIS, I will generate, analyze, and visualize spatial
data to identify potential archaeological sites, and other cultural areas, that may be in danger if a wall is constructed along the currently proposed route.

REVALUATING DATA: HOMESTEADING “FACTS” AND DATA VISUALIZATIONS
Amy Neumann Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Data are commonly seen as neutral and independent of the researcher’s ideas, theories and processes, but this is not true. The same data can often be used to support contradictory theories when interpreted by different researchers. After data are synthesized and presented as fact the lines between the gathered data and the interpretation are blurred once more. This paper examines the book Homesteading the Plains by Edwards, Friefeld, and Wingo (2017) which demonstrates that homesteading played a larger role in shaping the West than many scholars have been lead to believe. Edwards et al. examine 621 homesteads in Custer and Dawes counties as a case study to illustrate their point and further examine the dynamics of homesteading and community. I examine their methods of data analysis highlighting their use of social network analysis as a tool for interpretation.

THE MULTI-VOCAL TRAILSCAPE OF THE NATCHITOCHES TRACE: A TRAIL OF TEARS, TRADE, AND TRANSFORMATION
Jade Robison, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

Through their use, trails become inscribed on the landscape and in the memories of their users, in turn inviting continued use. Such a trailscape transcends both space and time as multiple groups of people use it for different purposes. The Natchitoches Trace is one such trailscape with a life history of both continuity in utilization and change in purpose. Its path was worn by pre-Columbian groups trading goods between St. Louis, Missouri and Natchitoches, Louisiana until its use by early European settlers colonizing the frontier. Later it became part of one route taken by the Cherokee during their forced removal, an event commemorated as the Trail of Tears (in Cherokee the nunna daul tsuny, “The Trail Where They Cried”). This study demonstrates how individuals have inscribed the Natchitoches Trace trailscape with meaningful narratives via oral traditions, historical accounts, and material evidence, and considers how descendent populations curate their heritage in such a landscape. In this presentation, I demonstrate the multi-vocality of the Natchitoches Trace trailscape as it was continually shaped and remade by groups of people with different cultural identities and motivations.

THOUGHT-THROUGH TRAVEL: THE IAIN C.G. CAMPBELL ARCHIVE & TOURISM ANTHROPOLOGY
Rebecca Salem and Effie Athanassopoulos, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368

The anthropology of tourism is a relatively recent development as an established field of study. Widely credited as the first scholarly tourism study, Theron Nunez’s 1963 article “Tourism, Tradition, and Acculturation: Weekendismo in a Mexican Village” introduced the topic to the field of anthropology. While it would be a slow introduction, eventually the discipline would embrace tourism as a legitimate field of study and begin to consider it from multiple perspectives. Important to understanding this application of anthropology is defining what tourism can be taken to mean and how that can direct inquiries. Further, the history of tourism itself and anthropology’s incorporation of it are important to consider when looking at examples of anthropological studies of tourism. This paper attempts to give an outline of the definition of tourism, the history of tourism, and the development of tourism from an anthropological perspective. As an attempt at application, this paper will examine the Iain C.G. Campbell archive, with its 32 photographs and two Roman lamps from Pompeii, from
an anthropological perspective. In taking this approach, a greater understanding of the meaning of the objects can be derived and a more comprehensive understanding of this Pompeii visit can be realized.

PHARMACIES AND MEDICINAL PRODUCTS IN LINCOLN, NEBRASKA AT THE TURN OF THE 20TH CENTURY

Erik Schulz and Effie Athanassopoulos, Department of Anthropology, and Mark Griep, Department of Chemistry, University of Nebraska-Lincoln, NE 68588-0368

In 1997, a salvage excavation conducted when the Lincoln City Union was being rebuilt. During this excavation, many artifacts were found that are still be analyzed. I am conducting research on the medicinal bottles in the collection, and analyzing pharmacy development during the late 1800’s through the early 1900’s in Lincoln, Nebraska. One pharmacy of particular interest is Roy’s Pharmacy that was located at 1014 P. St. The collection has two bottles from this pharmacy along with many other bottles traced to other local pharmacies. With these bottles, I am considering the patterns of usage, location, pricing, what were the contents and the intended remedy. This cistern dates to circa the 1880s to the 1920s. I am putting together an interactive map that will allow people to look at pharmacies throughout the years, and also see how long they were in business. Photographs of streets and business will be added in order to give more of a visual representation. The information is going to be compiled in hopes to understand who lived in the area, their social class, and what sort of medical concerns they had during the period of the cistern.

APPLIED SCIENCE AND TECHNOLOGY

DROP-IN WORKSHOP “LEARN TO PRINT 3-D MODELS FOR YOUR CLASSROOM”

Karin van Dijk and Michelle Howell, Department of Biochemistry, University of Nebraska-Lincoln, Lincoln, NE  68588-0664

Are you considering adding tangible interactive models to your class, but don’t know where to begin? Have you heard about 3-D printing but don’t know what it is, or haven’t given it much thought for your classroom? Are you unsure about the potential of this cutting-edge technology? Does 3-D printing sound exciting, inspiring, daunting, and unattainable all at the same time?

If you answered yes to any of the questions above, this workshop is for you. We will host a workshop that outlines some of the possibilities of 3-D printing for the science classroom. We will compare models that mimic metabolic structure to anatomically accurate models. We will introduce you to easy-to-use programs you will need to build the models. We will even walk you through designing a model for 3-D print, from start to finish. Through this workshop, it is our goal to break down barriers to 3-D printing, making this innovative technology accessible for you and effective for your classroom. Be sure to bring your laptop!

PROBING RNA STRUCTURE IN THE 5’ UNTRANSLATED REGION OF COXSACKIEVIRUS B3 GENOMIC RNA

William E. Tapprich, Bejan Mahmud, Quinn Nelson*, Sara Smith and Jamie Luhr, Department of Biology, University of Nebraska-Omaha, Omaha, NE

Coxsackievirus B3 (CVB3) is a cardiovirulent enterovirus that utilizes a 5’ untranslated region (5’UTR) to complete critical viral processes. This includes an internal ribosome entry site (IRES) responsible for cap-independent translation. Ample evidence supports the hypothesis that the 5’UTR with its IRES is an important virulence determinant for the virus. We are investigating the structure of the 5’UTR from RNA genomes derived from naturally occurring virulent and avirulent viruses.
Chimeric constructs and site-directed mutations of these genomes are part of the analysis. Our structural studies include queries of the RNA itself as well as the RNA complexed with host proteins such as polyrC binding protein 2 (PCBP2). We explore RNA structure in solution using base-specific modifying agents as well as backbone probes through selective 2’-hydroxyl acylation analyzed by primer extension (SHAPE). Our studies have resulted in a detailed secondary structure model for the 5’UTR, including those domains involved in the IRES. A comparison of the structure of 5’UTR sequences from virulent and avirulent genomes, including chimeric constructs, shows there are key structural differences that correlate to the virulence phenotype. These studies also identify a critical virulence determinant in domain II of the 5’UTR.

Chemical probing of 5’UTR molecules with bound PCBP2 shows that regions in the cloverleaf (domain I) and domain IV are protected from modification, indicative of direct protein interaction in these regions. Interestingly, other regions, particularly in the capping stem-loops of domain IV, show increased accessibility to chemical probes. Also indicative of conformational changes in RNA structure in response to protein binding. These increases in accessibility are concentration dependent.

In summary, our structural studies are defining the structure and structural dynamics of the 5’UTR from an important enterovirus. Moving forward, we will use SHAPE analysis to test our hypotheses regarding tertiary RNA folding interactions in the 5’UTR and focus on the dynamic nature of those interactions.

**PSEUDOMONAS AERUGINOSA STRAIN 14 BIOFILM ATTACHMENT ON SLIPPERY BMA-EDMA SURFACE**

Bailey Brigham* and Brett Schofield, Department of Biology; and Christina Wilson, Jasmin Sandoval, Michael Kangas and Andrea E. Holmes, Department of Chemistry, Doane University, Crete, NE

Biofilms present a problem in the medical field because of their resistance to treatments such as antibiotics which can lead to infections and costly medical procedures. Biofilms are able to form because of the initial attachment of a bacterial cell to a surface. Therefore, one promising method to prevent biofilm adherence is surface coating. Slippery Lubricant Infused Polymers (SLIPS) have been shown to possess anti-biofouling properties that could be utilized to prevent the attachment of bacteria to medical devices and other surfaces. The purpose of this study was to determine the effectiveness of slippery BMA-EDMA, a liquid perfluoropolyether infused porous polymer, on *Pseudomonas Aeruginosa* (PA) strain 14 biofilm formation in a drip flow reactor. To assess how the biofilms react to this environment, fluorescence microscopy and ImageJ were used to visualize and quantify the attachment and growth. Contradictory to our hypothesis, the results show that more growth was visible on the BMA-EDMA surfaces than on the glass control surface.

**THE DEVELOPMENT OF A COLORIMETRIC ARRAY TO DETECT VOLATILE ORGANIC MOLECULES IN CANDIDA ALBICANS**

Nicholas Stolze*, Najee Mustafaa, Christina Wilson, Arin Sutlief, Michael Kangas and Andrea E. Holmes, Department of Chemistry, Doane University, Crete, NE

*Candida albicans* is a type of yeast that is present in the human gut. If the human immune system is compromised, an overgrowth of *C. albicans* occurs, resulting in a condition called candidiasis, which can lead to yeast infections in the mouth or throat, commonly called thrush. *C. albicans* infections involve volatile organic molecules that are released as a result of cellular signaling molecules. Colorimetric sensors have been screened for the detection of these molecules in the vapor phase. The colorimetric sensors were printed on paper-like substrates and exposed to *C. albicans*. Following this exposure to volatile organic molecules, the printed sensors undergo a colorimetric change which is
imaged using a standard desktop scanner. Changes in red, green, and blue (RGB) pixel values can be analyzed in ImageJ before and after *C. albicans* growth, showing which sensors respond to volatile organic molecules. The development of this type of sensor could lead to an inexpensive and effective presumptive test for *C. albicans*.

**QUALITY CONTROL OF A NEW COLORIMETRIC SENSOR ARRAY TO DETECT QUORUM SENSING MOLECULES**

Najee Mustafaa*, Nicholas Stolze, Andrea E. Holmes, Arin Sutlief and Michael Kangas, Department of Chemistry, Doane University, Crete, NE

Colorimetric arrays have shown promise for the detection of various analytes, such as drugs, pesticides, warfare agents, etc. A new eight sensor colorimetric array was developed to detect farnesol, a quorum sensing molecule in *Candida albicans*. The arrays were made by loading tested sensors into empty ink cartridges, and printing them with a commercially available desk top printer on standard paper. The colorimetric sensor arrays were then placed into their own individual sealed plastic packs with silica gel and oxygen-absorber packs. Once the colorimetric sensors arrays were printed, they were tested for stability over a long period of time. The stability was evaluated by monitoring RGB values with standard deviation plots in Microsoft Excel. Initial scans of ten colorimetric sensor arrays were analyzed after printing. Ten packaged sensors were randomly chosen for quality control and sensor stability. Stability of the arrays was determined by comparing the ten randomly chosen arrays to the initial scans (control). When sensors were within +/- 3 standard deviation of the initial sensors, the arrays were considered stable.

**EVALUATION OF TARTARIC ACID IN WINE**

Joseph Benes, Valerie Fousek, Tyler Housh, Kristian Menard, Katelyn Wobken, Eric Pfeifer*, Jasmine DeMonte* and Darius Agoumba, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE

Wine is a well-known and consumed beverage around the world. It contains a number of organic acids including tartaric, malic, succinic, acetic, citric and lactic acids. Among them, tartaric is the most important as it influences acidity and sensory characteristics of wine. Important acidity related metrics to wine are pH, titratable acidity, total acidity and buffer capacity. If a wine is too low in acidity, it tastes dull. If a wine is too high in acidity, it tastes too tart. The goals of the presented investigation were to assess tartaric acid in wine using tested analytical methods and to develop additional approaches to follow the color change in wine during its titration using a spectrophotometer. Preliminary data show that red wine can be included into most of the laboratory experiments done in traditional analytical chemistry. In addition, the discussed methods will be of interest to individuals developing and delivering fermentation science courses.

**BIOLOGICAL AND MEDICAL SCIENCES**

**SESSION A**

**MAPPING THE BINDING SITES FOR CHROMATIN ASSEMBLY FACTOR 1 ON ROLIFERATING CELL NUCLEAR ANTIGEN**

Robyn Scott* and Dr. Lynne Dieckman, Chemistry Department, Creighton University, Omaha NE 68178

Cellular replication and proper genome stability require the accurate replication of DNA
and subsequent packaging into nucleosomes, composed of DNA wrapped around histone proteins. Nucleosome formation immediately following replication is controlled in large part by two proteins, chromatin assembly factor 1 (CAF-1) and proliferating cell nuclear antigen (PCNA). PCNA is a homotrimer that functions as a sliding clamp during replication and binds to CAF-1 during DNA packaging. CAF-1 is responsible for forming nucleosomes from newly synthesized DNA by aiding in the placement of histones onto the DNA. Although the interaction between these proteins is known to be critical in the proper packaging of DNA, their interaction is not currently well understood. Previous studies have identified the specific regions of PCNA to which most PCNA-interacting proteins bind. However, our preliminary data suggests that CAF-1 may interact with PCNA at an additional site. To study this secondary site of interaction, I have performed site-directed mutagenesis of two residues that we hypothesize are critically important to the novel CAF-1 binding site on PCNA. I purified the mutant PCNA proteins and have begun crystallization of the isolated proteins. We have obtained initial crystals that diffract to approximately 3.2 Å, which is sufficient resolution to determine the structure, and are screening conditions to generate crystals that diffract to less than 3.0 Å. Using X-ray crystallography, the structure of the mutant PCNA proteins will now be determined to compare to the structure of wild type PCNA and to observe any significant structural changes. Future studies to investigate the thermodynamic and kinetic properties of the interaction between these mutant PCNA proteins and CAF-1 in comparison to wild type PCNA and CAF-1 will be completed. The results of these studies will provide important information about the interaction between PCNA and CAF-1 and overall genomic stability.

IDENTIFICATION OF AN ALLOSTERIC TWISTER RIBOZYME FOR USE AS A SYNTHETIC GENETIC SWITCH
Samantha Stoupa* and Dr. Juliane K. Soukup, Chemistry Department, Creighton University, Omaha NE 68178

Synthetic biology is a rapidly emerging field focused on engineering biochemical systems and cellular functions for a variety of applications, including therapies for the treatment of infectious diseases and cancer, as well as tactics for vaccine development, microbiome engineering, cell therapy, and regenerative medicine. Many of the advances so far have involved engineering synthetic constructs aimed at bacterial gene regulation, but it is critical that synthetic biology tools also be designed for use in mammalian systems. One such tool that shows promise as a “device” for achieving synthetic gene regulation is a class of molecules called allosteric ribozymes, which bind small molecules and in response undergo self-cleavage resulting in modulation of gene expression. This project investigates whether mammalian gene expression can be controlled via allosteric ribozymes, namely, the Twister ribozyme.

Results from dual luciferase assays indicate that the wild type Twister ribozyme undergoes self-cleavage in mammalian HEK293 cells, resulting in the down-regulation of luciferase gene expression. The exceptional self-cleavage of Twister in vivo led us to investigate a variety of synthesized Twister ribozymes in vitro. We designed Twister ribozyme constructs with the aim of making RNA self-cleavage dependent upon the small molecule theophylline, which has a well-characterized aptamer that makes it suitable for our purposes. In vitro selection (SELEX) is being used to identify allosteric Twister ribozymes that are only active in the presence of theophylline. Preliminary results have identified allosteric Twister ribozyme sequences with minimal preference for cleavage in the presence of theophylline. Continued studies are ongoing. The results of this project may provide a foundation for the future use of allosteric ribozymes in modular systems to control mammalian gene expression.
**STAPHYLOCOCCUS AUREUS TOLERANCE TO ANTIMICROBIAL PEPTIDES**
Alexis Page*, Kaitlyn Oppliger, Kim Carlson and Austin Nuxoll, Department of Biology, University of Nebraska at Kearney, NE 68849

Persisters are a subpopulation of dormant cells tolerant to antibiotic killing. Persisters are thought to be the underlying cause of many chronic and relapsing infections. Staphylococcus aureus is responsible for a number of chronic infections, including endocarditis, osteomyelitis, and biofilm-associated medical indwelling device infections. Recent work revealed persister formation in S. aureus is dependent on lowered ATP levels. Despite recent advances, major questions remain unanswered, what is the underlying mechanism of persister formation and what is the significance of persisters in tolerance to components in innate immunity? Through whole genome screening, central metabolism was identified as an essential part of persister formation, specifically when the tricarboxylic acid (TCA) cycle was interrupted a significant increase in persisters was observed. Antimicrobial peptides (AMPs) are a key component of both the human and Drosophila innate immune system. Challenging S. aureus with the AMPs, LL-37 and hBD-3 revealed several logs of killing. Deletion of TCA cycle genes resulted in 10-fold more surviving cells compared to wild type. Currently, experiments are being performed with a Drosophila model for infection. Preliminary data suggests that persisters present a challenge for the immune system.

**EFFECTS OF GLUTAMATE METABOLISM ON ANTIBIOTIC TOLERANCE IN STAPHYLOCOCCUS AUREUS**
Megan Ingalls* and Austin Nuxoll, Department of Biology, University of Nebraska at Kearney, NE 68849

Staphylococcus aureus is responsible for a variety of infections. These infections vary from minor skin and soft tissue infections to bacteremia or endocarditis. S. aureus infections are often reoccurring, despite antibiotic therapy. Such recalcitrant infections are associated with biofilms. Biofilms are difficult to treat despite being composed of antibiotic susceptible bacteria. A possible explanation for this phenomenon is antibiotic tolerance mediated by persister cells. Tolerance is the ability of bacterial cells to survive antibiotic therapy by entering a state of reduced metabolism or dormancy. Persister cells have recently been defined as cells that enter the stationary phase prematurely. During stationary phase the cell experiences lower levels of intracellular ATP. Based upon this information, we hypothesize that persister formation is influenced by a decrease in tricarboxylic acid (TCA) cycle activity. It was found that the genes occurring late in the TCA cycle, after α-ketogluterate, had an increase in persister formation. This differs from the genes occurring early in the TCA cycle, which displayed no phenotype. We therefore focused our efforts on the genes that feed into the TCA cycle through glutamate catabolism. This pathway is of interest as glutamate catabolism produces α-ketoglutarate. Following antibiotic challenge, a knockout in glutamate metabolism resulted in increased persister formation and thus increased survival. We are currently investigating the relationship of this increase in persister formation and the energy status of the cell.

**PHARMACOLOGICAL PRIMING AGENTS MODULATE NON-VIRAL GENE DELIVERY TO MULTIPLE CELL TYPES**
Alec McCarthy*, Andrew Hamann, and Angela Pannier, Department of Biological Systems Engineering, University of Nebraska – Lincoln, NE 68583

Non-viral gene delivery, in contrast to viral delivery, is safer and more flexible with respect to genetic cargo size, ease of protocol, and scalability, but is significantly less efficient. One strategy to improve non-viral gene transfer efficiency is through priming (i.e. the pharmacological modulation
of gene delivery mechanisms and transgene expression by altering related cellular pathways). A high-throughput screen of the NIH Clinical Collection of drugs identified compounds that significantly modulated transgene expression in polyethylenimine- (PEI) transfected HEK293T cells (Nguyen, et al., 2016). To further assess the effects of compounds identified by the screen in cell types that are harder to transfect and clinically relevant, drugs were tested on Lipofectamine 3000 transfected human mesenchymal stem cells (hMSCs) and mouse embryonic fibroblasts cells (NIH/3T3s). Non-viral transfection can be cytotoxic from using cationic lipids to complex with DNA. Therefore, a live/dead viability assay was conducted on cells treated with and without drugs to assess the toxicity of complexing agents. Using pharmacological agents to improve transgene expression by countering the cytotoxicity and modulating other relevant pathways could lead to understanding enabling increased transgene expression efficiency in non-viral methodologies.

EXTRACELLULAR SUPEROXIDE DISMUTASE ENZYMATIC ACTIVITY PROMOTES PROTEIN TYROSINE PHOSPHATASE 1B ACTIVITY
Madison Lange*¹, Brandon Griess², Melissa L. Teoh-Fitzgerald², Douglas Christensen¹, Shawn Pearcy¹, Department of Life Sciences, Wayne State College, Wayne, NE 68787¹, Department of Biochemistry and Molecular Biology, University of Nebraska Medical Center, Omaha, NE 68198²

Reactive oxygen species (ROS) play an important role as secondary messengers in cell signaling. Too much ROS, however, results in oxidative stress and some malignancies such as breast cancer utilize increased levels of ROS to promote oncogenic signaling. This requires antioxidant enzymes such as superoxide dismutase (SOD) to scavenge ROS. Extracellular superoxide dismutase (EcSOD) is the only secreted isoform of the SOD antioxidant enzymes. Due to its ROS scavenging activity and unique location on the cell surface, EcSOD may decrease cell signaling by promoting dephosphorylation of c-Met by protein tyrosine phosphatase 1B. EcSOD expression has been observed in normal human breast tissues but expression is significantly decreased in breast cancer according to microarray data of human patient samples. Our lab has previously shown that EcSOD expression and enzymatic activity inhibits cell growth and inhibits activation of c-Met, a receptor tyrosine kinase that promotes oncogenic signaling activation, angiogenesis, cell proliferation and migration. We used MDA-MB231 triple negative breast cancer cells that overexpress a catalytically inactive EcSOD mutant (N180A, R186A) to determine the effect of EcSOD on cell invasion and phosphatase activity. 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.

GENERATION OF HUMAN CELL LINES THAT CAN BE INDUCED TO EXPRESS EPITOPE TAGGED ARGONAUTE PROTEINS
Daniel Gutzmann*, Douglas Christensen, Shawn Pearcy, Department of Biology, Wayne State College, NE 68787; and Audrey Atkin, Department of Biological Sciences, University of Nebraska-Lincoln, NE 68588

The Argonaute protein family plays an important role in RNA silencing, primarily as a major component of the RNA-induced silencing complex (RISC). Single stranded miRNAs become incorporated into the RISC complex and serve as a template to recognize complementary mRNA that is then cleaved by the Argonaute proteins. Identifying the miRNAs associated with RISC can be very useful in understanding the mechanism that miRNAs use to affect gene expression and silencing. To study miRNAs that are directly associated with the RISC complex in human cell lines, a stable cell line
that expresses epitope tagged Argonaute alleles must be generated. Generation of these cell lines allows for miRNA/RISC co-purification by PAR-CLIP to identify targets of RNA suppression. Our goal is to generate four HEK293 cell lines that can be induced to express epitope tagged Argonaute alleles. This presentation will describe the progress in determining if generation of these cell lines was successful. 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.

OPTIMIZING ALGAL CULTIVATION FOR BIOFUELS USING LOW VALUE SUGARS AND WASTEWATER
Amiera Rayyan*, Sydney Robertson and John Kyndt, Bellevue University, 1000 Galvin Road South, Bellevue, Nebraska 68005

Our general goal was to determine to what degree waste sugars from corn stover and wastewater can be used for cultivation of microalgae for biofuel production. We have identified an optimal microalgal species, Galdieria sulphuraria, as suitable candidate for cultivation, based on its capability to grow heterotrophically on corn stover-extracted waste sugars. Corn stover extracts were prepared thermochemically and the optimal ratio of extracted corn stover syrup and secondary treated wastewater that can be used for heterotrophic cultivation of G. sulphuraria was identified. In addition we determined that the optimal growth temperature for biomass yield of G. sulphuraria is at 45 °C. We also analyzed the lipid yield of the G. sulphuraria cultures by performing Soxhlet based lipid extractions. These cultivation conditions can potentially be the basis for larger scale cultivation for biodiesel production from microalgae.

DAY TO DAY AND LEG TO LEG VARIATION IN GENE EXPRESSION
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Skeletal Muscle Biopsies have been extensively used in research to investigate the effects of exercise. Serial biopsies are typically taken before and after exercise to determine the consequence of physical activity on gene expression. A resting control biopsy is needed as gene expression is expressed relative to this control. It is often assumed that the changes measured in the samples are due to experimental conditions. However, in many experiments it is not clear if the changes measured are due to experimental conditions or the effects of the previous muscle biopsy. While research has been conducted to determine the effects of repeated biopsies, such as inflammation and gene expression, in the same leg, not much research has been done to determine the differences in gene expression between legs. There is also limited evidence stating that using different legs in repeated biopsy studies can prevent artifacts and give stable results. The variation in gene expression from day to day within a leg and between legs is currently unknown. The purpose of this study is to determine the day to day variance in skeletal muscle gene expression in the same leg and between legs to establish an experimental design that eliminates artifacts and reduces the number of biopsies needed for a study.

DEGENERATION OF A NUCLEAR rRNA GROUP I INTRON IN THE LICHEN TELOSCHISTES CHRYSOPHTHALMUS
Audrey Codina* and Dawn M. Simon, Department of Biology, University of Nebraska Kearney, NE 68849; and Jolanta Miadlikowska, Ester Gaya, and François Lutzoni, Department of Biology, Duke University, Durham, NC, 27708

The origin of spliceosomal introns is difficult to discern due to high sequence divergence and
the absence of direct evidence linking an intron to its source. While spliceosomal introns are found primarily in protein-coding genes of eukaryotes, putative examples in nuclear ribosomal RNA (nrRNA) coding genes of lichen-forming and allied fungi also exist. Due to their unique genomic location and limited phylogenetic distribution (Pezizomycotina), the nrRNA spliceosomal introns are a potential example of a new type of recently derived intron. We specifically hypothesize that nrRNA spliceosomal introns arise from degeneration of group I introns. Here we focus on one lineage of introns found at a single position in the nuclear ribosomal small subunit (SSU) of Teloschistes chrysophthalmus. We have sequenced introns from 38 samples across the North American range of the species. A phylogeny was inferred using ITS sequences, which showed four groups of T. chrysophthalmus that are largely clustered based on geographic location. The recovered relationships among Teloschistes spp. is consistent with previous reports. Introns at the SSU position of interest are of varying lengths (187-407 nt), all contain characteristic sequences of spliceosomal introns and many have potential secondary structures typical of group I introns. We further characterized splicing in this intron lineage using in vivo reverse transcriptase PCR. A subset of the introns appears to either not splice or splice at low efficiency. This finding is consistent with a predicted correlation between degeneration and loss of splicing ability. Taken together, the evidence supports group I intron degeneration at this site.

VIRAL DISCOVERY IN THE SOUTH AFRICAN BAT FLY (EUCAMPSIPODA AFRICANA)
Matthew Martens*, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha, NE 68182

Bat flies are wingless, spider-like flies from the family Nycteribiidae and act as hematophagous parasites toward different species of bats. In South Africa, the bat fly Eucampsipoda africana can be found on the Egyptian fruit bat (Rousettus aegyptiacus), a species known to be a reservoir for hemorrhagic fever viruses. Due to a lack of mechanistic details on the transmission cycle of viruses that fruit bats may harbor, we set out to determine the virome present in bat flies collected in the field by our collaborators in South Africa. To this end, we performed next-generation sequencing on 12 pools of rRNA-depleted bat fly RNA using an Illumina MiSeq. Analysis of read mappings by our custom bioinformatics pipeline yielded the discovery of two entirely novel putative orthobunyaviruses characterized by divergent three-segmented genomes containing large, medium, and small segments. Two independent sequence alignments using both BLASTn and Bowtie 2.0 yielded 22-36% divergence at the nucleotide level between these viral sequences and the closest relative (Wolkberg virus). Further, structural analysis of the predicted nucleocapsid protein was completed through the use of the tool Phyre2, with a significant (>10%) divergence in predicted secondary and tertiary structure further supporting the classification of these two viruses as novel and distinct orthobunyaviruses. While additional in vitro characterization is necessary to provide further insight into the viral pathogenicity, this data provides evidence to support the role of bat flies as environmental reservoirs harboring novel and existing viruses of potential interest to human health.

EFFECT OF NORA VIRUS INFECTION OF GERM-FREE DROSOPHILA MELANOGASTER ON LONGEVITY
Makayla Nemecek*, Rebecca Best, Shelby Peters, Carlie Prokoski, Lesley Towery, Darby J. Carlson, & Kimberly. A. Carlson, Department of Biology, University of Nebraska at Kearney, Kearney, NE 68849

The bacterial component of the Drosophila melanogaster gut microbiome has currently become a "hot topic" for research in this area. Unfortunately, the possible role for viral infection is not known. One virus that may play a role in the gut microbiome is Nora virus, which is a picornavirus that exhibits fecal-oral transmission and persistent infection without any characterized pathogenicity. We hypothesize
that Nora virus may be important in maintaining a healthy gut microbiota in D. melanogaster allowing them to live longer. In this study, germ free D. melanogaster were generated and maintained on food with the addition of broad spectrum antibiotics. Four treatment groups were employed: Nora virus positive/bacteria positive, Nora virus negative/bacteria positive, Nora virus negative/bacteria negative, and Nora virus negative/bacteria negative. The presence of Nora virus infection was determined via RT-PCR. The presence of microbiota was determined by homogenizing D. melanogaster in Luria broth (LB), plating on LB agar plates, and gram staining. The major bacterial species belonged to the genus Bacillus. Longevity analysis was conducted on each of the conditions and survival curves constructed. The group that lived the longest were the D. melanogaster that possessed normal gut microbiota (bacteria positive), but no Nora virus. When this group was infected with Nora virus, longevity decreased. In fact, the group with the shortest survival time was those infected with Nora virus and bacteria negative. This suggests that Nora virus may not be needed to maintain a healthy gut microbiota, however, microbiota is beneficial regardless if Nora virus is present, but further testing is needed. 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.

BIOLOGICAL AND MEDICAL SCIENCES

SESSION B

THE PREVALENCE OF BORRELLIA LONESTARI IN CENTRAL NEBRASKA
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Borrelia lonestari is a bacterium vectored by Amblyomma americanum (the lone star tick) is a member of the Borreliaceae family, which includes the Lyme disease spirochete Borrelia burgdorferi. B. lonestari is suggested to cause variant Lyme disease, which has similar clinical symptoms of Lyme disease. In Nebraska, the tick that carries B. burgdorferi is not present, but reports of Lyme disease occur every year and are later determined as false positives. This has created confusion in the medical field when trying to diagnose the etiologic agent. In this study, we collected A. americanum ticks, extracted total DNA, and performed PCR with a B. lonestari specific primer set to identify the distribution and prevalence of B. lonestari. We have confirmed that B. lonestari is present in A. americanum along the Platte River in Central Nebraska. Determining B. lonestari prevalence may aid in diagnosing disease and help gain a better understanding of the risk of variant Lyme disease in Central Nebraska.

SCREENING AND EVALUATION OF EXPERIMENTAL COMPOUND U21 AGAINST ACUTE TOXOPLASMA GONDII INFECTION
Austin Sanford* and Paul H. Davis, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha NE 68182

Toxoplasma gondii is an obligate intracellular parasite that infects nearly 60 million individuals in the United States alone. Infection in immunocompromised individuals and in developing fetuses in first time infected mothers can be fatal. The aim of this research was to screen experimental compounds against the acute stage of T. gondii for both activity against the parasite and for overall toxicity in vitro. Our initial screen identified a compound, U21, that was more effective in vitro than the current standard in clinic for acute infection. Additionally, U21 was found to be effective against several helminths in vitro and in vivo as well as Plasmodium falciparum in vitro. An in vivo murine trial was performed
to test for efficacy in a living organism against a lethal T. gondii infection. Our results showed that the compound was not effective and further metabolomic data identified that the compound was rapidly metabolized in vivo. Further derivatives of this compound will need to be synthesized to create a compound that has higher metabolic stability in vivo.

**COMBATING CHRONIC TOXOPLASMA GONDII INFECTION USING COMBINATION GROUPS OF FDA DRUGS**

Elizabeth A. M. Ramler* and Paul H. Davis, Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha NE 68182

Toxoplasma gondii is an obligate intracellular parasite that exists in three life stages: tachyzoite, bradyzoite, and oocyst. The bradyzoite stage develops as a chronic infection, one in which the parasite resides in both muscle and brain tissue. To combat this infection, the current study aims to minimize or clear the bradyzoite cyst burden using various combinations of FDA approved drugs (pyrimethamine, sulfadiazine, miltefosine, elacridar, metronidazole, rifapentine, guanabenz, enrofloxacin, doxycycline, azithromycin, atovaquone, atorvastatin, itraconazole, clindamycin, and hydroxyzine). To maximize efficiency of the drugs known to be effective against the parasite, drug groups are designed to ensure passage of the drug through the BBB using additional drug groups known to decrease the integrity of the barrier. Previous trials suggest that sulfadiazine, pyrimethamine, and miltefosine in combination result in cyst burdens comparable to negative controls. For that reason, each novel drug group includes at least these three compounds.

**ELUCIDATING THE MECHANISM OF ACTION OF EXPERIMENTAL COMPOUNDS THROUGH DOUBLE CHEMICAL MUTAGENESIS OF TOXOPLASMA GONDII**

Sean Watson*, Department of Biology, University of Nebraska at Omaha, NE 68182

Toxoplasma gondii is an obligate intracellular parasite that infects nearly one-third of the world’s population with increased pathogenesis observed in the infection of pregnant women and immunocompromised patients. Current drug treatments for toxoplasmosis are incapable of clearing the chronic phase of the infection, and thus the development of new treatments is necessary. As these new drugs are developed, their mechanism of action (MOA) must be determined before they are viable candidates for clinical use. In this work, I demonstrate a novel technique integrating the use of a double mutagenesis with computational analyses to establish likely drug targets. This method is currently being implemented to facilitate the speedy and robust confirmation of the MOA for a known compound. Once it has been appropriately validated, this technique will be subsequently tested on an experimental compound which has exhibited substantial anti-Toxoplasma properties. If successful, this technique has the potential for robust elucidation of the MOA of any specie’s experimental compounds.

**CHEMICAL ATTRACTION OF Ticks (PARASITIFORMIS: IXODIDAE) TO DECOMPOSING ANIMAL REMAINS**

Mirtha Gutierrez*, Ashley Tagart, Iris Munoz-Ortiz, Kathleen Chance, Lisa Cuba, Shabnam Waheed, Amanda Roe Ph.D., Biology Program, College of Saint Mary, Omaha, Nebraska, 68106

For arthropods that require blood to complete their life cycle, finding an acceptable blood host is an integral component. One method to increase host-finding may be found in certain tick species: to preferentially move to carrion and/or be mechanically transported by necrophagous insects to carrion, which increases their chances of finding a host/carrion scavenger. Y-tube olfactometers were used to determine if semiochemicals from animal remains yielded a behavioral response in two common tick
species: *Amblyomma americanum* (Lone star tick) and *Dermacentor variabilis* (American dog tick). Three trials were conducted, all with distilled H2O as the control and dead fetal pigs at different decomposition periods as the variable. Trial 1 = < 24 hours decomposition, Trial 2 = 48 hours decomposition, Trial 3 = 96 hours decomposition. Knowing tick attractiveness to animal decomposition can lead to better understanding of their host-finding behaviors and lead to better tick population control measures.

**POLLEN TUBE DEVELOPMENT IN WATER-POLLINATED *STUCKENIA PECTINATA***

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Hydrophily, or water-pollination, is a rare mechanism of pollination found in flowering plants (angiosperms). Pollen is transported to the stigmas via the water surface or through underwater currents. It is thought that water-pollination evolved from wind-pollinated ancestors leading to a difference in reproductive traits. In this study, characteristics of the life history stage between pollination and fertilization of the water-pollinated plant, *Stuckenia pectinata*, were examined. Flowers of *Stuckenia pectinata* were hand pollinated and then collected at specific time intervals. The flowers were stained with aniline blue and then observed under a light microscope and imaged. The number and germination status of each pollen grain was documented and the length of the longest pollen tube was measured. The timing of carpel receptivity, pollen reception and germination, and ovule entry were documented. Pollen loads were observed to be quite high with approximately 50 pollen grains per flower. Results from this study will be compared to similar studies done with related water-pollinated species to better characterize this reproductive mechanism.

**CHARACTERIZATION OF THE PROGAMIC PHASE IN *RUPPIA MARITIMA***

Dayton Oki*, Richard Nguyen, and Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha NE 68178

*Ruppia maritima* is an aquatic angiosperm that grows in brackish inland, estuarine, and coastal waters. *R. maritima* exhibits water pollination, in which pollen grains are transported across the water surface to receptive stigmas. The goal of this research was to characterize the progamic phase, the life history stage between pollen germination and fertilization, in *R. maritima*. In order to determine the rate of pollen germination, immature flowers were collected in the field 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. Pollen grains germinated within five minutes after pollination and fertilization was achieved within an hour after pollination. Carpels were stained and imaged using light microscopy. The results of the study showed that consistently low number of pollen grains were present on most of the stigmas and considerably less amount of pollen grain germinations occurred. This reflects the degree of the reproductive success amongst the tested *R. maritima* pollen grains, as fertilization was not seen in abundant numbers. 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.

**POLLEN TRANSFER AND RECEPTION IN THE AQUATIC PLANT SPECIES *RUPPIA MARITIMA***

Richard Nguyen*, Dayton Oki and Mackenzie L. Taylor, Department of Biology, Creighton University, Omaha, NE 68178

*Ruppia maritima* is an aquatic angiosperm found in alkaline lakes and coastal areas around the
world. Ruppia is a water-pollinated (hydrophilous) species. In all flowering plants, pollen develops in the anther. Anthers dehisce, releasing pollen, which is transferred to receptive stigmas. In Ruppia, pollen grains float on the surface of the water in rafts until they reach nearby stigmas. Each pollen grain then germinates and produces a pollen tube, which grows through the carpel to reach the egg. Little is known about how the transition to water pollination has affected pollen reception and pollen tube growth. The goal of this study was to characterize the developmental events surrounding pollen reception in Ruppia. Using field collections and experimental-pollinations, timing of stigma receptivity, anther dehiscence and pollen reception were documented, as was pollen load size. The potential for self-pollination was also investigated. Investigating the reproductive biology of Ruppia will provide crucial information regarding the effect of the transition to hydrophily on reproductive traits.

INTEGRATION OF POLLEN DATA FROM LOCAL SOURCES AND SPECIMENS BELONGING TO THE HIGH PLAINS HERBARIUM IN CHADRON, NEBRASKA, INTO THE NEBRASKA POLLEN DATABASE

Brittany Soukup*, Steven Rolfsmeier, and Johnica J. Morrow, Palynology and Pathoecology Laboratory, Department of Physical and Life Sciences, Chadron State College, Chadron, NE

The Nebraska Pollen Database (NPD) was established in 2015 to provide a digital resource for pollen identification in Nebraska. Since the conception of the database, the collection and dissemination of information related to Nebraska pollen types has been an ongoing project. Beginning in the spring of 2018, Chadron State College allocated resources for enhancing this database by contributing data collected from local plants and herbarium specimens housed in the High Plains Herbarium within the college’s Physical and Life Sciences department. Pollen processing involved acetolysis, glycerin archiving, and the use of Lycopodium spores for pollen grain quantification. The current focus for this project is the processing, imaging, and quantifying of pollen grains from Liliaceae and Iridaceae. Genera within Liliaceae that are native to Nebraska include Lilium, Erythronium, and Fritillaria. Genera within the iris family native to Nebraska include Iris and Sisyrinchium. Following data collection from these pollen types, images and other data will be uploaded into the NPD and made freely available for use by the general public. These data will be useful for palynologists, apiculturalists, and other interdisciplinary areas of interest.

CHARACTERIZATION OF THE MICROBIAL COMMUNITY IN THE GLACIER CREEK PRESERVE

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The Glacier Creek Preserve serves to maintain an ecologically sustainable wildlife preserve. It focuses on the natural tallgrass prairie and associated ecosystems that serve as a site for environmental education and an important community resource for present and future generations. The Glacier Creek traverse’s diverse systems including agricultural land which can produce varied chemical and physical properties that leads to diverse microbial communities. The objective of this study was to characterize the microbial communities found in the creek bed sediment at 11 specific sites along the creek. Each site contained varied chemical compositions of sodium, calcium, chloride, nitrate, phosphate, iron, and/or aluminum. Each site was unique in the chemical makeup and concentrations. The land use adjacent or upstream of the sediment sites was also unique and included varied crop land or natural tallgrass prairie. DNA was extracted from soil sediment and 16S ribosomal RNA variable regions V3 and V4 were analyzed for phylogenetic classifications in diverse microbial populations. Sequencing was followed up with bioinformatic analysis to identify the bacterial genus present in the differing sites. This information will provide us with the knowledge of microbial communities present in natural water sources with specific chemical and physical characteristics that may be associated with the surrounding land use. Data to be presented. This project was funded by INBRE.
POLYMICROBIAL INTERACTIONS LEAD TO INCREASED ANTIBIOTIC TOLERANCE
Kennedy Kluthe*, Seoyoung Song, Dan Nabb, Justine Pitzer, and Austin Nuxoll. Department of Biology, University of Nebraska at Kearney, NE 68849

Microbial infections are one of the leading causes of death in the United States. Often mediated by biofilms, Candida albicans is a fungus that infects a number of medical devices, including shunts, catheters, implants, and prostheses. Studies estimate that one in three Candida infections are polymicrobial in nature, resulting in decreased antibiotic effectiveness and thus an increased mortality. The mechanism for the decreased ability to treat polymicrobial biofilms remains unknown. We examined the possibility that antibiotic tolerance, mediated by persister cell formation, was responsible for the decrease in antibiotic effectiveness. Early results suggest C. albicans increases persister formation in the virulent pathogen Staphylococcus aureus, both in planktonic cultures and within a biofilm. Coincubation of C. albicans and S. aureus resulted in increased survival compared to S. aureus alone when challenged with rifampicin, ciprofloxacin, vancomycin, and gentamicin. Current experiments are focused on identifying the mechanism for the increased tolerance. We will analyze and present the findings on the mechanism of decreased antibiotic effectiveness in polymicrobial cultures.

ANALYZING COXSACKIEVIRUS B3 RNA BY SITE DIRECTED MUTAGENESIS
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Coxsackievirus B3 (CVB3) is an etiological factor in the development of myocarditis, pancreatitis, and type I diabetes. The CVB3 genome is a positive, single-stranded ribonucleic acid (RNA) genome containing 7,400 base pairs, organized into four sections: 5’ untranslated region (5’ UTR), single open reading frame, 3’ untranslated region (3’ UTR), and a poly A tail. The 5’ UTR is 743 base pairs in length. Previous research has indicated base mutations occurring within the 5’ UTR can alter the RNA structure, and thus alter virulence. Following RNA isolation, the structure of the 5’ UTR is analyzed by treating with modifying chemicals: dimethyl sulfide (DMS), 1-cyclohexyl-(2-morpholinoethyl) carbodiimide metho-p-toluene sulfonate (CMCT), 1,1-Dihydroxy-3-ethoxy-2-butanone (Kethoxal), and N-methylisatoic anhydride (NMIA). DMS, CMCT, and Kethoxal each modify a select exposed base, while NMIA modifies exposed backbone nucleotides. Modified RNA is analyzed by primer extension using reverse transcriptase. Preliminary analysis reveals that mutations occurring within the 5’ UTR have altered RNA folding.

BIOLOGICAL AND MEDICAL SCIENCES
SESSION C
THE ROLE OF INTERFERON REGULATORY FACTOR 3 IN CELLULAR RESPONSES TO GROWTH FACTOR DEPRIVATION
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Interferon regulatory factor 3 (IRF3) is a transcription factor involved in innate anti-viral immunity. Classically, recognition of viral nucleic acids by pattern recognition receptors induces a signal transduction cascade culminating in the phosphorylation of IRF3 by the kinsases TBK1 and IKK-epsilon. Phosphorylated IRF3 dimerizes, translocates to the nucleus, and induces expression of antiviral genes such as interferon-beta and interferon stimulated gene 54 (ISG54). These IRF3-target genes induce subsequent interferon stimulated genes and contribute to an antiviral state. Alternative pathways have also been implicated in IRF3 activation. For instance, we have
shown that ERK MAPK is essential for the expression of IRF3 target genes during viral infection of macrophages. Because ERK MAPK is also involved in activating mitogenic transcription factors downstream of growth factors, we hypothesized IRF3 could be an overlap between growth factor and antiviral pathways. We will describe our recent findings involving the role of IRF3 in growth factor signaling.

**CURCUMIN INHIBITS THE GROWTH OF TRIPLE NEGATIVE BREAST CANCER CELLS THROUGH THE NF-κB PATHWAY**

Gabrielle Brumfield*, Shoichi Arai, and Ann Buchmann, Life and Physical Sciences Department, Chadron State College, 1000 Main St, Chadron, NE 69337

Triple negative breast cancer is an aggressive form of breast cancer which does not need estrogen or progesterone for growth and does not have an increased level of the growth factor receptor Her-2. This cancer is resistant to treatments with estrogen inhibitors or newer drugs that inhibit the function of Her-2. Curcumin, a chemical extract of the spice turmeric, has been shown to have anti-cancer and anti-inflammatory properties. Curcumin has shown promise as a treatment for several inflammatory conditions, including cancer. Treatment of triple negative breast cancer cells (MBA-MD-231) with curcumin resulted in high mortality 24-48 hours after treatment, as shown by MTT assay. The exact mechanism by which curcumin acts on cancer cells is not well known, but interference with the NF-κB pathway is suspected. Typically, the NF-κB pathway is associated with cell proliferation and inflammation. This research focuses on treating triple negative breast cancer cells (MBA-MD-231 and MBA-MD-436) with curcumin and determining whether treatment changes the levels and activity of proteins associated with the NF-κB pathway using Western blot and immunoprecipitation. Preliminary evidence indicates that the levels of NF-κB and the IkB kinase, IKK, decrease upon curcumin treatment, suggesting that curcumin may inhibit cell growth and survival by inhibiting the NFκB pathway.

**DYSREGULATION OF POLYAMINES WITH DIABETES IN BREAST CANCER CONDITIONS**

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Polyamines (spermine, spermidine, and putrescine) are involved in several cellular processes such as cell growth, replication, and transcription, and have been shown to be elevated in diabetes, as well as certain cancers including colon cancer and skin cancer. Prognosis of patients with cancer is worsened in diabetic states compared to those without diabetes. In addition, chemotherapeutic effect is also lowered in cancer patients with diabetes. In this study, it was hypothesized that polyamine pathway is associated with aggressiveness of breast cancer cells exposed to hyperglycemic conditions. Breast cancer cells including (MCF-7 and MDA-MB-231), and normal breast epithelial cells (MCF-10A) were treated with low glucose (LG, 5mM) or high glucose (HG, 25mM) for different time periods. Cell survival assay showed significant proliferation in both MDA-MB-231 and MCF-10A cells with HG but not MCF-7 cells at 72 hr. Simultaneous treatment with an ornithine decarboxylase (polyamine synthesis enzyme) inhibitor, difluoromethylornithine (DFMO) could prevent this effect. Polyamine levels in the cells showed a varied response with HG treatments, though DFMO was consistently effective in reducing the levels of spermidine, an important regulator in cell growth. In conclusion, polyamine pathway is involved with HG-mediated normal breast epithelial cell and breast cancer cell proliferation. Future studies will involve further analysis of the mediators which regulate polyamine production.
DEVELOPMENT OF NOVEL VCAP CELL LINE PROGRESSION MODEL FOR STUDYING CASTRATION-RESISTANT PROSTATE CANCER

Marlene Djidjoho*, Dr. Ming-Fong Lin, Matthew Ingersoll, Dannah Miller, Department of Biology, College of Saint Mary, Omaha, NE 68106

Prostate cancer is the third leading male cancer death in the United States with 90-95% adenocarcinoma. These cancer cells rely heavily on androgen to proliferate, but overtime through mutation become castration-resistant cells having a higher rate of tumorigenicity. Through model cell lines, the evolution of prostate cancer cells has been observed and developed to simulate a patient’s cancerous cell environment. This research seeks to develop and study the VCaP progressive model which mimics castration-resistant development and acquisition of aggressive metastatic phenotype for future prostate cancer research. A cell growth cultivation of nine days was used to compare the growth of VCaP androgen-sensitive (AS) vs VCaP androgen-independent (AI) cells. Moreover, a clonogenic colony growth assay of fifteen days was used to compare colonies formation of the VCaP AS vs VCaP AI cells. A transwell migration assay of 24 hours was used to compare the metastasis of the VCaP AS vs VCaP AI cells. Lastly, using Western Blotting, the rate of protein between Androgen Sensitive and androgen Independent cells was compared. The results showed the VCaP AI cells had an aggressive growth than VCaP AS cells in the cell growth cultivation. In the clonogenic assay, the VCaP AI cells had a higher number of colony growth than the VCaP AS cells. In addition, the transwell migration assay demonstrated a higher metastasis rate of the VCaP AI cells than the VCaP AS cells. Lastly, the western blotting showed a higher level of protein such as p66 Shc, ErbB-2, Cyclin B1, AKT, and ERK in the AI cells than the AS cells. These results displayed the development and study of the VCaP progressive model which mimics castration-resistant development through AI cells and acquisition of aggressive metastatic phenotype for future prostate cancer research.

TRACKING THE DIFFERENCES IN GENE EXPRESSION CORRELATION NETWORKS AMONG CANCER STAGES.

Qianran Li* and Dr. Kathryn Cooper, University of Nebraska at Omaha, Omaha NE

Time-dependent networks are used to track the changes in network structure across time. This network approach is frequently used to show the changes across time in social phenomenon analysis, disease separation analysis, and nervous system dynamic tracking. However, it is rarely used in the dynamic model of gene expression correlation in biomedical contexts. Gene expression correlation can represent co-expression relationships among genes that may implement biology functions. Tracking the change in gene expression correlation can help identify the cells' functional transformation at the gene level in a particular longitudinal time range. Thus, in this project, we are tracking the differences in gene expression correlation networks among cancer stages changing based on the time-dependent network model. We obtained data for Thyroid Carcinoma, Colon Adenocarcinoma, Stomach Adenocarcinoma, and Kidney Renal Papillary Cell Carcinoma from The Cancer Genome Atlas (TCGA) database. The results demonstrate that there are some significant differences in structure that manifest among stages in Kidney Renal Papillary Cell Carcinoma and Thyroid Carcinoma. The neighbor nodes of the main hubs in this two cancer are change between stages. These results show that the hub nodes genes are essential and have different correlation relationship with neighbor nodes.
EVALUATION OF PLGA-ANTIRETROVIAL NANOPARTICLES ON CELLS OF THE CENTRAL NERVOUS SYSTEM

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There are currently over 35 million people infected with HIV and over 2 million people continue to contract HIV each year. This indicates a need for antiretroviral therapy (ART) and pre-exposure prophylaxis (PrEP). These treatments have proved extremely effective in treating HIV. Even with these novel treatments, the central nervous system (CNS) remains particularly vulnerable to HIV because it serves as a viral reservoir, enabling HIV to go undetected. Chronic HIV infection damages brain cells, can induce inflammation and may lead to neurodegeneration and loss of cognitive skills. As well, ART therapies are associated with nervous system side-effects. Over 50% of HIV infected patients using oral ART suffer from HIV-associated neurocognitive disorders (HAND). Our lab is interested in nanoparticle (NP) antiretroviral drug delivery that alleviates cytotoxicity and delivers drugs efficiently over an extended period of time both to HIV target cells and potential HIV reservoirs such as the CNS. In conjunction with our collaborators, we have shown that Poly Lactic-co-Glycolic Acid (PLGA)-antiretroviral drug-containing nanoparticles (NP) enhance and sustain delivery of antiretroviral drugs to the brain and reduce drug cytotoxicity to brain cells as compared to drug solution alone. To assess cytotoxicity, cell viability assays comparing drug solution and nanoparticle delivery of emtricitabine (FTC) to primary cultured cortical neurons (10⁵ cells/well) were performed. FTC concentrations of 1 and 10 mcg/ml were tested, and survival response was evaluated after 96 hours. Neuronal viability remained over 90% when treated with 10 mcg/ml of PLGA-FTC nanoparticles, whereas neurons treated with FTC solution showed ~50% viability at 10 ng/ml of FTC. The effect of nanoparticles on neuronal differentiation and synaptic protein expression will be determined. Since drug delivery to neurons can influence neuronal viability directly and indirectly through activation of glial cells, my work will also compare the viability and potential pro-inflammatory activation of astrocytes and microglia following exposure to antiretroviral drug solution and antiretroviral nanoparticles. These studies will provide necessary information concerning the long-term use of antiretroviral nanoparticles for HIV treatment, pre-exposure prophylaxis, and reduction of HAND.

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THE EFFECTS OF GRAPHENE FAMILY NANOPARTICLES ON DANIO RERIO EMBRYOS

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Graphene is a one-atom-thick honeycomb-structured sheet of carbon. This compound, and its derivatives, known as Graphene Family Nanomaterials (GFNs), have several potential technological uses. This compound is known for its structural strength, and electrical conductivity. As its usage expands farther into the public industry, it may enter the environment, where it could harm both wildlife and human populations if not properly addressed or understood. This experiment seeks to examine the effects of graphene nanoplatelets on vertebrate embryo development, by observing their teratogenic effects on zebrafish embryos. Zebrafish eggs were exposed to graphene nanoplatelets, as well as reduced graphene oxide. The teratogenic effects were evaluated via microscopic methods, and through molecular assays of both catalase and superoxide dismutase. The results of this experiment demonstrated varied significant morphological and enzymatic effects from treatment with GNPs, and warrant further exploration.
LINGUAL NERVE DAMAGE INDUCES A TRANSIENT IMMUNE RESPONSE IN THE TONGUE

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The anterior tongue is maintained by bilateral gustatory (chorda tympani) and somatosensory (lingual) nerves which innervate tissue in close physical proximity. Previous studies in our lab have shown that these nerves have a cooperative, multimodal relationship, in which loss of one nerve results in corresponding changes to the tissue (e.g., taste bud or fungiform papillae) associated with the other. One possible mechanism for this may be immune response following nerve injury. We tested this hypothesis by measuring the innate immune response in the tongue after cutting the lingual nerve (LX), leaving the chorda tympani intact. Adult, female Sprague Dawley rats underwent unilateral LX at 65 days of age and were allowed to recover for 12, 24 or 48 hours. Tongue tissue was then collected, frozen, and sectioned. Immunohistochemistry was used to visualize myeloperoxidase positive immune cells (neutrophils), and counts were taken from 10 μm sections within the first 1.5 mm of the anterior tongue. Neutrophil counts were compared between the intact and denervated sides of the tongue and from animals that underwent a sham surgery (nerve was accessed but not cut). Additional control tissue from two age matched nonsurgical animals was also processed, counted, and used for additional comparison. Average neutrophil counts were elevated on the damaged side of the tongue 12 and 24 hours after injury compared to intact, sham and non-surgical tissue but returned to control levels by 48 hours post. Following LX, there was a stereotypical neutrophil response on the damaged side that significantly peaked at 24 hours post-surgery. These findings are consistent with previous reports of neutrophil invasion following chorda tympani nerve damage, and further implicate immune response as a critical mediating factor in the cross-modal interactions between the gustatory and somatosensory systems.

LEARNING LEAGUE OF LEGENDS: AN EXPLORATION OF NEURAL ACTIVITY RELATED TO PC GAMING

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Recent studies exploring human physiology and video games have focused on topics such as positive or negative behavioral changes, enhanced or diminished cognitive functions, and clinical applications. The present study is designed to examine brainwave activity in a small pilot study of test subjects learning to play a multiplayer online battle arena PC video game that is free to play. The video game, League of Legends (LoL), is created by Riot Games and is a globally popular esport with professional regional competitions that culminate in an annual World Championship featuring a multi-million USD prize pool. Participants in the present study were selected based on having never played the game and were given a brief tutorial prior to their first team gameplay. Electroencephalograms (EEG) were used to monitor participant brainwaves during gameplay. Participants were monitored once a week and EEG data were compared as participants adapted to the challenges of learning this new game.

EFFECTS OF STRIKE FORCE AND EPOE ALLELES ON DEVELOPMENT OF CHRONIC TRAUMATIC ENCEPHALOPATHY (CTE) IN DROSOPHILA MELANOGASTER

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Chronic traumatic encephalopathy (CTE) is a progressive neurodegenerative disease that is prevalent in people who have experienced multiple instances of mild traumatic brain injury (mTBI).
The symptoms of CTE are largely behavioral and cognitive deficits that lead to psychotic behavior and dementia, among other symptoms. CTE resembles Alzheimer Disease symptomatically and pathologically. The main indicator of CTE is the presence of hyperphosphorylized tau (p-tau) in the brain parenchyma. Here we inflicted Drosophila melanogaster with CTE using a striker and assessed the effects of the intensity of the strike(s) on the development of CTE. We also assessed whether the EPOE4 allele, which is a pre-disposition gene for Alzheimer Disease, would affect the development of CTE. Because of the similarity of CTE to Alzheimer’s disease, we use flies who express the APOEe4 gene and determine the severity of symptoms and p-tau build up in comparison to a control group of Drosophila that express the APOEe3 allele. To determine the impact of severity of strike we afflicted two groups of flies with the striker at 2.5 L/minute and 5 L/minute respectively. The group subject to 2.5 L/minute were inflicted with the impact multiple times while the group subject to a 5 L/minute were struck only once. To determine which group was more severely impacted, behavioral assays and p-tau staining methods were conducted.

EFFECTS OF ENVIRONMENTAL TEMPERATURE AND EXERCISE ON MITOCHONDRIAL QUANTITY AND QUALITY

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Mitochondria play several roles in the regulation processes of the human body, and therefore are found in many different cells. The highest number of mitochondrial DNA can be found within muscle tissue, and is highly susceptible to damage caused by reactive oxygen species (ROS) located nearby in the mitochondrial matrix. MtDNA repair systems are less effective than nuclear DNA systems, which results in dysfunctional mitochondria. Mitochondrial dysfunction has been linked to the aging process as well as many age-related diseases, such as Alzheimer’s disease, various types of cancer, and diabetes. Exercise training increases mitochondrial development within skeletal muscle, and while it may be more difficult for older or diseased populations to exercise, previous work done by our group indicates that environmental temperature may also effect mitochondrial development when it is paired with exercise training. Subjects were performed cycling exercise in hot, cold, or neutral environments (randomized order), and muscle biopsies were taken from the vastus lateralis muscle. The DNA will be isolated and analyzed, using qRT-PCR, which will target the mtMinArc, the mtMajArc, and B2M, a nuclear housekeeping gene. The mtMinArc is a region on mtDNA that is representative of the total number of mtDNA copies present within a sample, and the mtMajArc is a region on mtDNA that is representative of the most common mtDNA deletions. Using these markers, the mtDNA copy number and mtDNA deletion ratio will be compared between temperature environments, in order to identify potential changes with exercise and between environmental conditions.

CHARACTERIZATION OF STAPHYLOCOCCUS LUGDUNENSIS BIOFILMS

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Staphylococcus lugdunensis is a type of bacteria, which, not unlike Staphylococcus aureus and Staphylococcus epidermidis, can be found on human skin as normal flora. While S. aureus has been the primary focus of the medical community, there are new concerns that S. lugdunensis has been responsible for biofilm-induced infections, similar to those caused by S. aureus and S. epidermidis. With more accurate testing available, medical professionals are now able to distinguish S. lugdunensis from other coagulase negative bacteria. This has led to a greater appreciation for this organism as a major human pathogen. Contributing to the pathogenic nature of this organism is its ability to form a biofilm, which is the culprit of severe prosthetic joint infections, as well as cases of endocarditis. We set out to identify genetic factors essential for biofilm formation in S. lugdunensis. We mutagenized a S.
ludunensis culture by treating with ethyl methanesulfonate (EMS). Following mutagenesis individual cells were separated using a cell sorter and examined for biofilm formation at eight hours and 24 hours. Mutants of interest will be confirmed and whole genome sequencing will identify candidate biofilm genes.

PRE-TREATMENT OF ARABIDOPSIS ROOTS WITH HEAT-KILLED PSEUDOMONAS AERUGINOSA TO PREVENT BIOFILM GROWTH
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Pseudomonas aeruginosa is a bacterium that can infect multiple organism. It is a leading cause of hospital-borne infections (approximately 51,000 per year according to the Centers for Disease Control and Prevention). Bacterial biofilms are simply a cluster of individual microbial cells that make up a multicellular “structure” with unique physiological properties and are an effective tool in a pathogen arsenal.

While the pathogenicity of P. aeruginosa is well documented, current treatments for limiting or even preventing infection are not sufficient. There are many strains of this bacterium. In this study, the clinical isolate PA14 and the environmental isolate PA01 were utilized. In order to develop a treatment against P. aeruginosa biofilm formation, the A. thaliana root was used as an easy to acquire biological surface for growing biofilms. PA01 and PA14 were heat-killed and introduced to roots before inoculation with the corresponding live bacteria. Two positive-control groups and a negative-control group were also included.

Roots were imaged regularly for three days. Biofilm growth was measured using ImageJ and compared between treatments.

We have observed that PA01 vaccination of the A. thaliana root significantly reduces the formation and growth of biofilm on the root’s surface while PA14 vaccination did not. In addition, biofilm formation and growth of the two strains occur at different rates with PA14 growing slower than PA01.

BIOLOGICAL AND MEDICAL SCIENCES
SESSION D

EFFECT OF SEQUENCE POLYMORPHISMS ON THE RESIDUE NETWORK CONNECTIVITY OF PRION PROTEINS: A COMPARATIVE STUDY
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Cellular prion proteins (PrPc) are mammalian glycoproteins capable of self-replication. Under pathological conditions, the prion protein misfolds into the infectious isoform (PrPSc) which causes fatal transmissible spongiform encephalopathies (TSE) in a number of mammalian species. To better understand the structural basis that underlies the propensity of PrPSc toxicity, our study examines the residue network interaction of prion proteins PrPc. Our analysis indicates that the residues located in the a-helices show similar patterns of connectivity across all the PrPc we studied. Along the unstructured loops in PrPC, the connectivity is less conserved. Sequence polymorphisms exhibit distinct connectivity trend in each PrPc. We will discuss the effect of our results on the stability of the PrPc fold and potential nuclei for misfolding and aggregation.

This work was made possible partly by grants from the National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH), and its
ENERGETICALLY FAVORABLE ORIENTATIONS OF PRPC MONOMERS AND DIMERS WITH A MODEL MEMBRANE

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The normal, cellular form of the protein, PrPC, can convert to the infectious, conformationally altered isoform, PrPSc, leading to fatal neurological consequences. The transformation of PrPC to PrPSc via autocatalytic misfolding is critical to the development of transmissible spongiform encephalopathies (TSEs), a group of neurodegenerative diseases that includes Creutzfeldt-Jakob disease in humans and bovine spongiform encephalopathy, or “mad cow disease.” To gain insight on the factors that influence the PrPC to PrPSc conversion, it is pertinent to identify how PrPC interacts with its environment. PrPC is found attached to the cell membrane through a glycosylphosphatidylinositol (GPI) anchor. To further understand how PrPC is integrated with its membrane interface, we calculated the contribution of electrostatics to the free energy of interaction between the protein and the membrane at different angles of rotation. In this presentation, we will use these results to discuss the favorable orientations and side chain residue interactions of PrPC, in both monomer and dimer forms, with a model membrane. Our results will help in understanding the effect of the cell membrane on the initial events that lead to PrPC to PrPSc conversion.

This work was made possible partly 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.

DETERMINATION OF ATTACHMENT BY PSEUDOMONAS AERUGINOSA STRAIN PAO1 TO A SILICA-LIKE LAYER USING SURFACE ENHANCED RAMAN SPECTROSCOPY

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Biofilms are a collection of microorganisms that form on a surface and act as a single entity to overcome a wide variety of threats. Biofilms are almost everywhere and each carries out a varying set of functions. The affects of different biofilms can range from a series of damaging affects, such as sepsis, to restorative properties, such as purifying wastewater. The development of these ecosystems is complex and there is still a lot to be discovered about the mechanisms by which these biofilms attach to a surface. We have set out to directly measure the attachment of Pseudomonas aeruginosa strain PAO1 bacteria to SiO2 using Surface Enhanced Raman Spectroscopy (SERS). In this work, the surface enhancement is generated by a gold film deposited on top of polystyrene nanoparticles. A thin film of silica is then deposited onto the surface using a combination of self-assembled monolayer and sol gel techniques, providing a hospitable environment for the bacteria. The work presented here details the construction of the SERS substrates and the subsequent growth of biofilms on these surfaces via drip flow reactor. Data collected from this experiment is a step towards decoding the complex mechanisms of biofilm attachment and may bring forth a better understanding of biofilms as a whole.

This research is funded by National Institute for General Medical Science (NIGMS) (5P20GM103427), a component of the National Institutes of Health (NIH).
Staphylococcus epidermidis is a commensal organism, normally found on the skin of mammals. As an opportunistic pathogen, S. epidermidis causes disease in immunocompromised individuals, mediated through indwelling medical devices. Antibiotic treatment of these infections is often unsuccessful, leading to chronic, relapsing infections with poor patient prognosis. A likely explanation for these observations is persister cells (a subpopulation of dormant cells) are causing treatment failure. High persister isolates have been shown to occur in other microbial pathogens such as Pseudomonas aeruginosa and Candida albicans. Recent work in the related pathogen, S. aureus, demonstrates persister formation is dependent on energy depletion through the TCA cycle. Therefore, we examined whether high persister isolates occurred among S. epidermidis clinical isolates through an energy dependent mechanism. We found S. epidermidis clinical isolates frequently have a high persister phenotype when challenged with vancomycin. To determine if this phenotype occurred through an energy dependent mechanism, we are currently measuring ATP concentrations in these isolates. Antibiotic treatment frequently fails, even among antibiotic susceptible pathogens - these preliminary results indicate persister cells are an important component in this process.

How does microbiome manipulation of a mother affect the microbiome and health of her offspring? Previous microbiota studies focused on the effects in a single individual; however, I aimed to study the cross-generational implications of eliminating the gut bacteria from a host organism, noting the effects on growth, survival, and fecundity. To study these implications, I conducted an experiment that varied antibiotic exposure across multiple generations of the host and analyzed the effects on host health and gut microbiota system. Five generations of the host, Daphnia magna, were studied and antibiotic exposure was manipulated. Some hosts were raised in constant antibiotic environments, some in constant antibiotic-free environments, and some in antibiotics followed by subsequent generations in antibiotic-free environments. I focused on two key questions: are the changes in the microbiota observed under antibiotic exposure irreversible, and if not, how quickly can the microbiota and host health recover when antibiotics are removed from the immediate environment? My results show a significant effect of antibiotic exposure on the microbiota over the multi-generational study. The insights gained through this study provide further insights on the effects of antibiotic use on the microbiota and other host-microbiota relationships.

Boundary elements, also called insulators, are DNA sequences that subdivide the genome into functionally autonomous regions. This has the effect of protecting genes from the influence of certain enhancers and silencers, as well as limiting the spread of histone markers that lead to the formation of heterochromatin. The only vertebrate protein thus far identified as having a role in transcriptional insulation is CTCF. Here we utilize an insulator assay in the yeast Saccharomyces cerevisiae to screen candidate proteins for insulator activity by testing whether they can block the spread of repressive histone markers from a telomeric domain.
LATENT TOXOPLASMOSIS CYST VARIABILITY IN THE MURINE MODEL: A REVIEW OF METHODOLOGIES AND SPECIFIC CHALLENGES
Gabrielle F. Watson* and Paul H. Davis, Department of Biology, University of Nebraska at Omaha, NE 68182

Toxoplasma gondii is an obligate intracellular protozoan parasite that infects approximately 30% of the population of the United States. Natural transmission in humans is typically acquired from oral exposure, primarily through consumption of cysts and oocysts in undercooked, infected meat or contaminated water and vegetables. Immunocompromised individuals are at high risk of symptomatic presentation of the disease due to dormant intracellular brain cysts which can reactivate and potentially cause lethal degradation of neural tissue. While infection is considered benign in most people T. gondii may cause abortion, neonatal death, or fetal abnormalities in infected pregnant women. Currently the most effective treatment is a regimen of pyrimethamine and sulfadiazine however these drugs are mainly concerned with treating acute toxoplasmosis and due to an increasing resistance in parasites to this drug treatment, there is a growing need for alternative medications. Drug-like compounds have been tested in vivo for their efficacy against the parasite’s chronic infection, the stage when cysts form in the infected individual’s brain and prevail there for the remainder of the host’s life. A chief concern with these studies is the vast range of cyst burden, with some studies containing a larger standard deviation than mean, indicating a large fluctuation. This review attempts to analyze the difference seen in cyst burden of infected mice by evaluating the parasite strain, mouse strain, mode of infection, number of parasites, and method for quantification. This review identified low variation in cyst burden seen in Balb/c and Kunming mouse strains with the inoculation of T. gondii ME49 and PRU strains, respectively.

A PUTATIVE TOXOPLASMA GONDII TRANSCRIPTION FACTOR BINDING SITE DRIVES DIFFERENTIATION BY INDUCING EARLY BRADYZOITE-SPECIFIC TRANSCRIPTS
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Toxoplasma gondii is an obligate intracellular parasite with worldwide distribution. This protozoan can infect all nucleated mammalian cells, and is the etiologic agent of toxoplasmosis in humans. The T. gondii life cycle includes the conversion from tachyzoite to bradyzoite – stages which give rise to acute and chronic infection, respectively. Bradyzoite-stage cyst infection is lifelong and has no treatment or cure. This work highlights the mediation of bradyzoite differentiation by a stage-specific transcription factor which putatively regulates the expression of bradyzoite genes. Using a transcriptomic microarray approach, a cluster of transcripts upregulated early during bradyzoite induction was identified. MEME analysis of these “up early” transcripts identified a shared upstream consensus motif, a putative transcription factor binding site. Using a dual luciferase assay adapted for recombinational cloning and reporter gene quantification by qPCR, we demonstrate developmental stage-specific expression of the luciferase reporter gene. The shared consensus motif was found to be an autonomous cis-element by conversion of a constitutive promoter into a bradyzoite growth condition-inducible promoter. Much detail concerning the mechanism of differentiation is yet to be discovered and this work highlights the mediation of life cycle progression by bradyzoite differential gene expression. These data demonstrate the control an early bradyzoite promoter exercises on stage differentiation and provide insight for future studies on gene regulation in this important protozoan pathogen.
DYNAMIC MODELING AND STOCHASTIC SIMULATION OF METABOLIC NETWORKS.
Emalie J. Clement, Ghada A. Soliman, PhD, Beata J. Wysocki, PhD, MEngSc, Paul H. Davis, PhD, Tadeusz A. Wysocki PhD, DSc, MEngSc, Senior Member, IEEE, University of Nebraska at Omaha, Omaha NE

Throughout our current generation, scientific studies, with the help of increased technological methods, have enabled the investigation of biology at nanoscale levels. Nevertheless, such systems necessitate the use of computational methods to comprehend the complex interactions occurring. Traditionally, dynamics of metabolic systems are described by ordinary differential equations producing a deterministic result which negates the intrinsic heterogeneity of intracellular systems. More recently, stochastic modeling approaches have gained popularity with the capability of providing more realistic outcomes. Yet, solving stochastic algorithms tend to be computationally intensive processes. Employing the queueing theory, an approach commonly used to evaluate telecommunication networks, reduces the computational power required to generate simulated results, while simultaneously reducing expansion of errors inherent to classical deterministic approaches. Herein, we present the application of queuing to efficiently simulate stochastic metabolic networks. For the current model, we utilize glycolysis to demonstrate the power of the proposed modeling methods, and we describe simulation and pharmacological inhibition in glycolysis to further exemplify modeling capabilities.

IN VITRO AND IN VIVO LOCALIZATION OF CBU_1651 FROM COXIELLA BURNETII
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Coxiella burnetii is an obligate intracellular pathogen and the etiological agent of Query Fever. To cause disease, C. burnetii uses the Type IVB secretion system (T4BSS) to establish a replicative compartment, termed the parasitophorous vacuole (PV), and from here manipulate host cell functions via the release of effector proteins. A potential effector protein encoded by the gene cbu_1651, which is unique to C. burnetii, is of interest. Using in silico analyses, cbu_1651 is predicted to encode a hypothetical membrane associated protein with a transmembrane domain and is likely co-regulated with the T4BSS since it is located between the T4BSS genes icmW and icmX and suggests a possible important function for CBU_1651 during pathogenesis. The overall goal of this study was to characterize the localization of CBU_1651 during in vivo and in vitro growth. We have successfully developed polyclonal antisera against CBU_1651 and are using it for subsequent assays. We have found by western blot that CBU_1651 is secreted in a T4BSS dependent and lipid dependent manner into the growth medium. In tissue culture, indirect fluorescent antibody (IFA) assays indicated CBU_1651 to localize to the PV lumen. To confirm our IFA analysis, we are ectopically expressing CBU_1651 in HeLa cells infected with C. burnetii. These data suggest that CBU_1651 is mediated by a mechanism that senses environmental stimuli and potentially plays a role in pathogenesis, which has not been previously identified for this unique protein.

PREVALENCE OF COLORECTAL CANCER AMONG THE LATINO COMMUNITY IN OMAHA AREA
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Colorectal cancer is the third most common cancer diagnosed in both men and women in the United States. It is also the third most kind of cancer worldwide which causes mortality. The American Cancer Society estimates number of colorectal cancer cases in the United States for 2018 to be 140,250 new cases. The data for 2014 estimated that 1,317,247 people in the United States are suffering from
colostral cancer. The incidence rate per 100 thousand of the population in the country is 39.8 while this incidence rate in the state of Nebraska is 43.6 which are higher as compare to the national level. Hispanics in Nebraska generally have the lowest incidence rates of colorectal cancer. The rate of colorectal cancer among Hispanics living in Nebraska is 33.0 per 100 thousand of the population which are 39.6 for Asian/Pacific Islanders, 44.7 for Native American, 49.1 for Caucasian & 64.9 for African-Americans. Many Hispanic in the United States are immigrants from Mexico, Central and South America. In the state of Nebraska the population of Hispanics grew from 83,878 (or 4.9%) in 2003 to 156,483 (8.7%) in 2013. So there is an increase of 86.6% in Hispanic population in the State of Nebraska for the past 10 year. As the population of Hispanics continue to grow, it is essential to investigate the rates of colorectal cancer among this sections of the Nebraskan as Hispanic are not a homogenous race. Keeping in mind the fast growing populations of Hispanic community in Nebraska, we collected colorectal cancer data from the National Cancer Institute’s Surveillance, Epidemiology, and End Results Program (SEER) as well as North America Association of Central Cancer Registries (NAACCR). Statistical analysis of the collected data indicates that although there has been a downward trend in colorectal cancer deaths since 1992 but more people specially the number of younger populations getting diagnosed with colorectal cancer. The details of this finding along with correlation and trend at the national level will discussed at the conference.

A NETWORK-BASED COMPARTMENTAL MODEL FOR THE SPREAD OF WHOOPING COUGH IN NEBRASKA

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Bordetella pertussis is a very serious bacterial disease, also known as whooping cough, with random patterns of infection. Whooping cough easily spread via air by cough and sneeze of an infected individual. Infectious for up to three weeks, the disease can be easily transmitted to others. Vaccination is the best way to prevent spreading of whooping cough according to the Centers for Disease Control and Prevention (CDC). Although the disease is theoretically preventable, it remains a challenge to control. Outbreaks of whooping cough have increased over the past few years and have drawn the attention of health care providers.

Understanding the spreading mechanisms of contagious disease is very important and timely. Extension of contagious disease depends on many complicated factors including pathogen and host environment, exposed populations, and their behaviors. In this work, we try to find the best prediction algorithm to predict the infected and exposed populations. A new SEIR model based on network modeling (NB-SEIR) is proposed to improve the accuracy of prediction for number of infected individuals.

For this purpose, the number of whooping cough reported cases in Nebraska between 2000-2017 is gathered from different databases (CDC, HealthMap and TYCHO). In the first step, the standard compartmental SEIR model is used to predict the number of infected individuals, then RMSE and ME are calculated to estimate the accuracy of the model. The results show that the SEIR model prediction for number of infected individuals is very higher than the actual number.

We use the property of the scale-free network to predict the number of exposed individuals and thus improve the SEIR accuracy in predicting the number of infected people. The proposed NB-SEIR model can estimate the number of infected more accurately than the standard SEIR model.
DETERMINING THE EFFECTS OF ATRAZINE ON *DANIO RERIO* EMBRYONIC DEVELOPMENT
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Atrazine is a common herbicide applied to broadleaf weeds and is primarily used on corn and grain sorghum and can enter natural watersheds. This has the potential to affect water quality. Currently, the EPA considers atrazine levels that exceed 3 ppb to be a public health risk. In this study, zebrafish were used to assess how atrazine levels affect embryonic development. Morphological features, mortalities, and other non-characteristic features were measured during development after zebrafish were exposed to three levels of atrazine solution. Features assessed included yolk sac size, eye size and notochord length. An ANOVA on Ranks was performed on the data to determine statistical significance. The results show that there was a large number of mortalities within the atrazine-treated groups. A majority of the atrazine-treated individuals died within the first six hours of the experiment. However, there was no statistical significance in any of the morphological features. Overall, this study may suggest that atrazine exposure has a negative impact on zebrafish embryonic mortality.

SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL EVALUATION OF 2-FLUORENYL-SUBSTITUTED TRIAZOLIUM SALTS
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1,3,4-trisubstituted-1,2,3-triazolium salts have recently been shown to display both antibacterial and antifungal activity that is sensitive to substituent identity. With the addition of a fluorophore functional group these compounds might also possess the ability to fluoresce, which may be beneficial for future imaging studies. The objective of this project was to develop new triazolium salt analogs that demonstrate both antimicrobial and fluorescent properties. Using a Sharpless-Meldal CuACC ‘click’ reaction between 2-azidofluorene and aliphatic terminal alkynes of varying size, a family of 1,4-disubstitued-1,2,3-triazoles was prepared. Substitution at the 3-position of the 1,2,3-triazole ring with benzyl bromide electrophiles resulted in six unique 1,3,4-trisubstituted-1,2,3-triazolium salts. To evaluate each compound’s antimicrobial properties, minimum inhibitory concentration (MIC) assays were run against Gram-positive bacteria, Gram-negative bacteria, and fungi. The triazole compounds were not significantly bioactive, while the triazolium salts displayed a wide range of activity. The lowest MIC values observed were 2 µM against Gram-positive bacteria and yeast, and 16 µM against Gram-negative bacteria. Triazolium salt analogs also displayed significantly brighter fluorescence emission properties than their triazole precursors. Details regarding the synthesis, characterization and antimicrobial assays will be presented. This publication was made possible 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.

CHEMISTRY AND PHYSICS
CHEMISTRY

DOCKING STUDIES ON ISOFORM-SPECIFIC INHIBITION OF JANUS KINASE 3 (JAK3).
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The Janus kinases (JAKs) are receptor-associated tyrosine kinases which are important for the downstream signal of type I and type II cytokine receptors. JAKs are mostly associated with
immunopathology and inflammatory diseases. There are four members belongs to JAKs: JAK1, JAK2, JAK3, and TYK2. JAK1 with JAK3 is mainly expressed in leukocytes. An important characteristics of JAK signaling is the necessity for the hetero- or homo-dimerization of JAK kinases with JAK3 within the cytokine receptor complex. JAK3, which is highly connected with severe combined immunodeficiency (SCID) disorder, was the first therapeutic target among the JAKs. Many JAK3 inhibitors have been developed, but selectivity is still lacking. One of the notable differences in the JAKs active sites is a Cys909 residue in JAK3. Covalent irreversibly inhibitors which bind to Cys909 of JAK3 can highly increase the selectivity. We applied docking study to covalent JAK3 inhibitors against the JAK1, JAK2, JAK3, and TYK2. Our data suggests that distinguished differences in Cys909 between the JAKs play critical roles in ligand binding and can be used to design and develop selective inhibitors against the JAK3. In addition to Cys909, structural and size differences in the activation and hydrophobic domains of JAK3 could be utilized for the design of selective JAK3 inhibitors. Also, we generated a QSAR model of the physicochemical properties of JAK3 inhibitors and their biological activities.

AN EFFICIENT SYNTHESIS OF NΠ PROTECTION OF 4-L-PHENYLSPINACINE AND ITS HYDROGENOLYSIS TO THE CORRESPONDING HISTIDINE.

Brice Tsao*, Department of Chemistry, Creighton University, Omaha.

Initially, 4-L-phenylspinacine was made from L-histidine and benzaldehyde via a Pictet-Spengler reaction. Characterization of product was made by IR and 1H-NMR spectroscopy. N-1 protection of the product was performed using p-toluenesulfonyl chloride in methanol/chloroform and sodium carbonate. Attempts were made to hydrogenolyze the N-1 protected spinacine using ammonium formate and MeOH with 10% Pd/C at reflux. Results of the reaction will be discussed. Future research will include dissolving metal reduction methods.

SOLID STATE CHARACTERIZATION AND ANTIOXIDANT STUDIES OF CURCUMIN AND RESVERATROL BINARY/TERNARY POLYMER COMPLEXES.

Melissa Mosbrucker*, Mary Morris, and Dunesh Kumari, Department of Chemistry, College of Saint Mary, Omaha.

Background and Significance: Curcumin (CUR), found in turmeric, and resveratrol (RES), found in red wine, are two poorly soluble phytochemicals with powerful antioxidant and anticancer potential. Due to limited solubility in water, their bioavailability is low, limiting their therapeutic anti-oxidant potential. Hypothesis and Objective: We hypothesize that “Hydrophilic polymer (HP) interacting with poorly soluble CUR and RES can enhance their solubility thus increasing the antioxidant capacities in aqueous medium”. The objective of the study is to screen and formulate various soluble and stable binary (CUR-HP/ RES-HP) and novel ternary (CUR-RES-HP) complexes for antioxidant activity. Materials and Methods: The polymers Hydroxypropyl-β-cyclodextrin(HPβ-CD), Polyvinylpyrrolidone(PVP), and Hydroxypropyl Methyl Cellulose (HPMC), Polyethylene Glycols (PEG) were screened using X-ray diffraction(XRD) to select the ideal polymer for designing binary (2:1, 1:1, 1:2 w/w CUR/ RES: HP ratios) and ternary (1:1:1 CUR: RES: HP) complexes. Briefly, CUR and/or RES were dissolved in Methanol, mixed with different HP solutions, dried while stirred for >2 hours to obtain the complexes. Pure drugs, physical mixtures (PM) and binary/ternary complexes were characterized using X-ray Diffraction (XRD) for crystallinity and Infrared Spectroscopy for molecular interactions. Time dependent antioxidant testing using DPPH and FRAP assays were used to determine the antioxidant capacity of complexes. Results and Conclusions: All the polymers were found to be effective in forming amorphous complexes in a concentration dependent manner. XRD studies showed that CUR has higher crystallization potentials than RES in prepared binary and ternary complexes. PVP
was the optimal polymer, resulting in amorphous ternary complexes at 1:1:1 and 1:1:2 CUR: RES: HP ratios. IR-studies confirmed stronger interactions of both CUR and RES with PVP compared to HPβ-CD and HPMC. CUR and RES hydroxyl group was found to interact with carbonyl group of PVP in both binary and ternary complexes. Selected binary and ternary complexes resulted in higher concentration of CUR and RES in aqueous medium, compared to pure CUR/RES (immediately precipitated). Anti-oxidant activity of these selected complexes were confirmed using DPPH and FRAP assays.

SOLID STATE CHARACTERIZATION AND ANTI-OXIDANT ACTIVITY OF CURCUMIN AND PIPERINE COMPLEXES.

Mary Morris*, Melissa Mosbrucker, and Dunesh Kumari, Department of Chemistry, College of Saint Mary, Omaha.

The aim of our work is to investigate and develop Curcumin (CUR) and Piperine (PIP) combinations as potent antioxidants for astronauts. CUR have significant anti-oxidant activity but is known to have very low bioavailability due to poor absorption and metabolism. On the other hand, recent studies have confirmed anti-oxidant potential of PIP and its role in prevening the metabolism of CUR. Thus, successful combination of CUR and PIP can result in higher anti-oxidant potential which can be used to combat oxidative stress associated with space travel. Binary and ternary complexes of CUR and PIP were prepared with hydroxy propyl β-cyclodextrin(HPβ-CD), polyvinylpyrrolidone (PVP), and Hydroxypropyl Methylcellulose (HPMC) by using solvent evaporation method. In vitro Ferric reducing antioxidant power (FRAP) and DPPH (2, 2-diphenyl-1-picrylhydrazyl) assays were validated and antioxidant capacity was determined using UV-Vis Spectrophotometer. Solid state characterization of these complexes was carried out using Fourier Transform Infrared spectroscopy (FTIR) and X-Ray Diffraction (XRD) to study the complexation/ intermolecular interaction between binary and ternary complexes of CUR/ PIP and polymers. For binary complexes, PVP was found be most effective for CUR whereas HPβ-CD worked well with PIP. For ternary complexes, CUR-PIP-HPβ-CD (1:1:2) was found to be completely amorphous whereas other polymers resulted in partially amorphous complexes. IR studies confirmed interactions between CUR with PVP and HPβ-CD in binary complexes. In ternary complexes, several peak shifts were obtained. Anti-oxidant activity was confirmed on selected binary and ternary complexes of CUR and PIP.

DEVELOPING 3D PRINTED DEVICES TO CONCENTRATE DNA FOR GENOME ANALYSIS.

Cody Masters*, Jocelyn Dolphin, April Maschmann, and Kristy L. Kounovsky-Shafer, Department of Chemistry, University of Nebraska at Kearney.

To understand structural variation for personal genomics, an extensive ensemble of large DNA molecules will be required to develop a database of genomic variations. Nanocoding, which is a whole-genome analysis platform, can analyze large DNA molecules for construction of physical maps that are assembled for a genome. However, it is very difficult to handle large DNA molecules, so we imbedded cells in an agarose matrix to protect DNA during cell lysis and cleanup. In order to get DNA molecules out of the agarose, we needed to electrokinetically elute DNA into solution and then concentrate that DNA. As a result, we utilized 3D printing technology to fabricate meso-fluidic devices to concentrate lambda DNA molecules eluted from a gel matrix under an electric field. To concentrate DNA molecules, a gel matrix was cured within the device to create a roadblock for the DNA molecules migrating through the channel. The matrix allows the buffer solution to move through, but prevents DNA molecules from traversing the matrix thus creating a roadblock. Conditions for creating the roadblock were tested to find the optimal conditions to create a matrix that possessed small pores and was curable within our polylactic acid (PLA) devices. In addition, DNA was concentrated at our roadblock and then recovered.
Analysis with ImageJ showed that there was a 62.6% decrease in the mean fluorescence after the DNA was removed from the device. Furthermore, the DNA was analyzed to determine if the molecules were full length after the completion of the experiment.

**UTILIZING A PULSED WAVEFORM TO ELUTE DNA MOLECULES IN 3D PRINTED DEVICES FOR GENOME ANALYSIS.**

Molly Kohlbek*, Bryant Menke, Laura Stoner, April Maschmann, and Kristy L. Kounovsky-Shafer, Department of Chemistry, University of Nebraska at Kearney.

An immense population of large DNA molecules will be required to cover structural variations found within the human genome. However, the fragility of DNA molecules requires the protection of agarose during cell lysis and cleanup to maintain their original length. In order to use the DNA molecules for Nanocoding, or other physical mapping platforms, they need to be in free solution. Therefore, we leveraged 3D printing to fabricate meso-fluidic devices to elute DNA molecules from a gel matrix using an electric field. Fluorescently stained λ DNA was mixed with molten agarose to form an insert. Once the insert is solidified, it is placed into a 3-D printed device and a pulsed voltage was applied to the device, using different ratios of time, to elute the DNA molecules from the insert into the solution. Images were taken periodically by illuminating the YOYO-1 stained DNA with blue LED light and analyzed. These images were analyzed to quantify the amount of DNA eluted for each pulsed waveform. Through these measurements, the most effective waveform and ratio of time was determined in order to elute large DNA molecules from an agarose insert; using these parameters, pulsing for only two hours led to approximately 60% of the DNA leaving the insert.

**EXAMINATION OF ORNITHINE DECARBOXYLASE ANTIZYME RNA STRUCTURE AND FUNCTION FOR THE DEVELOPMENT OF ANTIBILOGICAL AGENTS.**

Zach Frevert*, Korey Krutsinger, Logan Baumburger, and Julie Soukup, Department of Chemistry, Creighton University, Omaha.

Riboswitches are non-coding sequences in messenger RNA that directly bind to cellular metabolites and affect gene expression through feedback regulation. Riboswitches are widely found in bacteria, with one class in fungi and plants, and none previously found in animals. We propose riboswitch functionality of a translational frame-shift stimulatory pseudoknot RNA (PK RNA) that is highly conserved among vertebrate ornithine decarboxylase antizyme (OAZ) genes that are involved in polyamine biosynthesis regulation. Apparent binding affinity and specificity for polyamines were determined using in-line probing and equilibrium dialysis. Mouse OAZ1-PK RNA binds to spermine with greater affinity than other polyamines. Spermine binding to OAZ1-PK RNA causes conformational change, a characteristic property of riboswitches. Spermine analogs (with equal or greater net positive charge) have lower affinity and specificity for the OAZ1-PK RNA. We next used isothermal titration calorimetry to determine binding affinities. Results indicate that the Kd (binding affinity) of OAZ1-PK RNA for spermine (the natural ligand) is ~275 µM. Further experiments on spermine analogs have shown Kd~s of ~5 mM. Despite OAZ1-PK RNA binding to spermine not being a unique property, results suggest that translational frame-shifting in OAZ expression evolved for a spermine-dependent regulation of PK RNA. PK RNA function as a spermine sensor and mammalian riboswitch indicates a wider expression of riboswitches amongst eukaryotes and offers a novel mechanism for affecting metabolic processes in cancer and other diseases.
1-(4-NITROPHENYL)-1H-1,2,3-TRIAZOLE-4-CARBALDEHYDE: A USEFUL SYNTHON FOR SOLUTION- AND SOLID-PHASE 4-FORMYL-1,2,3-TRIAZOLE PREPARATIONS.
Rebecca K. Zawistowski* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.

The aim of this study was to develop an efficient method for preparing 4-formyl-1,2,3-triazole containing compounds for both solution and solid-phase chemistry. Traditional synthesis of many 4-formyl-1,2,3-triazole analogs can be complicated by the use of alkyl azide reactants that are either unstable or slowed by steric hindrance. It is therefore advantageous to develop alternative methods for these syntheses. Previous work showed that imine formation on 4-formyl-1,2,3-triazole compounds allows for L’abbe rearrangement, which proceeds via open-chain diazoimine intermediates. Because of the simplicity and efficiency of this reaction, this method was chosen for the preparation of the 4-formyl-1,2,3-triazoles in this study. 1-(4-Nitrophenyl)-1H-1,2,3-triazole-4-carbaldehyde (1) was efficiently synthesized using a tandem click approach. Solution-phase reactions mixed 1 with commercially available amines containing various functional groups of interest, and the reaction was allowed to proceed through L’abbe rearrangement. The functional groups chosen were used to survey both steric and electronic effects on the overall reaction. Solid-phase reactions mixed 1 with various commercially-available amine-functionalized resins, resulting in immobilization of the 4-formyltriazole unit. The impact of resin identity, solvent identity, stoichiometry, and temperature on reaction rate and progress was observed. Monitoring of reaction progress both in solution-phase and solid-phase studies was accomplished by measuring the absorbance of the yellow 4-nitroaniline byproduct of the rearrangement reaction at 390 nm. This presentation will describe in detail the optimization of both of these reaction methods. This publication was made possible 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.

ELUCIDATING THE PA01 ATTACHMENT MECHANISM ON SILICA AND POLYSTYRENE SURFACES VIA SURFACE ENHANCED RAMAN SPECTROSCOPY.
Christopher Huber*, Brady Stuhmer, Jaysa Hoins, and Tanner Harsin, Department of Chemistry, Doane University, Crete.

Biofilms are colonies of microorganisms that form in order to improve the vitality of the community as a whole. Bacterial biofilms are of particular interest to the medical field due to their enhanced antibiotic resistance. In this work, we look to study the attachment mechanism of the opportunistic pathogen, Pseudomonas Aeruginosa, on silica and polystyrene surfaces. Our goal is to use Surface Enhanced Raman Spectroscopy (SERS) to directly detect the chemical groups used by PA01 bacteria to attach to these surfaces. In order to accomplish this goal, we have optimized the synthesis of SERS-active Au substrates and developed two different surface modification methods to produce silica-like and polystyrene-like surfaces via silica sol-gel synthetic methods. Bacterial growth studies have shown that these surface-modifications have promoted biofilm growth on an otherwise uninhabitable Au surface suggesting that bacterial attachment to a surface is substantially superficial. Raman data has been collected on biofilms grown these surfaces and analysis underway.
RING-DEGENERATE REARRANGEMENTS OF 1-SUBSTITUTED-4-IMINO-1,2,3-TRIAZoles.
Joseph A. Christensen, Matthew D. Hanson, Rebecca K. Zawistowski and James T. Fletcher*,
Department of Chemistry, Creighton University, Omaha.

This study examined parameters governing ring-degenerate rearrangement reactions of 1-substituted-4-imino-1,2,3-triazoles. As originally reported by L’abbe in 1990, such rearrangements are prominent at elevated temperature and driven by increasingly electron-rich substituents at the imino position. In addition to exploring the influence of imino substituent identity in greater detail, including the direct analysis of imine product distributions, this study also aimed to examine the influence of triazole substitution on the rearrangement process. A series of 1-aryl-4-formyl-1,2,3-triazoles with variable electronic properties at the para-aryl position (including nitro, trifluoromethyl, methyl, methoxy and diethylamino groups) were prepared by a tandem click method and surveyed against an analogous series of anilines. It was observed by NMR that unsymmetrical condensation reactions conducted at 70° C produced up to four imine products via a dynamic equilibrium of condensation, rearrangement and hydrolysis steps. Rearrangement was prominent even at room temperature for triazole analogs with electron-poor substituents. Among the analogs studied, only the electron-poor nitro-substituted triazole resulted in irreversible rearrangement outcomes and correspondingly simplified product mixtures. Kinetic studies utilizing 1-(4-nitrophenyl)-1H-1,2,3-triazole-4-carbaldehyde with varying amines showed both steric and electronic influences on rearrangement rates. Such measurements were facilitated by a high throughput colorimetric assay that directly monitored the generation of 4-nitroaniline byproducts. With a recent surge in interest regarding 4-imino-1,2,3-triazoles due to their utility in preparing bioactive molecules and coordination compounds, the results of this study inform the design of target compounds within this motif and inspire new methodology where controlled L’abbe rearrangement might be used to prepare 1-substituted-4-formyl-1,2,3-triazole compounds of interest. This publication was made possible 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.

STUDIES OF AMINO ACID MUTATIONS IN DRUG RESISTANCE OF THE SMO PROTEIN.
Eunice Wintona* and H. Andy Zhong, Department of Chemistry, University of Nebraska at Omaha.

Smoothed receptor (SMO) is a protein, which in humans is encoded by the SMO gene. Known as a GPCR-like receptor, it is a component of the hedgehog signaling pathway. An uncontrolled or inappropriate activation of the Hedgehog pathway drives tumor progression and a number of birth defects. Two drug molecules like Vismodegib and Sonidegib were approved but drug resistance occurred due to mutations. Our goal is to computationally study the protein-drug interactions on wild-type and mutants of SMO protein and by doing so to predict which mutants are susceptible to drug treatment (i.e., having a good docking score). Certain mutations in this protein may result in a resistance to the present-day drugs, thus reducing their efficiency. To achieve these goals, the molecular modeling software MOE was used to build small molecules and drug molecules. These molecules were docked to the binding pockets of the wild-type and mutants of SMO. Systematic mutations of residues in the binding pocket were generated at positions of D473, V321, C469, and E518. Our preliminary results show that D473Y would weaken the binding of all the molecules except MDB5 and MDB6; and that V321M would increase the binding to MDB2, MDB4, and GDC_0449. In other words, some of the molecules are predicted to be active against both the wild-type proteins and the mutants, while other molecules fail to inhibit mutants.
USING MACROCYCLIC CAVITANDS FOR REACTION SELECTIVITY AND SUSTAINABLE CHEMISTRY.

Treyvon Bokoskie*, Akshay Kashyap, Wuilian Martinez, and Mahesh Pattabiraman, Department of Chemistry, University of Nebraska at Kearney.

Macrocyclic cavitands are spherical molecules with cavities that can include smaller molecules within them; the small molecule thus included reacts differently from a free molecule due to its spatial restrictions. This is referred to as host-guest chemistry, wherein the macrocyclic is analogized to a host and the included molecule the guest. Our group has utilized this phenomenon to direct and control reactivity of molecules by manipulating the intermolecular forces between the host and guest, and guest and guest. This method has been shown to be useful in affecting 2+2 photocyclization reaction of 2+2 alkene photocycloaddition reaction in regio- and stereo-selective manner. The same approach has been utilized towards controlling iodocyclization of disubstituted acetylenes. The macrocyclic cavitands used in our studies, gamma-cyclodextrin and cucurbit[8]uril, are water-soluble, which afford the reactions to be performed in aqueous media and/or in organic-solvent-free conditions. As intermolecular interaction and reaction selectivity are tied in a cause-and-effect relation, this approach is useful in studying supramolecular interactions based on product distribution and reaction kinetics.

EXPANDING THE CAVITAND-MEDIATION APPROACH FOR PRODUCING STEREO- AND REGIOSPECIFIC SUBSTITUTED CYCLOBUTANES FROM CINNAMIC ACIDS.

Akshay Kashyap*, Wuilian Martinez, and Mahesh Pattabiraman, Department of Chemistry, University of Nebraska at Kearney.

[2+2] Photocycloaddn. (PCA) of alkenes is an important photochemical reaction, which is often used in chemical optical data storage systems and in photopolymerization. Stereospecific cyclobutanes are important intermediates in organic synthesis, and are frequently encountered in natural products. Developing a reliable method for producing stereospecific cyclobutanes will be of high value in this regard. However, the unimol. isomerization reaction of alkenes often precludes the bimolecular. PCA; and even when PCA ensues, selectivity in the reaction is often low as four possible stereoisomers could result. Our group has been successful in directing the PCA of substituted alkenes through the cavitand-mediation approach. In this method, macrocyclic cavitands (γ- cyclodextrin and cucurbit[8] uril) are used to non- covalently bind two reacting olefins within the cavity to form ternary inclusion complexes (1:2) ; photoexcitation of the complex would yield the dimer in high yields. This method is also effective in enforcing stereoselectivity, as the stereochem. of the product is structurally similar to the oriented arrangement of the reacting alkenes. Previously we had demonstrated that the syn H- H dimers of cinnamic acids could be reliably produced using this approach. By exerting steric hindrance in one end of the mol., we now show that selectivity in the reactions could be directed towards another dimer - the anti H- T isomer. Our work in this area indicates that the cavitand-mediation approach is developing into a reliable method for producing stereospecific cyclobutanes. We will present our recent findings in this line of research from our group.

COLORIMETRIC SENSOR ARRAYS FOR THE DETECTION OF WARFARE ANALYTES.

Andres Mora*, Dr. Michael Kangas, and Dr. Andrea Holmes, Department of Chemistry, Doane University, Crete.

In order to prevent any casualties in warfare it is imperative to know which hazardous substances are surrounding the soldier. Unfortunately, the presence of chemical weapons, like nerve gas and toxins, might not be recognizable at first glance, leaving the soldier exposed to danger. The detection of these analytes is imperative, and colorimetric arrays can offer a method resulting in a color change when is
exposed to chemical weapons. The purpose of this research is to find the fastest and most affordable detection method by formulating sensors for printing on solid support, like paper, that can be then used by soldiers or emergency first responders in the field. The results of this research will show how the colorimetric sensors are formulated and tested using 96-well plate to compare the color change of sensors with compounds that mimic chemical weapons, explosives, and other agents. The colorimetric sensors that worked the best in solution are printed on paper using an Inkjet printer and then again exposed to the analytes. The arrays are scanned using a commercially available desktop scanner. The resulting images are then analyzed using ImageJ and chemometric methods. Adhesion studies are also performed on all sensors to determine if the sensors attach properly to the paper without leaching.

**CHEMISTRY AND PHYSICS**

**PHYSICS**

**B-MODE IMAGING USING GAMPT ULTRASOUND EQUIPMENT**

Wes Anderson, Physics Department, Hastings College, Hastings, NE 68901

Medical imaging techniques have exhibited major milestones over the past century. One of its marvels, ultrasound imaging was developed in 1956. Since then, its results have been improved through the use of new technologies and modifications such as a B-Mode imaging, harmonic imaging, and ultrasound elastography. During this study, I have investigated the capabilities of GAMPT ultrasound measurement system which included multiple transducers and a pulse-receiver. An algorithm was developed that corrects for attenuation of waves as they travel to and from the ultrasound transducers. Multiple medical ultrasound phantoms (materials resembling the different densities of normal body tissue) have served as test objects and have provided many insights into the capabilities and limitations of the GAMPT ultrasound equipment. B-Mode ultrasound imaging is the most commonly used form of ultrasound imaging. Commonly, it is used for tissue imaging, as well as obstetrics, and many other imaging applications. Consequently, the trials and results from this experiment deal only with B-Mode ultrasound imaging.

**FORCE SENSITIVE RESISTORS AS A SUPPLEMENTAL TOOL DURING WEIGHT BEARING REHABILITATION**

Tyler Lowry, Physics Department, Hastings College, Hastings, NE 68901

Force sensitive resistors (FSRs) are sensors that allow for the detection of physical pressure, squeezing and weight. Though they are not highly accurate, they are relatively cheap and easy to use. During this project, FSRs were used to provide weight bearing information for several of my friends. After testing the accuracy of the FSRs using standard masses, I then investigated possible qualities of and guidance provided by the feedback from the sensor for people who placed them in their shoes. Participants were given standard verbal cues used in most hospitals during their testing of the force sensors. In addition, I compared the accuracy of a person’s ability to gauge weight bearing with and without sensors in their shoes. Finally, I analyzed the forces and torques involved in the distribution of weight placed on the foot to search for additional insights into how to improve current weight bearing rehabilitation methods. The measurements of force applied to the FSRs were performed by exploiting the linear conductance trait of the sensors and an op-amp circuit.

**DESIGN, ASSEMBLY AND ANALYSIS OF AN UNMANNED AERIAL VEHICLE**

Chris Perez, Physics Department, Hastings College, Hastings, NE 68901

Unmanned aerial vehicles have been around for decades, but they have recently achieved
greater popularity. Over the past few years, drones have been considered as a means to perform various duties for businesses and government organizations. They are now used in a variety of ways including photography, product delivery, and even becoming an essential tool in search and rescue. There are a wide range of drones on the market, and they differ in size, design, and properties. During this project, the design and construction of a drone using OEM parts was performed. Instead of simply purchasing a kit or fully assembled drone, the required pieces were purchase and then assembled into a drone with unique features. Physics phenomena investigated during this project included projectile motion, rotational motion, and thrust from rotors. In addition, much was learned about the use of various sensors and software to provide remote control of a drone.

FABRICATION AND TESTING OF CARBON FIBER REINFORCED POLYMER WITH STRUCTURAL APPLICATIONS TO AN EXPLORATION ROVER
Brian Puckett, Physics Department, Hastings College, Hastings, NE 68901

For decades, NASA has been one of the largest organizations focused on human exploration of space. The desire to explore and to achieve the seemingly impossible is what has driven most of NASA’s greatest achievements, and the following research is a direct supplement to NASA’s ambitious aspirations to further study our universe. With dreams of sending humans to Mars in the future, research is needed to develop optimal transportation vehicles for astronauts. This project investigated methods for the construction of a man-powered, all-terrain rover prototype. Because conventional vehicles are not practical for use on the moon or other terrestrial planets, the construction of our rover required the use of novel technologies for wheel design, steering mechanisms, suspension systems, and overall structure. This project investigated carbon fiber reinforced polymer (CFRP), fabricated in various geometries, in an effort to approximate the mechanical and structural properties of these composites. Specifically, I focused my study on the structural integrity of a variety of composite materials for wheels and framing purposes. Tensile and compression testing was performed on handmade CFRP parts. Stress-strain curves were determined as well as approximate tensile and compressive strength values. A computational structural analysis was performed, indicating the strongest and weakest points on the rover. In conclusion, our rover will be most effective for astronauts to travel short distances because pedaling a rover containing significant amounts of cargo would be too exhausting over an extended period.

FUNCTIONAL REACTIVE PROGRAMMING FOR CONTROL OF AN UNMANNED AERIAL VEHICLE
Amanda Romero, Physics Department, Hastings College, Hastings, NE 68901

Unmanned aerial vehicles have been around for decades, but they have recently achieved greater popularity. Over the past few years, drones have been considered as a means to perform various duties for businesses and government organizations. They are now used in a variety of ways including photography, product delivery, and even becoming an essential tool in search and rescue. During this research project, an investigation of the use of sensors connected to a rotor speed control system was investigated. The sensors provided information about the drone’s speed, direction, and height. Three-axis gyroscopes simultaneously detected angular changes along three axes. Another important aspect of this project was the implementation of software capable of providing continuous control of the quadcopter without any input from the remote control unit. This project demonstrated the robust nature of Functional Reactive Programming (FRP) for processing data from common sensors to control a quadcopter.
SOIL MOISTURE ESTIMATION USING SURFACE TEMPERATURE AND OTHER METEORLOGICAL DATA
Jessie Johnson, Physics Department, Hastings College, Hastings, NE 68901

Soil moisture is defined as the quantity of water measured in a sample of soil. Knowing accurate soil moisture values is important for meteorology, natural disaster prediction, and agriculture. In agriculture, the yield of a crop is determined mostly by the soil moisture of the soil rather than the deficiency of other nutrients. Currently, NASA utilizes the Soil Moisture Active Passive, SMAP, satellite to provide soil moisture data for large geographical areas. This data is helpful for weather predictions, but its usefulness is diminished from an agriculture viewpoint because the area covered is so large it may not correlate to the exact crop field in question. This study focuses on smaller scale mapping of soil moisture. During this project, the relationship between soil moisture and soil surface temperature for sandy and silty types of soils were investigated. The long term goal of this research endeavor is to develop a low-cost way to remotely sense the soil moisture in a crop field. This new remote moisture sensor will enable farmers to efficiently irrigate their crops.

DEVELOPMENT OF HIGH VOLTAGE SUPPLY CONTROLS FOR THE STAR EXPERIMENT AT RHIC
Samuel Ruiz, Jiro Fujita, Creighton University Department of Physics, Omaha, NE

The STAR (Solenoidal Tracker at RHIC) experiment at RHIC (Relativistic Heavy Ion Collider) at Brookhaven National Laboratory studies the collisions of various ion species. Due to the scale of the STAR detector, the large number of channels to be controlled and monitored require an experiment-wide control system for efficient operation. Additionally, the radiation levels require that the user interfaces of the system are located outside the experimental hall. Each sub-detector system at STAR is controlled by software input/output controllers (IOCs). Aging high voltage control programs at STAR are being replaced or are having their software updated to run on new processors. The outdated high voltage controls software occasionally malfunctions or requires frequent rebooting of the remote hardware. This talk will cover the design and implementation of more effective controls software for the STAR high voltage systems. This work will also be applicable to other subsystems with similar hardware issues.

FEASIBILITY STUDY FOR THE OBSERVATION OF INCOHERENT PHOTOPRODUCTION OF PHI MESONS IN RELATIVISTIC Pb-Pb COLLISIONS IN THE ALICE DETECTOR AT THE LHC
Amrit Gautam, Department of Physics, Creighton University, Omaha, NE

The Large Hadron Collider (LHC) started its operation in September 2008. It collides ions at very high energy and recently began colliding lead ions (Pb) at an energy of 5.02 TeV. The ALICE detector is one of the detectors used to study Pb-Pb collisions at the LHC. An Ultra-Peripheral Collision (UPC) occurs when the impact parameter is greater than twice the nuclear radius. In this situation the interaction between the nuclei is purely electromagnetic. This electromagnetic interaction can be viewed as the interaction of virtual photons. In incoherent photo production the photon emitted from one nucleus interacts with a nucleon of another nucleus. The feasibility test was done to determine whether the incoherent photoproduction of the phi meson is observable in the ALICE detector during the current run. In this talk the different kinds of interactions in UPCs and the process of Monte Carlo simulation of these interactions (using STARLIGHT) will be described. The results of the Monte Carlo simulations will be presented along with the estimated number of phi mesons that will be observed in the ALICE detector.
Quantum dots (QDs) have applications and promising myriad applications in photovoltaic cells, biomedical imaging, targeted drug delivery, and quantum information processing. These have led to much research on their interactions with other systems. For biological systems, research has focused on the biocompatibility and cytotoxicity of QDs in the context of imaging/therapy. However, there is a paucity of work on how biological systems might be used to alter the optoelectronic properties of QDs. Here, we show that these properties can be altered by biological macromolecules following controlled changes in cellular activities. Using CdSe/ZnS core-shell QDs, spectroscopic analysis of optically excited colloidal QDs with HL60, K562, and HCN2 cell lines are performed. Our results show statistically significant ($p < 0.0001$) quenching of the emission spectra of the colloidal dispersions due to the reactive oxygen species (ROS) produced by these cells following chemotherapy and radiotherapy. This optical modulation constitutes what we describe as cyto-molecular tuning. This type of tuning will possibly enhance applications of QDs in green energy and biomedical imaging.

**MATHEMATICAL MODELLING OF CELLULAR BIOIMPEDANCE FOR PHYSICS OF CANCER**

Andrew Walther, Anh Vo and Dr Andrew Ekpenyong, Creighton University, Omaha, NE

Physics of Cancer is a new research frontier which focuses on the mechanical properties of cancer cells and their role in cancer disease and metastasis. Metastasis itself is the complex process by which cancer cells spread from the primary tumor to other tissues and organs of the body where they form new tumors. Metastasis leads to over 90% of all cancer deaths. An important step in the metastatic cascade is migration. Various chemotherapeutic and radiotherapeutic approaches target cancer cell proliferation and not metastasis. We have recently quantified extensively, the impact of these approaches on cancer cell migration, using bioimpedance as readout. Here, we model our vast experimental data in order to gain mechanistic insights into the role of various chemotherapeutic and radiotherapeutic approaches on cancer metastasis.

We have recently used a commercially available Electric Cell Impedance Sensor (ECIS) to quantify the migration of various cancer cell lines including HL60 (leukemic), K562 (erythro-leukemic) and HCN2 (neuronal) following chemotherapy (Doxorubicin, Daunorubicin, Paclitaxel) and following radiotherapy (using a cell irradiator, Faxitron CellRad). We now apply both integer order and fractional order equivalent circuits to model the bioimpedance data, using MATLAB codes. Of note, we recently submitted a manuscript titled: “Fractional calculus modeling of cell viscoelasticity quantifies drug response and maturation” for publication.

Preliminary fits of equivalent circuit models are currently being done. However, even without data fitting, we find that the irradiated HCN2 cells attach and migrate significantly more than non-irradiated cells in the first 20 hours post irradiation.

Owing to the multilevel complexity of biological systems and the growing intractability of diseases, especially cancer, there is an urgent need for better modelling of living matter in the context of health and disease.
THE POSSIBLE EFFECTS OF MOBILIZED EOLIAN SAND ON SOIL FORMATION IN PEORIA LOESS, SOUTH-CENTRAL NEBRASKA, USA

Jeremy S. Dillon, Ryan May, Dylan Nichol, and David Urban, Department of Geography, University of Nebraska at Kearney, Kearney, NE 68849

The northern margin of the upland surface on the south side of the Platte River valley near Kearney, Nebraska includes a narrow band of isolated, low dunes composed of silty, fine and very fine sand. Soils in the interdunal areas are formed in Peoria loess and are mapped by the NRCS as Coly and Kennesaw silt loams. These are thin soils with relatively weak development (A-A/C-C and A-Bw-C horizonation, respectively). The soils formed in Peoria loess immediately to the south are mapped as the Holdrege silt loam; a thick, clay-rich soil with A-Bt1-Bt2-BC-C horizonation. Our transect of core samples and limited laboratory analyses confirm this soil-landscape relationship.

We propose a conceptual model to explain some of the differences in soil development. During periods of aridity (which were episodic throughout the Holocene) eolian sand becomes mobilized on the surface with low, isolated dunes. As sand grains, and possibly sand-sized soil aggregates saltate, their impacts with the ground surface dislodge finer particles which are then entrained and transported downwind. The soils thus experience some degree of deflation. The mobilized sand also creates an unstable surface where Holocene eolian dust from regional sources is less likely to accumulate. Meanwhile, the soils immediately to the south do not experience the “bombardment effect” of salting sand grains and thus do not experience the related deflation. Moreover, the lack of mobilized sand allows regional eolian dust (and possibly locally-derived sediment from the dune mantled surface to the north) to accumulate on the relatively stable surface. Thus the soils on the surface without saltating sand develop thick, clay-rich, cumulic profiles. We do not discount the likely role of texture-related soil moisture and concomitant differences in vegetative cover. However, we do propose that mobilized eolian sand has played at least some role in the significant differences in soils developed in Peoria loess on these adjacent landscapes.

IMPACT OF AN EXTREME FLOOD EVENT ON STREAMBANK RETREAT ON CEDAR RIVER, NEBRASKA

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Streambank migration is a natural process categorized by simultaneous erosion and accumulation processes. Some of the factors influencing the magnitude of these processes are streamflow, soil type, land-use change and riparian vegetation. Literature documenting the impact of a single extreme flood on streambank processes is lacking. The objectives of this study were to (i) evaluate the impact of an extreme flood event in 2010 on streambank retreat on 45 km of Cedar River relative to the average annual retreat from 2006 to 2016; (ii) quantify the changes in streambank retreat and accumulation for each km downstream from the breached dam; and (iii) evaluate the impact of riparian vegetation on streambank retreat. We calculated the average annual streambank retreat and accumulation during the pre-flood (-2010), flood (2010) and post-flood (2010-2016) periods for each km downstream of the dam using aerial images and ArcGIS. Using measured bulk density and streambank height, coupled with a Monte Carlo analyses, streambank mass and volume were calculated and the impact of riparian vegetation quantified.
SYNOPTIC ANALYSIS OF THE 1888 “CHILDREN’S BLIZZARD”

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The winter of 1887-88 was cruel and relentless due to some of the most impactful storms in the United States in recorded history. Perhaps the worst storm of that winter began on 12 January 1888. The tragedy of this storm was partially due to the unexpected nature of it having been preceded by above average temperatures on the afternoon of the 12th. The purpose of this study will be to analyze the synoptic conditions that led to the January Blizzard of 1888 in the Great Plains. Data will be gathered from the National Oceanic and Atmospheric Administration. Because of minimal data existence in this time period, the most useful resource will be the U.S. Daily Weather Maps. An additional source of data is the Earth System Research Laboratory’s 20th century reanalysis product. These products will be integrated and interpreted to explain what caused this devastating weather event. An initial hypothesis would be that the storm was the usual Norwegian Cyclone that often occurs across the Great Plains. Upon analysis, however, it appears that the blizzard occurred during northwesterly flow, an uncommon regime for devastating blizzards in this region.

THE FRICK LABORATORY AT THE AMERICAN MUSEUM OF NATURAL HISTORY – NEBRASKA CONNECTIONS

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The Frick Laboratory at the American Museum of Natural History amassed a collection of approximately 255,754 Neogene mammals during the 1930’s and 1940’s. Morris Skinner from Ainsworth and Ted Galusha from Hay Springs are the most famous of many Frick associates from Nebraska. Skinner’s early partner in fossil collecting was James Harrison Quinn, also raised in Ainsworth. Ralph Mefferd; Gordon Fletcher; Howard Williamson; the three Potter brothers Albert, Jess, and Hugh, and Robert Emry, all at one time Skinner assistants, were from the Ainsworth area. Cooperative studies between the Frick Laboratory and the University of Nebraska State Museum were managed by C. Bertrand Schultz, Thompson Mylan Stout, and Loren Toohey.

Several other Frick-Nebraska connections are lesser known. Guy Hazen, who collected for Frick in California and Arizona, was born in Norfolk. John Lynch, who worked for Frick in Texas, was born in Crete. Richard Jenkins, who shuttled between California and Sioux County, Nebraska, through the 1930’s, is buried in Gering. Frank Otto William Geist, a pioneer anthropologist and paleontologist in Alaska, once worked as the chauffeur for Nebraska’s own J. Sterling Morton. Surprisingly, both of Frick’s long-term stenographers were from Nebraska. Mabelle Marie Campbell was born in Clay Center. She married in 1945. Mabelle and her husband David Nelson settled in Clay Center, and both are buried there. “Hattie” Elizabeth Meek was raised in Sheridan Township, also in Clay County. Miss Meek continued to serve the Frick estate after Childs Frick’s death. She died on the Frick estate on Roslyn Harbor, New York, in 1972. She was buried here in Lincoln.

ORIGIN OF VOIDS IN CLIFF EXPOSURES OF COLORADO PLATEAU SANDSTONES

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Well-sorted, calcite-cemented sandstones of Late Paleozoic and Early Mesozoic age are widespread and well exposed in southern Utah, northern Arizona, and southern Nevada. These rocks are porous and permeable, forming extensive aquifers as well as oil and gas reservoirs. On many cliff-faces exposing these sandstones, large, rounded voids (from a centimeter to several meters in diameter) are prominent. Cavities are best developed along vertical tectonic joints, but also appear between joints. Sheeting joints (which develop parallel to rock slopes and are younger than the vertical joints) appear
to cut across these cavities. The climate is arid (southern Nevada) to semi-arid (Utah and Arizona) with sparse vegetative cover. Most precipitation is delivered by brief, heavy downpours during the late-summer--the “Arizona monsoon”. The cavities appear to be products of either ghost-rock karstification (“phantomes des roches”) or hypogene karstification. The ghost rock process was proposed in the late 1990’s by geologists in France and Belgium; it interprets certain karst features developed in carbonate rocks as the result of a two-step process (not a simple, single dissolution episode). This study extends the concept to explain features in calcite-cemented sandstones. The first step in this process is dissolution of the cement from the permeable sandstone. This takes place in a low-relief landscape below the water table. The dissolution, controlled by joints and high-permeability beds, produces horizontal galleries and vertical pipes filled with in situ, but weakly cemented or uncemented sand (“alterite”). These are surrounded by solid, unaltered rock. The second stage begins when uplift and erosion increase the topographic relief. The alterite (which formed in a low-energy setting) is then removed by high-energy processes operating on and just below the steep, naked outcrops. Rock falls expose pre-existing tectonic joints, and sheeting joints develop parallel to the land surface cutting across the alterite-filled dissolution galleries. Rock slides from these joints further open the alterite-filled chambers. Most of this weak material is likely flushed out of the exposed galleries and pipes during heavy rainstorms. The fluids responsible for step 1 for the Jurassic Navajo and Wingate Sandstones are so far unknown. The ghost-rock hypothesis relies on descending, soil-derived CO$_2$-rich water for dissolution of the calcite. For the hypogene karstification hypothesis, acidic water is derived from below and bears volcanogenic CO$_2$ and/or H$_2$S. Further study of the Colorado Plateau sandstones is required to constrain the source of the fluids (from above or below?) and the timing and depth of the dissolution step. Prior work on iron-oxide-cemented concretions in the Navajo Sandstone indicated that siderite precipitation was triggered by degassing of a CO$_2$-charged aquifer. With uplift and erosion, the siderite was oxidized by shallow groundwater. The distribution of large voids in the Navajo and the timing of their formation may lead to better understanding of the evolution of ancient pore fluids and of their flow paths through these sandstones.

**DETERMINANTS OF MAGMA TRANSPORTATION AND EMPLACEMENT AT SPREADING RIDGES**

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Though the relationship between oceanic crustal construction mechanisms, pressure, temperature, and mantle source heterogeneity has been studied over decades, there is still not a uniform consensus about what dominantly governs magma transport and crust construction. Mid-ocean ridge basalts are principally the products of magma upwelling and eruption. Both major and trace elements exhibit systematic variations in mid-ocean ridge basalts (MORB) at both global and local scales. Langmuir and Klein (1987) argued that mantle temperature controls the distribution of MORB composition on both global and regional lengths, while other studies show that low pressure fractionation affects global MgO variations. Mantle source heterogeneity is another factor for affecting MORB generation and chemistry distributions. Enriched mantle and depleted mantle result in different trace element species; participation of garnet in low degree melting and eclogite recycling are also critical for isotope variations in MORB (Langmuir et al., 2005). At regional scales, hot spots near mid-ocean ridges also influence the chemistry and composition of nearby MORB, likely due to source heterogeneity.

To better understand geochemical patterns and relationships in MORB, geochemists have developed sophisticated melting models to explain how magma is produced and extracted from partially molten mantle sources. Based on the content and residence time of melts in residual solids, melting models can be divided into categories: batch and reactive porous flow models assume complete chemical
disequilibrium except for a small increment of melt in equilibrium with solids (Mckenzie, 1985).

Additional developments include the MELTS family of models, which provide further constraints on melt fraction, temperature, and crustal thickness by calculating thermodynamic phase equilibria during melting (Asimow, 2001). MELTS predicts an up to 0.08 mean melt fraction and a maximum crustal thickness (15 km) for passive flow; a range of 60° C is acceptable to explain the range of global oceanic crustal thickness.

GEOLOGIC HISTORY OF THE NEW CALEDONIA BASIN, WITH IMPLICATIONS FOR THE GEODYNAMIC HISTORY OF ZEALANDIA
Claire Richardson, Caroline Burberry, and Irina Filina, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, NE 68588

In the southwest Pacific Ocean lies a purported continent known as “Zealandia”. This proposed 4.9 Mkm² area includes the North and South Islands of New Zealand, and extends to the northwest to include the Lord Howe Rise and New Caledonia, and to the southeast to include the Chatham Rise and the Campbell Plateau. The true continental status of Zealandia is an ongoing topic of debate among scientists, due to the potential existence of oceanic crust in the New Caledonia Trough. A range of suggestions have emerged for the formation of this basin, with endmembers being several episodes of rifting of eastern Australia, or back-arc spreading related to the initiation of the Tonga-Kermadec subduction zone.

Using potential fields data, reflection and refraction seismic data, wireline logs, and results from IODP Expedition 371, this study seeks to investigate the nature of the New Caledonia Trough, to reconstruct its geologic history, and to apply those results to understand the geodynamic history of Zealandia. With these data, an integrated geophysical model will be constructed through the Tasman Sea to constrain possible crust types, crustal architecture, and crustal thicknesses. Subsequently, we will use tectonic reconstructions to test which of the aforementioned endmembers the modeled crustal architecture is consistent with. Results of this modeling will also have implications as to whether Zealandia can be properly classified as a continent, as they will either support or oppose the existence of oceanic crust in the New Caledonia Trough.

SUBSURFACE FAULTS RELATED TO MIDCONTINENT RIFT IN NEBRASKA FROM INTEGRATED GEOPHYSICAL ANALYSIS
Kris Guthrie, Irina Filina, Mindi Searls, and Caroline Burberry, Earth and Atmospheric Sciences Department, University of Nebraska-Lincoln, Lincoln, 68588

This study focuses on the subsurface structures associated with the Midcontinent Rift (MCR) in Nebraska. The MCR is a Mesoproterozoic failed spreading center that runs through the North American craton. In Nebraska, the MCR goes through SE part of the state where two well-populated cities of Lincoln and Omaha are located. Regularly occurring small magnitude earthquakes (less than 4.5) caused by subsurface faults associated with the Midcontinent Rift are documented in Nebraska and the adjacent states. The major objective of this study is to examine the MCR and its related faults in SE Nebraska via integrated analysis of all available geological and geophysical data.

For our study, we use the previously developed earthquake database (Guthrie et al., 2017), published gravity and magnetic maps (Sandwell et al., 2014, Meyer et al, 2017, Bankey et al., 2002, Phillips et al., 1993) and well logs from the Nebraska Oil and Gas Conservation Commission and from Kansas Geological Survey. The goal is to constrain the locations of the MCR-related faults identified in previous studies (Burberry et al., 2015, Searls et al., 2017). By integrating multiple geophysical and geological datasets, we intent to derive a more confident map of the MCR structures in SE Nebraska.
INVESTIGATING MECHANISMS OF HYDRAULIC CONDUCTIVITY TRANSIENCE IN SANDY STREAMBEDS

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Streambed hydraulic conductivity (K) is known to be spatially heterogenous, but few attempts to record its temporal variability have been made. This study examines the hypothesis that seasonal transience in K is primarily controlled by deposition and erosion in mobile sediments. We use hydraulic, geophysical, and sedimentological methods to examine changes over an eight-week period in the Loup River in east-central Nebraska. Falling head permeameter tests and slug tests were conducted at depths of 0.5 meters below the bed to determine vertical K (Kv) and K (slug test K), respectively. Repeat measurements were made on a grid that included: 1. a stationary braid bar where diagenetic pore clogging is expected to control K transience, and 2. mobile sediments of the adjacent stream channel where deposition/erosion are thought to be the dominant controls. Sediment samples were collected at the site of each hydraulic test to determine grain size distributions and estimate K. Ground penetrating radar (GPR) surveys at 450 Mhz and frequency domain electromagnetic geophysical surveys were conducted providing high resolution images of subsurface structure. Kv ranges between 0.1 and 45 meters/day, and K ranges between 15 and 55 meters/day. Kv and K changed significantly only between July and August. K declined 14-20% in both environments while Kv declined 27% on the bar, but was unchanged in the channel. Despite evidence of scour and fill in the channel captured by GPR, deposition and erosion did not exert a dominant influence on K transience. The results of this study suggest that processes responsible for K heterogeneity within streambeds such as bioclogging and gas ebullition need to be more closely studied.

CRITICAL WEDGES AND PENETRATIVE STRAIN: HOW DOES PENETRATIVE STRAIN ALTER THE CONCEPT OF CRITICAL WEDGE?

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By definition, a critical wedge shows limited internal deformation, and, also by definition, penetrative strain is deformation occurring on a microscale within a deforming rock sequence. Critical wedge theory is typically used to understand the development of fold thrust belts, where variables such as the internal and basal friction, surface taper and dip of the decollement are taken into account. Numerical modeling shows that the minimum stable surface taper is dependent on the basal friction and the overburden, but that there are a range of possible tapers for a stable wedge. This study presents a series of analog models, where the overburden thickness is systematically varied over a constant basal decollement layer. Models are shortened to 5%, 10% and 15% respectively, creating a total of 9 experiments. Models were photographed from top and side view at each increment (1%) of shortening and side view photographs were used to measure surface taper. We expected that the surface taper would increase with a thinner overburden, and this did occur in early model stages. However, in the latter stages of shortening and in the final configuration, models tended to the same surface taper, within the stable field, accommodated by varying amounts of penetrative strain. A model with a thinner overburden showed an increase in average penetrative strain within the overburden, relative to the comparison model with a thicker overburden from a previous experimental series. Furthermore, models demonstrate a notable drop in surface taper with the development of the second fold structure. These results suggest that whilst critical wedge theory is a valuable construct for understanding the final configuration of a fold-thrust belt, the detailed behavior and development of the wedge cannot be understood without the inclusion of the penetrative strain concept.
PENETRATIVE STRAIN RELATED POROSITY LOSS IN CLASTIC RESERVOIR UNITS OF THE DENVER-JULESBURG BASIN

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Penetrative strain (PS) represents the total percentage of shortening not accommodated by the formation of map-scale geologic structures. Studies of compressive settings in the Appalachians place PS estimates in the range of 2-23% shortening. At outcrop-scale, PS is accommodated through sub-seismic slip on brittle fault planes. At the microscale, PS is accommodated through grain impingement, pore-scale compaction, and grain rotation. This study considers the PS accommodated in thePennsylvanian-Cretaceous sedimentary sequence exposed at the foothills of the Front Range, with emphasis on the clastic reservoir units that yield oil and gas within the Denver-Julesburg (D-J) Basin. Field observations, petrographic analysis, magnetic susceptibility (AMS) data, and analog modeling are used to estimate the amount of PS in four E-W transects along the I-25 corridor. Intergranular deformation patterns were analyzed from 46 thin sections within the basin. Best fit ellipses were applied to compressed, rotated sand grains altered by low-temperature deformation. Compromised grain boundaries were reconstructed using the Onasch method. Preliminary results from sandstones of the Cretaceous Dakota Group show strain percentages on the order of 11-15%. This is consistent with AMS studies of Triassic red-beds of the Wyoming Salient. Similar AMS techniques are deployed in this study to measure weak, concealed deformation of ferromagnetic minerals from the iron-rich Fountain and Satanka Formations. We predict elevated PS will correspond with increasing depth in the sedimentary system, reaching a maximum with the basal Fountain Formation. Analog models of Laramide deformation scenarios will be used to provide a framework for understanding the field data. Our study aims to provide a systematic and precise dataset, as well as determining the spatial and temporal component of volume loss. We predict results from this study will indicate that PS is highest near the base of the sedimentary section. The presence of overburden accumulated during deposition, as well as the absence of a basal shale or evaporite detachment, limits strain partitioning in the Fountain Formation. Therefore, PS is accommodated into strain fabrics which significantly reduce reservoir quality by constricting porosity through dislocation processes, such as creep and glide.

INTEGRATED ANALYSIS OF GEOLOGICAL AND GEOPHYSICAL DATA IN THE NORTHEASTERN GULF OF MEXICO

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Despite over a century long exploration activities in the Gulf of Mexico (GOM), the tectonic history of the basin is still being debated. The thick sedimentary strata, complicated by a presence of massive salt deposits, challenges the seismic imaging of the crustal structures. That is why the integrative approach based on all available geological and geophysical data is necessary to develop a robust and confident crustal model of the basin. This study focuses on the northeastern part of the gulf. The overall objective is to delineate various crustal zones in the study area in order to develop additional constraints on the tectonic reconstruction of the basin. In our study, we integrated gravity and magnetic fields with seismic refraction data; we used well logs to constrain the physical properties of sedimentary section. The framework of our project are two seismic refraction profiles (GUMBO 3 and GUMBO 4; Eddy et al., 2014; Christeson et al., 2014) that were used to build two 2-dimensional subsurface models in the northeastern GOM (Liu and Filina, 2017). We then correlated the mapped geological structures from these profiles with the lineaments observed in gravity and magnetic fields. This allowed us to expand our structural interpretations outside of the seismic coverage and map the Ocean - Continent boundary (OCB), transform faults and several
segments of extinct mid-ocean ridge in the northeastern GOM. This presentation focuses on validation of our structural results. We used two recently published seismic reflection datasets - the 3D study from Deighton et al., 2017 and several 2D lines from Rodrigues, 2016 to evaluate our interpretation. We concluded a very good correlation between the features interpreted in seismic reflection data and the structures mapped from our integrated geophysical analysis.

Overall, this integrated approach allowed us to delineate two distinct crustal zones in the northeastern GOM that show drastically different crustal structures, as well as to map a series of transform faults that separate these zones. The next step will be to incorporate all of our results as constraints for the tectonic restoration of the entire Gulf of Mexico.

SUBSURFACE STRUCTURE IN SOUTHEASTERN GULF OF MEXICO FROM INTEGRATED GEOPHYSICAL ANALYSIS
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Subsurface structures in the Southeastern Gulf of Mexico are challenging to map due to thick sedimentary cover with complex salt structures. The presence of pre-salt sedimentary strata (beneath the autochthonous salt) is known from sparse published seismic data (Williams-Rojas et al., 2012; O’Reilly et al., 2017). However, the overall extent and the thickness of these sediments in the Southern Gulf of Mexico are still not well known. Our study intends to provide constraints on the pre-salt sediments based on integration of potential fields (gravity and magnetics), seismic reflection and seismic refraction data from publicly available sources.

We applied several filters to gravity and magnetic grids to highlight the Ocean-Continet boundary (OCB). We developed several 2D subsurface models along seismic reflection profiles, and used them to validate our OCB interpretation. These models consisted of sedimentary layers constrained by seismic images, upper and lower continental crust, oceanic crust, and the upper mantle. We assigned physical properties (densities and magnetic susceptibilities) based on well logs and typical values for given rock types according to published literature. We constrained densities and magnetic susceptibilities in corresponding layers to be consistent across all models. These models allowed us to evaluate the thickness and spatial extent of the pre-salt sedimentary section, as well as the thicknesses of various crustal units.

Integrative approach allowed us to map the OCB location in the Southeastern Gulf of Mexico, evaluate the thickness and delineate an extent of the pre-salt section, and derive the thickness of individual crustal units. By combining several independent geophysical methods, we developed more confident subsurface models.

ENVIRONMENTAL SCIENCES

INVERTEBRATE COLLECTIONS AT WAYNE STATE COLLEGE: SUMMARY AND A REVIEW OF CONSERVATION NEEDS
Barbara L. Hayford, Department of Life Sciences, Wayne State College, Wayne, NE, 68787

The Wayne State College A. Jewell Schock Museum of Natural History houses 15,000 specimens of birds, mammals, invertebrates, plants, and fossils. Herein, I summarize the freshwater mollusk and insect collections. Jewell Schock, former WSC Zoology Professor, created and maintained the freshwater mollusk collection. Updates to the mussel taxonomy were made in 2016 with all specimens ascribed species names. Insect collections have been maintained at WSC for over a century and the Museum received specimens of freshwater insects identified to the species level from the Kansas Biological Survey in 2011. The collections contain just over 5000 specimens representing 3000
collection sites and nearly 450 species. Most sampling locations were regional and collection dates ranged from 1902 to 2014. Thirteen orders of insects are in the collection with over 56% of the insects found in four large orders: beetles (Coleoptera), dragonflies and damselflies (Odonata), butterflies and moths (Lepidoptera), and true flies (Diptera). Most terrestrial insect specimens in the collection require identification past the family level. Even though the freshwater mussel collection is small, it is important for conservation research given the declining number of species in the Central Plains. I will present regional maps of major groups of insects and of the freshwater mussels and will discuss conservation of freshwater fauna.

**RATES OF ATTACHMENT AND MODIFICATION OF VARIOUS GRASS PROPAGULES TO BISON FUR**

Megan Royal, Biology, Wayne State College, 1111 Main St. Wayne, NE 68787

American bison may have been an important force for seed dispersal in North American grasslands. The objective of this study was to determine which propagules of grass attached best to bison fur. Little bluestem propagules had the highest extent of attachment to bison fur followed by Indian grass, big bluestem and sideoats grama. To determine which part of the little bluestem propagule was most essential for attachment, the individual components of the propagule including the rame segment, the pedicellate spikelet, the awn, and/or the hairs were removed. The extent of attachment using these modified propagules was investigated. The complex structures associated with varying prairie grass propagules will be compared to their significance for propagule attachment to bison fur.

**THE IMPACT OF LAND USE ON NITRATE-N MOVEMENT AND STORAGE IN THE VADOSE ZONE OF THE HASTINGS' WHPA**

Craig Adams, Daniel Snow, and Chittaranjan Ray, University of Nebraska at Lincoln, NE 68583

Nebraska relies heavily on irrigation and fertilizer application to maintain crop yields. Over-irrigation and continuous application of nitrogen (N) in many areas has led to accumulation of nitrate-N in soils and sediments of the vadose zone throughout the state. Because nitrate-N is both persistent and mobile, groundwater concentrations in many areas of Nebraska and other agriculturally intensive states are increasing. Nitrate-N contamination of public and private drinking water supplies that utilize groundwater are of particular concern. Vadose zone sampling is an important method for rapidly assessing the effect of changing land use on the potential groundwater contamination. In the current project, 32 vadose zone soil cores were collected from the Hastings, NE Well Head Protection Area, building on a 2011 study done by UNL’s Department of Agronomy and Horticulture. Profiles were generated from cores collected from urban land, pivot irrigated farmland, and gravity irrigated farmland. In areas where irrigation changed from gravity to pivot application there was an average reduction of approximately 170 lbs-N/acre in the top 55 ft of the profile over a five-year time span. Cumulative nitrate-N beneath the top 65 ft for urban irrigated lawns, pivot irrigated farmland, and gravity irrigated farmland have an average of 320, 540, and 700 total lbs-N/acre respectively. This reinforces the belief that sprinkler irrigation allows for a more uniform application, eliminating potential leaching at the head and tail rows of gravity irrigated fields. While additional research is needed, the importance of vadose zone monitoring in evaluating and protecting groundwater is beneficial in determining connections between surface activities and the underlying groundwater.
This project focuses on the natural removal of atrazine from waterways negatively impacted by agriculturally heavy areas using biofilms. Biofilms are a group of microorganisms in which cells adhere to abiotic or biotic surfaces through extracellular polymeric substances and can play a beneficial role in controlling the biogeochemical flows of an ecosystem. This is of great interest in agriculturally heavy areas due to large amounts of pesticides needed to ensure success of crop growth. This massive application of chemicals to land results in a large amount of runoff into nearby waterways due to the short retention time of pesticides in soil. Atrazine is our specific compound of interest because it is the most widely used pesticide in the United States and can be found in 94% of US drinking water tested by the USDA. Because of the presence of Arthrobacter Aurescens TC1 in atrazine prominent soil in South Dakota and previously reported capability of metabolizing atrazine, it has been of interest for bioremediation of atrazine. A high-throughput microfluidic bioreactor called Bioflux was used to study the biofilm efficiency of pesticide degradation in water samples present with Atrazine. This microfluidic device allowed for controlled shear flow conditions and other factors that are present in naturally occurring bodies of water. Preliminary data consists of biofilm formation of Arthrobacter Aurescens TC1 in the microfluidic device. An HPLC assay was used for monitoring atrazine levels during biofilm formation. This research project is working towards the feasible application of an optimal biofilm community that can effectively degrade and remediate pesticides from agricultural run-off in hopes to improve human and environmental health.

IMPLICATIONS FOR HUMAN HEALTH OF NITROSYLATION OF CYTOPLASMIC AND MEMBRANE PROTEINS OF CHIRONOMUS DILUTUS

Kristy Hansen, Bobby Hansen, and Barbara Hayford, Department of Life Sciences; and Gustavo Zardeneta, Department of Physical Sciences and Mathematics, Wayne State College, Wayne, NE 68787

Nitrogen toxicity causes major shifts of the natural food web by removing pollution sensitive species in agricultural ecosystems. Even though the ecological implications of nitrogen toxicity have become clearer in recent years, the potential effect of nitrogen toxicity on humans in terms of public health is not fully understood. However, ecosystem health and water health have been linked to human health in agricultural systems. To better understand this link, the aquatic larvae of a non-biting midge, Chironomus dilutus, which is a common bioindicator of poor water quality was exposed to peroxynitrate to observe cytoplasmic and cuticle protein modification through nitrosylation of tyrosine residues. Improvements were made to previous protocol by removing unreacted tetranitromethane, TNM, a chemical precursor to peroxynitrate. The unreacted TNM was before midge treatment, so the resulting protein nitrosylation and midge death was due only to peroxynitrate not to the more caustic agent, TNM. In addition, spectrophotometer readings were taken, and Beer’s Law was applied to derive a standard curve. This lead to the discovery that protein modification and premature midge death occurs even if the true concentration of peroxynitrate is in the mM range. Our preliminary results suggest that even extremely low levels of nitrates can cause protein nitrosylation which has major implications for agricultural communities with streams that have nitrogen levels as high as 10 mg/L. Our results add to the growing body of knowledge linking insect, fish, and amphibian impairment to nitrate and nitrite toxicity. This research, taken collectively, should cause concern over the response of human health to nitrogen pollution from agriculture. Further work, will determine the identity of the modified proteins in the cuticle and cytoplasm which could then be compared to analogous proteins in humans.
CHALLENGES TO ENVIRONMENTAL EDUCATION IN HAITI
Debra S. Baker and Dr. Donald Huggins, Kansas Biological Survey, University of Kansas, Lawrence, KS 66047

The purpose of this talk is to share experiences of teaching environmental education in Haiti to better prepare non-Haitians who either teach or engage Haitians in activities that require some level of scientific understanding (e.g. medical field, water and sanitation, agronomy, public health). Ms. Baker has taught ecology in Haitian universities since 2012, and in schools and communities since 2009. Co-author Dr. Huggins has joined her in presenting scientific information to government groups, communities, and non-government organizations (NGOs). Some misunderstandings of the natural world that penetrate even into the university are that bats come from old mice and snakes suckle from nursing mothers. Hawks and owls are maligned and killed for killing chickens, and snakes killed for being Satan. There is a sense that the environmental degradation in Haiti is too large to overcome. Our experiences have led us to conclude that the local belief systems (social or religious), misinformation, insecurities in accepting positive environmental changes, and inadequacy in science curricula in most Haitian schools, makes teaching sciences, especially environmental sciences and ecology, a challenge unless one is prepared to accept and compensate for these educational obstacles. While it is easy to point out scientific misunderstandings found in other cultures, a deeper examination of why those misunderstandings exist may help us see misunderstandings in our own culture and emphasizes why a solid background in science is necessary for all citizens.

PRESENCE OF MOSQUITO SPECIES IN PHYTOTELMATA: PUBLIC HEALTH INITIATIVES
Meghan Krajicek, Dr. Barbara Hayford

Phytotelmata, plant held waters, provide habitat for communities of aquatic insects. These might be in leaf axils, flowers, tree holes, modified leaves, or fallen vegetative parts. Mosquitos are one of the most common inhabitants of phytotelmata. Some mosquitos are vectors for diseases such as Dengue, Zika, or Malaria. Many of these mosquitoes are container mosquitoes, adapted to living in small, temporary waters such as those found in phytotelmata. The purpose of this study was to examine data collected on the species found in phytotelmata for incidences of vector species and to relate incidence to plant species and geography. A comprehensive review of literature on Web of Science (Thomas Reuters) encompassing over 100 years of publications yielded 3000 associations between aquatic flies and phytotelmata in two types of plants, Bromeliaceae and Zingerberales. More than 1500 of these associations were between mosquitoes and the phytotelmata, with 5 species within 2 genera of Malaria, Dengue, or Zika carrying mosquitoes. Geographic range of phytotelmata in this study was from southern Florida to southern South America and included islands in the Caribbean. Incidence of vector mosquitos was calculated per country, data representing presence, not presence versus absence. Geographic variation in mosquito/plant interaction may be due to sampling bias. Overall, few vector species were found in most samples, with percent incidence for sites with mosquito vectors ranging from .027 to .455 percent incidence. Based on the results of this study we recommend that removal of phytotelmata will not be effective in fighting the vectors of major diseases. If phytotelmata are removed as a mosquito vector control, then these unique ecosystems will be eliminated with minimal reduction in mosquito populations.
INSECT PRESENCE AND BIRD VOCALIZATIONS DURING A TOTAL SOLAR ECLIPSE

Kristy Hansen and Mark Hammer, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Total solar eclipses usually occur between two to four times each year across the earth. Even though solar eclipses are frequent events, there is limited information known about ecological changes during a total solar eclipse. The purpose of this study was to examine the effect of the total solar eclipse of August 21, 2017 on a prairie ecosystem. Insects were sampled using a sweep net at various points before, during, and after the eclipse in a prairie grassland near Marquette, NE. In addition, bird vocalizations were recorded throughout the course of the eclipse and compared to abiotic changes. Weevils (Coleoptera: Curculionidae) were the most common insect during totality of the eclipse. Weevil numbers increased greatly toward totality, then began to decline following totality. There was no direct correlation between the amount of bird vocalizations and temperature, average wind speed, or relative humidity throughout the course of the eclipse. Weevils collected during the eclipse may have nocturnal behaviors that were induced during the total eclipse.

ANALYSIS OF MEDICAL PLANTS BY REGION AND THE BACTERICIDAL PROPERTIES OF MORUS ALBA

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An analysis was done on recorded medical plants from four geographical regions consisting of North America, India, China, and Africa. Plant binomials were identified and a Jacquard similarity index was performed to determine if any plants were historically used in multiple regions. North America and China had the greatest similarity at the genus level with a Jacquard similarity index of 0.18. The Artemisia genus was used across all four regions, and Morus alba, the white mulberry tree, had historical medical use in all regions but Africa. A disc diffusion assay and minimum inhibitory concentration test will be performed on a methanolic extract of Morus alba to determine any bactericidal properties the tree may have.

A BRYOPHYTE SURVEY OF THE NEBRASKA PINE RIDGE: IMPLICATIONS FOR ASSESSING SPECIES RICHNESS OF, AND THREATS TO, THE STATE’S BRYOFLORA

Steven Rolfsmeier, High Plains Herbarium, Department of Physical and Life Sciences, Chadron State College, Chadron NE 69337

A recent multi-year survey of bryophytes in the Nebraska Pine Ridge ecoregion reveals the presence of 66 species newly documented from this area, doubling the number of species known in 2010. A species accumulation curve suggested that discoveries of newly documented species began to plateau in 2016, at which time specimen collection density in the region was 0.72 specimens/km², up from 0.16/km² in 2010. Estimated collection density for Nebraska as a whole is currently no more than 0.1 specimens/km². As 25 species were newly recorded from Nebraska during this survey, it is suggested that similarly intensive surveys in targeted species-rich landscapes elsewhere in the state might represent an effective strategy to expand our knowledge of the scope of the state’s bryoflora, and provide a starting point for assessing threats to species persistence in the face of climate change. Species with few populations that are found in microhabitats susceptible to wildfire appear to be particularly vulnerable to extirpation. Among Nebraska species restricted to the Pine Ridge, those with the greatest risk of elimination include Brachythecium erythrorrhizon, Heterocladium dimorphum, Hylocomium splendens, and Orthotrichum affine, all of which are currently known only from high-quality pine forest in the Hat Creek breaks of Sioux County.
TEACHING OF SCIENCE AND MATH

TREATING PLANT BLINDNESS
Phyllis Higley, Biology, College of Saint Mary, Omaha, NE 68106

Plant science teachers have long struggled to motivate student interest in plants. Disinterest in plants and disregard for their value is widely prevalent in the general population. Wandersee and Schussler coined the term, plant blindness, to describe this phenomenon. Plant blindness is a concern because it negatively impacts plant conservation initiatives. People are less likely to support funding to protect plants than they are to protect animals. Additionally, services provided by plants are not readily recognized. Plants’ visual blending, lack of noticeable motion, dissimilarity to human characters and behaviors, and minimal focus in education may contribute to the phenomenon. In my classes I incorporate slow motion videos of plant movements and make special effort to illustrate the relevance of plants to students’ lives. I’ve also created a one credit class that focuses on the importance of plants in the world. In my presentation I will describe the actions I’ve taken to increase plant visibility and discuss their potential and limitations.

THE EFFECT OF A FOCUSED SUPPORT PROGRAM FOR UNDERREPRESENTED STUDENT SCIENCE RESEARCHERS
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Science and engineering fairs provide opportunities for students outside of the classroom to experience the Science and Engineering Practices described in A Framework for K-12 Science Education (National Research Council, 2012). The skills gained from participation in STEM clubs and science fair competitions have been tied to post-secondary matriculation (Sahin, 2013). Schmidt & Kelter (2017) found that a majority of students who participated in science fairs realized a positive shift in their attitudes toward STEM careers. Schmidt & Kelter also found a significant portion of the effect seen on student participation and overall interest in students’ pursuit of STEM-related careers correlates with strong, consistent support from an adult. How will an intensive cognitive apprenticeship program affect the performance of underrepresented student researchers? Over the past two years, a diverse group of twenty students, representing four urban middle schools experienced a program to provide intensive science research support. Opportunities during the first two years included three and five-day field-research immersions, visits to college research facilities, regular conversations about science with an adult mentor, and ongoing support with science research. Because participation in all activities has been voluntary and therefore varied, approximately 25% of the treatment group did not participate in the most current intensive research weekend.

TENSILE STRENGTH, TIEABILITY, AND HYDROLYZABILITY OF ABSORBABLE POLYESTER SUTURES: DEVELOPING A SOPHOMORE ORGANIC CHEMISTRY LABORATORY
Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178

An investigation of the tensile strength, tieability, and rate of degradation of polyester and polyamide fibers was designed for the sophomore organic laboratory. MW 70,000 poly(caprolactone) (PCL) was heated and drawn into fibers ca. 0.2 mm in diameter. The tensile strength and rate of hydrolysis of these fibers were compared with those of similar diameter sutures of poly(glycolide) (PGA), poly(glycolide-co-caprolactone) (PGCL), and poly(hexamethylene adipamide) (nylon). The order of tensile strengths was found to be PGA > nylon > PGCL > PCL; the easiest fiber to tie was PGA.
The rate of hydrolysis was nylon >> PGCL > PGA > PCL. The factors influencing these rates will be discussed.

EDUCATIONAL GAME DESIGN AS A VEHICLE FOR INTEGRATING STATISTICS INTO BIOLOGY COURSES: A PRELIMINARY STUDY
Kyle B. Johnson, Concordia University, 800 N. Columbia Ave., Seward, NE 68434

Math is necessary to explore science actively, as someone who can communicate and evaluate fully the research generated by others. Despite this, many students are fearful of math and do not see its importance within the biology curriculum. In an effort to integrate make students understand the importance of math to interpreting biology, students (n = 6) in and basic pharmacology class undertook a project designing an educational game to teach lower level students from an intro to research class some basic pharmacology principles. Students designed a pre- and post-test to evaluate players' improvements in understanding of the pharmacology topic. Students who designed the games were given their own pre- and post-test over different statistical tests and different circumstances for when they would use them. Prior undertaking the game design project, students averaged 18 ± 7% (mean ± SD) on the post-test, while they averaged 50 ± 29% on the post-test, a statistically significant increase (p<0.05). The results of this preliminary experiment suggest that this activity may be one way that students can meaningfully increase their understanding of when to apply appropriate statistical tests.

MINDMUP SOFTWARE IN PROMOTING COLLABORATIVE AND CRITICAL THINKING LEARNING
Mark Jones and Josef Kren, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE 68506

MindMup is a simple, JavaScript application, which can be used to link ideas into concept maps. Although there are various mind mapping applications, MindMup seems to be user friendly and powerful. We decided to use MindMup in two consecutive semesters in a doctoral program of nurse anesthesia to map concepts in clinical anatomy and clinical physiology. We believed that development of a concept map will help students to learn the required information. During the clinical anatomy course, students were developing individual maps of the autonomic nervous system (ANS) of the human body. In the clinical physiology course, students were adding autonomic receptors to their maps developed during the previous semester. Our expectation was that the project would greatly enhance students’ learning and understanding of the anatomy and physiology of the ANS. As health care providers, nurse anesthetists face clinical challenges involving the ANS on daily basis. After completion of the project, we anonymously surveyed 17 students regarding their experience with MindMup. Students’ views and our expectations did not match each other.

A COMPUTER MODEL OF ACQUIRED ANTIBIOTIC RESISTANCE
MaKayla Coan and Alexia Morales, Department of Biomedical Sciences, Bryan College of Health Science Lincoln, NE 68506

The prescribing of pharmaceutical drugs in both medicinal and agricultural practices today is becoming increasingly prevalent. Although there is high regulation set in place, there is still a concern about the release of these drugs and the increasing prevalence of antibiotic resistance in the environment. There is a large knowledge gap in the long-term effects of ecological health as well as direct human and animal health due to antibiotic resistant bacteria being spread throughout the environment. I am proposing a computer simulation model, using STELLA software that offers various ways to view the dynamics of antibiotics in the ecosystem. I have incorporated several environmental variables that
influence the natural bacteria in the ecosystem. This model can be used to show a variety of ways that humans and animals can acquire antibiotic resistant bacteria from the environment.

COMPUTER SIMULATION OF INFLUENZA EPIDEMIC
Holly Didier and Josef Kren, Department of Nursing and Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE 68506

Influenza is a contagious respiratory illness caused by the influenza virus. It can cause mild to severe illness and even death. High risk populations, such as older people, young children, and people with other health conditions such as asthma, chronic lung conditions (COPD), heart disease and diabetes, are at high risk of serious influenza complications. Influenza viruses are spread by droplets from sneezing, coughing or talking. Healthy adults can infect other people within 1 day before being symptomatic and up to 5-7 days after sick. Children may pass the virus for longer than 7 days. A community is at risk of an influenza epidemic if precautions are not taken to prevent the spread of the virus. These precautions may include, immunization, isolation, handwashing, proper coverage of nose and mouth, and protecting the high risk population. There have been numerous attempts to better understand the spread of the influenza virus in the community. We are proposing a computer model, which simulates the typical dynamics of influenza epidemic in a population of highly susceptible subjects and a population of least susceptible subjects. Two major parameters of our model are being discussed; recovery without symptoms and mortality. This model can be used by health care professionals to visualize the spread influenza for the purpose of education in the medical community.

COMPUTER SIMULATION OF PATIENT/COST BENEFIT IN ROBOTIC BARIATRIC SURGERY: THE DA VINCI VS. OPEN PROCEDURE
Tessa Kingsley, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE 68506

More than one-third of the adults in America are obese, and as the number continues to rise we are seeing a drastic increase in the number of obesity-related health complications. Among the many complications of obesity are premature death, increase risk of type II diabetes and cancer, hypertension, heart disease, and many other diseases that can greatly reduce someone’s quality of life. On average and obese American spends $1500 more, annually on healthcare than those of a recommended weight. I am looking at the differences of using a DaVinci Robot to do laparoscopic surgery, versus an open procedure. There are many variances in each procedure performed. I am addressing the major alternatives that could cause one option to outweigh the other. Major risk factors of all surgery include development of blood clots and infection. Through this computer simulated model I am mapping out the cost and benefits of laparoscopic robotic surgery versus and open bariatric procedure.

COMPUTER MODELS AS A TOOL TO GUIDE CLINICIANS IN THE NEUROSURGICAL INTERVENTION OF INTRACRANIAL HEMORRHAGE
Haley Liberty and Jamie Stewart, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE 68506

An intracranial hemorrhage is an emergency medical condition that may result in death if not properly treated. This bleeding within the skull may occur spontaneously, or may occur as the result of traumatic injury. The primary goal of critical care is to assess the cause and location of the bleed, stabilize both blood pressure and intracranial pressure, and then correct the coagulopathy. I have developed a computer simulation that models this coagulopathy of intracranial hemorrhage, as well as other pathological effects that may or may not be present. In my presentation, I will use this model as a
guide to demonstrate how the decisions of a clinician may impact the prognosis for the patient. While treating intracranial hemorrhage, time is valuable, and the correct decisions must be made as quickly as possible. It is also very important to consider the location and pathology of the hemorrhage as well as the best approach of treatment. The goal of this model is to serve as a clinical guide in the process of the neurosurgical treatment of intracranial hemorrhages.

INVESTIGATION OF $\alpha$-KETOGLUTARATE UTILIZATION IN UROPATHOGENIC E.COLI USING COMPUTER MODELING
Ana Martinez-Hottovy, Department of Biomedical Sciences, Bryan College of Health Sciences, Lincoln, NE 68506

One of the primary causes of urinary tract infections are due to the uropathogenic bacterium Escherichia coli, which causes approximately 80%-90% of community-acquired urinary tract infections worldwide. Certain strains of uropathogenic E. coli can infect the renal proximal tubule cells, which can lead to the manifestation of pyelonephritis. Previous studies have shown that for the renal proximal tubule cells to perform their physiological function, high concentrations of $\alpha$-ketoglutarate accumulate in the environment, and a genomic island, containing genes c5032-c5039, have been demonstrated to play a role in anaerobic utilization of $\alpha$-ketoglutarate in a uropathogenic strain of E. coli, CFT073. A specific metabolite transporter in uropathogenic E. coli, C5038, demonstrated to have been acquired through horizontal gene transfer, has become specialized for anaerobic $\alpha$-ketoglutarate utilization; therefore, indicating that the gene encoding this transporter (c5038) is vital for in vivo fitness of this strain of bacteria. The purpose of the model I am proposing is to represent how increased $\alpha$-ketoglutarate concentrations increase the fitness of certain strains of uropathogenic bacteria, specifically E. coli, and therefore increase the risk of urinary tract infections. The information generated by this model can be used for potential targets for new treatments and therapies for urinary tract infections, and to enhance our knowledge of uropathogenic E. coli physiology, specifically non-traditional virulence factors that augment metabolic mechanisms, which increase their adaptability and pathogenicity.

MODELING THE PHARMODYNAMICS OF ATTENTION DEFICIT HYPERACTIVITY DISORDER MEDICATIONS
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Prescription drug abuse has become a major concern in recent years, with over 15 million people taking nonprescription drugs in the U.S. alone. This trend is reflected in college and university students, where ADHD medications are commonly abused in an attempt to increase focus and memory. I have developed a model that demonstrates the effects of these drugs on a student’s memory, as well possible adverse side-effects that occur with the prescription drug abuse. I will use this model as a source of education for college and university students that believe these prescription drugs are a safer alternative to other forms of stimulants.

A COMPUTER SIMULATION ON THE EFFECTS OF LIFESTYLE ON HUMAN HEALTH
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Chronic inflammatory diseases have become a prevalent issue for people over the age of 50. This problem can be traced back to negative changes in diet, lack of exercise, and additional stressors on the body that have occurred in the past few decades. Some of the most common inflammatory diseases include asthma, chronic peptic ulcer, rheumatoid arthritis, and colitis. There are inclinations that the
onset of many common diseases today are caused by chronic inflammatory disease. These diseases are lifelong and the therapy to treat these chronic diseases has a high cost. This cost can take a toll on the individuals and be a contributing factor to the increase in chronic inflammatory disease. I have developed a computer simulation model using STELLA to demonstrate lifestyle factors that contribute to the development of chronic disease. The applicability of my model is educating the community that a healthy lifestyle benefits all aspects of life.

**ADVANTAGES OF TAKING PATHOPHYSIOLOGY AND PHARMACOLOGY COURSES SYNERGISTICALLY IN NURSING CURRICULUM**

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Most nursing curricula offer pathophysiology class the third semester, followed by pharmacology class in the fourth semester. Both classes are three credit hours. It is currently recommended that nursing students complete pathophysiology before taking pharmacology. The usual arguments against taking the two classes at the same time is that both of them are challenging classes that require many hours of studying and that pathophysiology is the entire basis for pharmacology. However, there could be a benefit of taking both classes at the same time. Some students claim that both classes go hand in hand in many ways, especially when covering the same body system in both classes at the same time. Several nursing students at Bryan College of Health Sciences took both classes the same semester (Fall 2017) and consider both, cost and benefits of doing so. An example of pathophysiology of congestive heart failure and medication used to treat the condition is discussed.

**COLLEGIATE ACADEMY**

**BIOLOGY**

**SESSION A**

**LASSA VIRUS VACCINATION FROM RECOMBINANT VSV**

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Lassa Fever is an acute viral disease that appears, most commonly, in West Africa. This disease was first discovered in 1969 in Nigeria, Africa. Lassa virus is endemic in Nigeria, Sierra Leone, Guinea and Liberia, with around 300,00-500,000 cases annually. The purpose of this research was to start cloning the Soromba-R strain of Lass Virus into VSV, in order to create an rVSV vaccine. The reason why this study was approved is because there is a population of 60-120 million people that are at risk of contracting Lassa fever. To accomplish the goals of this experiment scientists used the following techniques: Restriction Digest of DNA, Ligase, Agarose Gel, Sanger Sequencing, Nanodrop Spectrophotometer, Gel Purification, PCR, and PCR Purification. These protocols were designed to clone Lassa Virus into VSV. The cloning steps of this project did not result in the data that was expected. Since the cloning of this project did not work the next step of this project would be to repeat the cloning till it works. Once the cloning works then it would need to be rescued. We also want to look at the potential use in neutralization assays to test for the presence of Soromba-R Strain of Lassa Virus. The last step would be testing for potency and safety as a vaccine in Mastomys and other species.
ROLE OF ARSENIC (3) METHYLTRANSFERASE IN REACTIVE OXYGEN SPECIES ACCUMULATION AND CELL PROLIFERATION

Joseph Roper and Koren Mann, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

Arsenic exposure is a major public health issue, where chronic exposure can lead to an increase in the occurrence of cancer. One of the reasons for this is that arsenic is metabolized in the body through the gene Arsenic (3) Methyltransferase (As3MT), which will stimulate the production of reactive oxygen species (ROS) thus leading to DNA mutations and ultimately cancer growth. Currently it is not known how As3MT enhances ROS following arsenic exposure or if there are alternative functions to As3MT beyond arsenic metabolism. However, it is suspected that As3MT may control the antioxidant levels from within the cell which would either enhance or diminish ROS. Therefore, this project focused on how the deletion of As3MT affected the antioxidant levels following arsenic exposure. Using quantitative PCR and western blotting, it is argued that the deletion of the As3MT gene in mice will result in increased antioxidant levels, a result of an increased production of ROS, following arsenic exposure. It was observed during this research that female mice lacking the As3MT gene had gained weight, leading to a question of whether there is another function to As3MT besides arsenic metabolism. Cell growth rates were studied to determine if there is a potential alternative function for the As3MT gene.

A BPH COMPARISON OF WOODRUFF AND SIKORA BUFFER IN DETERMINATION OF LIME REQUIREMENTS IN SOIL PH

Riley Taylor, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

Woodruff Buffer is a solution that is used in some laboratories in the Midwest due to its proven ability to predict accurate lime requirements in soils. However, this method is less preferred to be used in laboratories due to the hazardous component para-nitrophenol present in the solution. This study focuses on potentially replacing the hazardous Woodruff Buffer with the non-hazardous Sikora buffer which, mimics the hazardous Shoemaker-McLean-Prat (SMP) Buffer that contains the same hazardous chemical para-nitrophenol. The experiment took place in an agriculture lab where samples from around the United States were analyzed to see if similar buffer pH (BpH) values were obtained from the two buffers. NAPT samples indicated a linear relationship (r2 = 0.993), while experimental samples showed a non-linear relationship (r2 = 0.508). NAPT sample gave promising results that the two buffers may correlate in predicting lime requirements through similar BpH values, however experimental samples did not.

GENETIC ANALYSIS OF ESCHERICHIA COLI STRAINS ISOLATED FROM HOSPITALIZED PATIENTS

Nicole Liske* and D. Michael Olive, PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

In U.S. hospitals it is estimated there are greater than 1.7 million hospital-acquired infections (HAIs) each year, resulting in more than 100,000 deaths and a healthcare budget burden of $5 to $10 billion annually. Infections caused by gram-negative bacteria are of particular concern because of their frequent multidrug resistant characteristics. While a plethora of practices have been recommended to control the spread of these infections, hand hygiene remains the single most important measure that can be undertaken by healthcare workers to prevent nosocomial infections. In fact, despite being simple, effective, safe, and cheap, the worldwide compliance of healthcare workers to proper hand hygiene is typically below 50%, and it is estimated that 50-70% of nosocomial infections are transmitted on the hands of healthcare workers. In order to establish a preliminary evaluation of possible in-hospital
transmission of organisms, we analyzed sixteen clinical strains of Escherichia coli isolated from inpatients at a local hospital. E. coli is the most common etiologic gram-negative organism, and is most frequently associated with urinary tract infections. They are also frequently isolated members of the Extended Spectrum Beta-Lactamase (ESBL) class of multidrug resistant organisms. Each isolate was evaluated for its antibiotic resistance using the Kirby-Bauer disk diffusion method. Isolates were also examined for growth on ESBL-Chromagar, which selects for ESBL strains. E. coli isolates were examined for genetic relatedness by polymerase chain reaction typing of repetitive DNA using a BOX-1 primer. Although each E. coli isolate originated from a different patient, several were indistinguishable by genetic analysis, suggesting they may have had a common source. While not definitive, a possible source responsible for this observation could be carry-over from a healthcare worker.

ISOLATING THERAPEUTIC BACTERIOPHAGES TO DEVELOP AN ANTIMICROBIAL AGAINST CRE-RESISTANT KLEBSIELLA PATHOGENS
Nicole Carbajal and D. Michael Olive PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

Klebsiella pathogens are a group of bacteria at the origin of many severe diseases including septicemia, pneumonia, urinary tract infections, and soft tissue infections. Though these bacterial infections were once treated without much difficulty, as the use of antibiotics increases, this is no longer the case. Carbapenem-resistance Klebsiella pneumoniae is an emerging, multi-drug resistant nosocomial pathogen resistant to carbapenems—a class of antibiotics typically used as a final effort of clearing an infection; however, current research has shown promising outlook of therapeutic bacteriophages acting as potential solutions for treating several multidrug-resistant pathogen infections such as Acinetobacter baumannii treated with Pseudomonas aeruginosa. Extractions from water sources around Lincoln, Nebraska were taken from four different sources, isolated on plates, and screened for phage activity (plaques) on four Klebsiella isolates in the lab to isolate a potential therapeutic bacteriophage specific for Klebsiella pneumoniae. One successful phage capable of clear lysis was found suggesting its potential use in a “phage cocktail” to act as an antimicrobial against CRE-resistant Klebsiella pneumoniae infections.

CONFIRMATION OF THE cDNA ENCODING FKBP, A REGULATORY PROTEIN, IN A SUITABLE EXPRESSION VECTOR FOR MALIGNANT HYPERTERMIA (MH) RESEARCH
Eliza Fallick* and Kathryn Stowell, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

This last semester, I participated in research on Malignant Hyperthermia at Massey University in Palmerston North, New Zealand. Malignant Hyperthermia is a genetic condition that is inherited in an autosomal dominant manner. It triggers a severe, sometimes lethal, reaction to drugs used in anesthesia due to the misregulation of Ca2+ homeostasis in skeletal muscles. The purpose of my research was to confirm whether the lab had regulatory proteins FKBP12 and FKBP12.6 in suitable expression vectors. Using plasmid minipreps and gel electrophoresis, we determined FKBP12 was in a suitable vector. The procedure needs to be repeated with FKBP12.6. In the future, these vectors will be used to introduce FKBP into RYR1 expressing HEK293 cells to determine whether FKBP affects calcium release from mutated RYR1. We hypothesize that FKBP needs to be expressed in order to show a pathogenic effect.

UTILIZATION OF CREATED PLASMID MET30DUT-GFP IN PDM304 TO IDENTIFY THE LOCATION OF DUTPASE ENZYME, A POTENTIAL TARGET FOR ANTI-CANCER DRUGS
Dan Mai, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

Cancer was known as one of the most dangerous diseases with consequence of high death rate. The number of new cases has increased gradually since cancer was first discovered. There are several of
cancer treatment methods such as chemotherapy, surgery, and radiation therapy. All of those treatments have provided effective results at some point but the side effects and other limitations stimulate scientists to making more research in purpose of finding the most efficient method to cure cancer. Abnormalities in the deoxyribonucleotide pool have long been recognized as determinants of DNA replication fidelity, and hence may contribute to mutagenic processes that are involved in carcinogenesis. Understanding the relationship between deoxyribonucleotide metabolism and carcinogenesis, we created a plasmid called Met30-GFP in pDM304 to identify the location of dUTPase enzyme, a potential target to cure cancer. The plasmid was created by using ligation, transformation, DNA extraction, DNA digestion, gel electrophoresis, and DNA sequence. The result from gel electrophoresis indicates success on creating the plasmid.

TOWARDS A MECHANISM OF ACTION OF AN ANTISCHISTOSOMAL DRUG: MEASURING GRANULOCYTIC ACTIVITY
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Schistosomiasis is a neglected tropical disease caused by a family of schistosome parasites which leads to vital organ damage. Praziquantel (PZ) is the only available treatment, but it is effective only against the adult worm. Partner labs have tested an antischistosomal drug which has been shown to have a higher efficacy against both juvenile and mature parasites in mice and monkeys compared to PZ. This effectiveness does not transfer to in vitro experiments; it kills the parasite outside of its host only at extremely high concentrations. This indicates that its efficacy is host-dependent, but the mechanism by which it functions in vivo remains unknown. The aim of this study is to investigate a possible mechanism of this treatment as a drug which facilitates the activation of the host innate immune system. It is hypothesized that an increased number of eosinophils will undergo degranulation in the mice treated with the drug in vivo, measurable by an increase in the granulocytic proteins eosinophil derived neurotoxin (EDN) and superoxide anions. Male BALB/c mice were orally administered the experimental drug while untreated mice served as controls. Sixteen hours post-treatment, eosinophils were isolated from mouse spleens by magnetic separation. EDN levels were determined by enzyme-linked immunosorbent assay, and superoxide anion concentrations were measured by calculating the reduction of cytochrome c. Preliminary results show that the experimental drug increased superoxide anion levels six fold. This work and future studies on this drug may progress the release of this treatment for schistosomiasis if resistance of PZ grows.

ANTIVIRAL ACTIVITY OF PLANT DEFENSINS
Dalton Hegeholz*, Hernan Garcia-Ruiz, Plant Pathology Department, University of Nebraska-Lincoln

Turnip mosaic virus is a positive strand RNA virus that is part of the potyvirus family, and can act as a pathogen in rice, maize, wheat, soybeans, trees, and vegetables. Potyviruses like TuMV encode a polyprotein that is cleaved by virus-encoded proteases. Defensins are small cysteine-rich cationic proteins that are part of the innate immune system, which is one of the mechanisms of defense against pathogen attack. Defensins are known for their antifungal activity and are predicted to inhibit proteases, like the ones encoded by TuMV. Through bioinformatics analysis, we predicted that all six members of the AtPDF2 family in DEFENSIN 2.6 (AtPDF2.6) on the Arabidopsis thaliana genome have antiviral activity against TuMV. To test this hypothesis, A. thaliana single mutants lacking one PDF member were inoculated with TuMV in order to test if these single mutants experienced faster viral spread or accumulated more virus than the wild-type A. thaliana. At 6 days post inoculation (dpi), we found no significant difference in the amount of local infection between the wild-type A. thaliana and the single
mutants. However, upon collection of infected samples and testing for coat protein accumulation, we found that pdf2.2 and pdf2.6 had higher amounts of coat protein accumulation, indicating more viral infection in the absence of pdf2.2 and 2.6. Because pdf2.2 and 2.6 had higher coat protein accumulation, it is believed that these two genes have antiviral activity, so they were cloned regularly and cloned with a 1xHA tag in order to more easily identify the antibodies through Western blot analysis. These pdf clones were then combined individually with TuMV and used to infiltrate Nicotiana benthamiana in order to observe the spread of virus in the leaves (average infection spots per leaf). N. benthamiana was used because the pdf genes are already present on the A. thaliana genome, so a different species was needed in order to test the effects of each individual gene. At 5 dpi, it was found that the TuMV-GFP+AtPDF2.6 and TuMV-GFP+AtPDF2.6-HA constructs both had significantly lower amounts of infection spots per leaf relative to the positive control (TuMV-GFP+GUS). This indicates that the pdf2.6 gene does have antiviral activity. The pdf2.2 gene does not have antiviral activity.

A COMPUTER SIMULATION STUDY OF THE EFFECT OF GLUCOSE CONCENTRATION ON SURFACE ROUGHNESS OF PSEUDOMONAS AERUGINOSA BIOFILMS

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Biofilms are microbial communities that grow on a surface or interface in a extracellular polymeric substance secreted by the microorganisms. Physical, chemical, and biological factors all impact the manner of biofilm growth creating challenges for theoretical understanding. Computer simulation models can inform our understanding by allowing for detailed studies of the growth dynamics while controlling all the hypothesized relevant properties of the system. In this study, morphological features of the film were calculated from simulation data for the bacteria Pseudomonas aeruginosa grown in a glucose-based medium. A Michaelis-Menten kinetics model was used for the study. The time behavior of surface roughness, surface cell to total cell ratio, and textural entropy were studied as glucose concentration changes.

AN IMPROVED COLORIMETRIC SENSOR METHOD TO LOCALIZE AND QUANTIFY FREE AMINES IN ROOT EXUDATES OF MAIZE

Truc Doan, Doane University, Crete, NE 68333

Interactions between plants and microorganisms in the soil are mediated by exudates produced by the plant roots. The major components of exudates are amino acids, sugars and organic acids. They provide a unique chemical signature that can vary from plant to plant, across developmental stages, and change in response to environmental stress. Greater understanding of exudate composition and localization to root structures during the plant lifespan will drive development of agricultural innovations. A detection assay was developed to observe and localize the production of exudates containing free amines in the root architecture of maize seedlings throughout its early development. Ninhydrin, a sensor commonly used to detect free amine groups, was printed onto paper-like surfaces using an ink-jet printer. After testing a variety of surfaces, nylon membrane was found to produce the the best combination of background and signal uniformity and color development. Methods to reproducibly apply calibration standards were developed to facilitate more accurate signal quantification. In addition, the blotting and imaging elements of this new method are being formulated to make the method more time-efficient, accurate, and easier to use for high throughput studies.
VERIFYING IMIDAZOLINE HERBICIDE RESISTANCE IN NEW VARIETIES OF CLEARFIELD WHEAT

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Wheat is one of the most important staple food crops in the world, but production is limited by competing plant species. Clearfield wheat, a cultivar of winter wheat (Triticum aestivum), was developed with a mutation allowing for resistance to imidazoline herbicides, creating a more efficient solution to rid of such plant species. In this study, 26 new, genotypically different varieties of Clearfield wheat were tested for imidazoline herbicide resistance. The number of days until flowering began, the plant height, and the yield were measured for the wheat varieties with and without exposure to herbicide treatment. The hypothesis predicted no significant differences would exist in the measured characteristics between treated and untreated Clearfield wheat, and a one-way ANOVA test provided results supporting the prediction. Future research will study the effect herbicide has on the quality of seed produced from these varieties, including the seed diameter and thickness, the protein concentration, the moisture content, and the test weight. Herbicide resistance is also found in other crops such as maize, soybeans, and cotton; development of crops with this trait will continue as herbicide resistance emerges in targeted weeds from repetitive herbicide exposure.

APPLYING PHASOR FLIM TO ASSESS THE METABOLIC IMPACT OF HER2 INHIBITION IN CULTURED SQUAMOUS CELL CARCINOMA AND IN-VIVO SKIN

Dan Pham, Creighton University, Omaha NE

The cellular functions of NAD(P)H are diverse, including its role as electron carrier in metabolism and its regulatory activity on the transcriptional corepressor C-terminal binding protein family. Fluorescence lifetime imaging (FLIM) of endogenous NAD(P)H can be used as a sensitive and non-invasive technique to understand the impact of physiological and environmental factors on living cells in vitro and in vivo. This suggests the potential of FLIM in monitoring the altered metabolic activity and genetic regulation in cancer cells. In our study, we used FLIM to evaluate the influence of inhibiting Human Epidermal Growth Factor Receptor HER2 (whose expression is associated with tumor formation, proliferation, and metastasis in multiple cancers) on two Squamous Cell Carcinoma cultures, SCC74A and SCC74B, displaying low- and high-HER2 expression, respectively. Our previous analysis of FLIM images used bi-exponential fitting of the measured fluorescence decay to determine the fluorescence lifetime distribution. We developed a phasor-based model-independent analysis method, in which the fluorescence decay is transformed to form a phasor distribution histogram representing the ratio of free to enzyme-bound NAD(P)H. Our study reveals a decrease in NAD(P)H lifetime following HER2 inhibition by AG825 in both cell lines, with SCC74B displaying a more significant effect. The NAD(P)H lifetime change was more significant in the nucleus n compared to the cytoplasm or mitochondria in SCC74B. Since SCC74A and SCC74B showed different magnitudes of response to HER2 inhibition, this study demonstrates the potential sensitivity of FLIM-based metabolic imaging to monitor disease progression in vivo. This study was made possible 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.
CHARACTERIZATION OF A NOVEL MITOCHONDRIAL PLASMID IN BRASSICA

Mackenzie Strehle, Minnetrista, MN

Possessing some of the largest and most complex genomes of any eukaryotic organelles, plant mitochondria are notorious for their rapidly rearranging genetic framework. In addition to containing a large and complex mitochondrial genome, the mitochondria of several plants in the genus Brassica have also been shown to contain an independent, self-replicating linear plasmid. Interestingly, the plasmid appears to be able to move independently between the cytoplasm and the mitochondria, and it can be paternally inherited, unlike the rest of the mitochondrial genome. The plasmid also has features similar to those of adenoviruses, including terminal inverted repeats and covalently bonded proteins at the 5’ termini. This has led us to hypothesize that the plasmid was originally acquired as a virus by a subspecies of Brassica and has since become an integrated component of the mitochondrial machinery in these plants. The goal of our research is to analyze the coding regions and terminal proteins of the plasmid in order to better understand the mechanisms by which it is transported into and replicated within plant mitochondria. If we can determine how the Brassica plasmid moves between the cytoplasm and mitochondria, there is considerable promise to use this process to target individual gene sequences into plant mitochondria and direct the synthesis of specific RNA molecules and proteins within the organelle. A mitochondrial-targeting plasmid such as this would not only allow for a better understanding of the molecular composition of plant mitochondria, but it may also lead to an enhanced ability to alter their genetic and biochemical environment, which could have effects on the traits and life history of the plant.

HABITAT AREA OF DELPHINUS CAPENSIS, TURSIOPS ADUNCUS, AND SOUSA CHINENSIS WITHIN MOSSEL BAY, SOUTH AFRICA

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For many species of dolphin, general data such as range, current population trends, and habitat are lacking. During my internship with Oceans Research in Mossel Bay, South Africa I found that there is no current habitat data for three dolphin species residing in the bay. So for this project, we examined the habitat area and the overlap of habitat for native dolphin species residing in Mossel Bay. To do this, we observed the bay once a day for five hours using binoculars. If a dolphin was seen, a theodolite was used to track it throughout the bay and data was written down. Computer programs, Pythagoras and QGIS, were used to analyze the data and create maps of the dolphin habitat. These maps revealed that the Indo Pacific Bottlenose dolphin resided along the breakers and zone 1, while the Indian Ocean Humpback dolphin resided along the breakers, zone 1, and zone 3, and the Long-Beaked Common dolphin was found only in zone 3. Also, it was found that the humpback dolphin had areas of overlap with both the bottlenose and common dolphin, suggesting they may travel together. However, there was no overlap seen between the common and bottlenose dolphins. With this information, I was able to successfully create maps of habitat for these species of dolphin in the month of June.
GENETIC VARIANTS OF SURFACTANT PROTEIN A2 (SP-A2) AFFECTS AIRWAY EPITHELIAL RESPONSE TO INTERLEUKIN 13 (IL-13)
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Polymorphisms in surfactant protein A2 can influence how the body's airways respond to Interleukin 13, a cytokine involved in the expression of allergic asthma. Which polymorphism is more beneficial is not yet known, but previous studies have shown that the glutamine variant is associated with higher lung function over the lysine variant. We analyzed whether the lysine or glutamine polymorphism at amino acid 223 of surfactant protein A2 would be more effective in lessening IL-13 induced phosphorylation of STAT3 and MUC5AC gene expression, a mucus gene. Analysis was done through collecting western blot and qPCR data in both human and mouse models. In all but one test, the glutamine variant was more effective at lessening the two values measured than the lysine variant. The glutamine variant significantly reduced MUC5AC gene expression in asthmatic human airway epithelial cells, while the lysine variant did not. The glutamine polymorphism of surfactant protein A2 at amino acid 223 is generally more effective at reducing IL-13 induced phosphorylation of STAT3 and MUC5AC gene expression than the lysine polymorphism.

EFFECTS OF MEAL CONSUMPTION ON ARBOREAL LOCOMOTION OF CORN SNAKES
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Snakes have developed various types of locomotion to allow mobility in different types of environments. In this study, we focus on arboreal locomotion, which is used to travel along branches using horizontal loops and extending the head forward, while balancing the other portions of the body on the surface. We combine this need for tight bends and coils, with the fact that snakes consume their prey whole and potentially impeding flexibility, to ask the question: Do snakes have slowed arboreal speed after consuming a meal? We test this hypothesis by using 27 snakes in 3 equally distributed groups with different feeding types. These groups include a group that consumes no mice, 1 mouse, and 2 mice. They are tested for speed in 3 runs and followed up 24 hours later with trials completed directly after indicated feeding. Our results showed a significant difference between the 3 groups using an ANOVA and a p-value of 0.00311. Our linear regressions looked for a correlation between change in maximum speed and prey mass and area, respectively. These showed no significance. In conclusion, we found that the snakes had a significant drop in speed after consuming 2 mice.

METABOLIC CYCLES IN LOXODONTA AFRICANA
Kaden Schopp* and Kari Morfeld PhD, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

Captive elephants in North American zoos are currently edging ever closer to become demographically non-viable in the coming years. One of the most studied causes is ovarian complications. Decreasing reproductive age, ovarian inactivity, non-cycling, irregular cycles, and others, are all factors contributing to this. Furthermore, is the role that metabolic hormones play in the functioning of the ovaries, and the potential possibility of them causing a ovarian disruptions. This study specifically looked at the roles of progesterone, insulin, glucose, and glucose:insulin to determine any correlations that could potentially result in ovarian complications. The study utilized six, reproductively mature, female, African Elephants. Blood serum was drawn every other week from each elephant, and yielded a year worth of data. Immunoassay kits were used to find progesterone and insulin values. Glucose was found using a touch glucose analyzer. Data analysis was done by using generalized linear
mixed models. Correlation coefficients were calculated for correlation between progesterone and each metabolic factor. Mann-Whitney tests were used as well. This study found no correlation between the metabolic factors and the estrous cycles. No general metabolic adaptation to the estrous cycle could be identified, with the females showing various individual variations in metabolic factor concentration. This study will nonetheless provide opportunities to build upon this research and conduct more targeted comparative research on the physiology of ovarian disruptions in female African Elephants.

NOTCH 3 IS OVEREXPRESSED IN THE LUNG TISSUE OF MARFAN SYNDROME MOUSE MODEL

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Marfan syndrome is an autosomal dominant mutation in the Fibrilin-1 gene that causes bone overgrowth, thoracic aortic aneurysm, and distal airspace enlargement, commonly known as lung emphysema. Previous work on the Marfan syndrome (MFS) mouse models shows altered expression levels of Notch 3, Krupel-like Factor 4 (KLF4), and Smooth Muscle Actin (SMA) in aortic smooth muscle cells. We hypothesized that these genes were also expressed differently in the lung tissue of MFS mice. This may explain the decrease in septation and distal airspace enlargement that has been observed in MFS mouse models. The H&E staining of 1 week MFS mouse lungs shows that our model has lowered levels of septation. We then performed IHC staining for Notch 3, a developmental gene, and found it was expressed at higher levels. RT-PCR analysis of the 1 week MFS mouse lungs supports the findings of the Notch 3 IHC staining. We continued to examine downstream genes of Notch 3 and found that SMA, KLF4, and Lunatic Fringe (LFNG), a Notch 3 activator in lung development, were overexpressed in MFS mice. While we have established a correlation between the overexpression of these genes and the distal airspace enlargement in Marfan model mice, more research is required to determine if it is the cause.

MYCN EXPRESSION AND NEURAL DIFFERENTIATION IN NEUROBLASTOMA CELL LINES

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Neuroblastoma (NB) is one of the most common extracranial pediatric cancers that affects children under the age of five. This cancer develops from immature sympathetic nerves and previous research leads to the belief that poor patient prognosis is the result of mutated MYCN, a proto-oncogene responsible for cellular growth. The goal of this experiment was to decrease MYCN expression and stimulate neural differentiation. Drug treatments with PL-71 and retinoic acid were used on MYCN amplified NB cell line BE-2c. The hope was to successfully transform uncontrollable NB cancerous cells to more stem-like, differentiated cells. Overall analysis focused on protein expression of MYCN, stem cells, and apoptosis and neurite formation. Methods included the use of western blot analysis, light microscopy, and ImageJ. Results present statistically significant differences between specific treatment groups, however not the expected nor intended groups. Based on the results, in order to evaluate effectiveness and expand outcomes, further research needs to be done. If successful, new approaches to patient standards of care can be used to rid or lessen the cancerous effects of neuroblastoma.
THE USE OF COMBINED PATTERN RECOGNITION RECEPTOR AGONISTS ALLOWS FOR FINE-TUNING OF DENDRITIC CELL IMMUNE RESPONSES

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Current vaccines for the Influenza A virus (IAV) target outer coat proteins by inducing antibody production, but are often ineffective because of viral antigenic shift and drift. Vaccines can be improved using adjuvants, which are additives that enhance the quality and quantity of the immune response. Adjuvants have the ability to induce the activation of antigen presenting cells (APCs), such as dendritic cells, which prime T cells that can recognize and respond to the inner, more conserved viral proteins. This response provides a greater potential for heterosubtypic protection and B and T cell memory through cellular immunity. Adjuvants used in our experiments engage pattern recognition receptors (PRRs). We hypothesized that by triggering multiple PRRs, we will be able to increase cytokine and chemokine production by APCs. To investigate this hypothesis, cytokine and chemokine mRNA expression in vitro by bone marrow derived dendritic cells treated with a TLR9 agonist, TLR4 agonist, TLR3/MDA5 agonist, and a RIG-I agonist, alone and in combination, was measured by RT-qPCR. The agonist combinations maintained or increased cytokine and chemokine production compared to each agonist alone. Additionally, transcriptome analysis of the immune response after treatment with TLR4 and TLR9 agonists is being analyzed. These findings contribute to our ongoing effort to develop a more effective and universal IAV vaccine that can provide heterosubtypic protection without the necessity of yearly vaccination.

CHARACTERIZATION OF STAPHYLOCOCCUS AUREUS STRAINS ISOLATED IN A UNIVERSITY SETTING

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Community-acquired methicillin resistant Staphylococcus aureus (CA-MRSA) infections have become an increasing problem in athletics as well as in the general population. Skin infections are one of the most frequently observed pathologies and are often due to self-infection by bacteria that colonize a person’s skin or mucosal surface. Human-to-human transmission can also occur and is usually either through direct contact with an infected individual or indirect exposure through touching fomites like towels, sheets, clothes, workout areas, or sports equipment. S. aureus skin infections include boils, carbuncles, furuncles, and abscesses, the latter of which may require surgical debridement or even amputation. Since athletes represent an “at risk” group for staphylococcal infections, we conducted a study comparing the incidence of drug resistant S. aureus and particularly MRSA among athlete and non-athlete students. Athletic equipment and facilities were also surveyed for the presence of the bacteria. Throat and nasal swabs were collected from 20 athletes and 29 non-athletes and screened for S. aureus. Thirty-six isolates of S. aureus were obtained and screened by Kirby-Bauer disk diffusion assay for resistance to a panel of antibiotics. Polymerase chain reaction detection of the mecA gene was used to confirm the identity of all suspected MRSA isolates. The genetic relatedness of the strains was determined by repetitive element PCR (rep-PCR). In contrast to other published reports, all of the MRSA strains isolated from students were from non-athletes. Most of the S. aureus strains isolated from athletic facilities were MRSA, yet none of the athletes carried these strains. With the exception of two isolates obtained from the athletic center, there appeared to be no genetic relationship between the strains, indicating there was no common source. These results suggest MRSA may not be as communicable as originally reported.
EXPERIMENTAL DETERMINATION OF AN EMPIRICAL ATTACHMENT MODEL FOR PSEUDOMONAS AERUGINOSA BIOFILMS GROWN ON POLYCARBONATE

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Biofilms are microbial communities attached to a surface and embedded in an extracellular polymeric substance secreted by the microbes, which provides a stable environment for microbial growth. Biofilms are problematic in many biomedical applications such as catheters and implants since they are difficult to kill with antibiotics. Efforts to eliminate biofilm growth will be aided by understanding the initial phase of growth as suspended cells attach to the surface. We report on a study of biofilm growth by the human pathogen Pseudomonas aeruginosa on a polycarbonate surface in a glucose-based minimal mineral media. Suspended and biofilm cell accumulation was measured as a function of time in a batch reactor system with constant shear. The data was fit to a Michaelis-Menten kinetics model with a cell attachment term. We determined the best form for the attachment model using least-squares regression.

CHARACTERIZATION OF APOPTOTIC ACTIVITY OF BUGGY CREEK VIRUS

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Buggy Creek virus (BCRV) is an alphavirus that is carried by Oeciacus vicarius, the Swallow Bug. BCRV infects the house sparrow, Passer domesticus, and the cliff swallow, Petrochelidon pyrrhonota. BCRV has not been shown to infect humans, but it is closely related to other alphaviruses such as chikungunya virus. Additionally, the swallow bug is a cimicid insect (like human bed bugs) so investigation of alphavirus dynamics in cimicid vectors is relevant to human health. While house sparrows and cliff swallows are the primary amplifiers of the virus, they are only transiently infected during the summer breeding season. However, within the swallow bugs, BCRV persists year round. The purpose of this project was to study the phenotype of BCRV in swallow bugs collected throughout the year from Southwest Iowa and Southeast Nebraska. After observing virally-induced apoptosis within cell lines, we approached the study by homogenizing our swallow bug samples and filtering the homogenate to isolate the virus. This filtrate was then plated with the cell lines and the levels of apoptosis throughout the year were quantified. Virally induced apoptosis was approximately 4.5 times higher in in samples collected from May to July compared to the rest of the year. Additionally, this pattern persisted through multiple stages of growth. The youngest, instar 1, through adult swallow bugs all demonstrated an increase in activity in the summer months. May through July corresponds with the nesting season of birds; therefore, nestlings are present in the nest. These data show that the virulence of BCRV changes in swallow bugs throughout the year. While BCRV does not yet infect humans, this data could be helpful in predicting outbreak and transmission patterns for other arboviruses. This publication was made possible 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.

EXOSOMES ENHANCE CHEMORESISTANCE IN EWING'S SARCOMA

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Ewing sarcoma (EWS) is a highly aggressive bone tumor affecting children and adolescents. EWS is curable if detected early, but patients with metastasis often show relapse and develop resistance to chemotherapy. EWS is driven by the aberrant oncogenic transcription factor, EWS-FLI1, which results from a chromosomal translocation. It has recently been shown that exosomes derived from EWS cell lines contain the fusion gene, but the role of EWS-FLI1 in exosomes is unknown. Cancer patients
have significantly elevated levels of exosomes in their peripheral vasculature; however, the exact functional role of these exosomes is not well understood. Emerging evidence suggests that exosomes play key roles in promoting tumorigenesis, tumor growth, metastasis, and resistance to chemotherapy. Exosomes contain materials that can influence cancer cells to resist chemotherapeutic agents, possibly enhancing cell proliferation, migration, anchorage independent growth, and chemotherapy resistance. Moreover, exosomes have been shown to propagate the cancer stem cell population, further contributing to the aggressiveness of EWS. The experiments performed test the hypothesis that exosomes increase aggressiveness in EWS cells by promoting resistance to chemotherapy. To test this, we perform a series of characterization assays, including exosome Ultracentrifugations, Transmission Electron Microscopy, and Western Blots. Once the results clearly indicate that the exosomes are isolated, we utilize an MTT assay to assess chemoresistance by measuring the cell viability of cells treated with both chemotherapy and exosomes. By performing an MTT assay with appropriate controls, our results demonstrate that exosomes are able to negate the effects of doxorubicin. We were able to further conclude that there was almost a 100% rescue rate of our treatment group when compared to our control groups, suggesting exosomes enhance resistance to chemotherapy. The impact of these results can act as a platform for medical innovation to improve targeted chemotherapies or modes of exosome inhibition.

DESIGNING A DNA VACCINE AGAINST TOXOPLASMA GONDII
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Toxoplasma gondii is an obligate intracellular parasite that has the ability to infect all nucleated mammalian cells and is found worldwide. This protozoan parasite can cause severe ocular and neurological disease in immunocompromised persons and fetuses. While there are treatments available for individuals infected with the tachyzoite stage of the parasite, which defines the acute infection, there is no effective way to treat for the latent cyst forming stage which is associated with behavioral changes. Thus, there is a need for an effective protective vaccine. This work highlights the design of a versatile DNA sequence that will function in conjunction with a novel delivery system that seeks to stimulate T cell- and antibody-mediated memory responses at mucosal pathogen entry sites. As multi-epitope DNA vaccines have been shown to provide effective protection against other pathogens, the developed sequence consists of three full length T. gondii genes, GRA7, SAG1, and MIC1 separated by tri-alanine linkers. The sequence is designed in such a way that the latter two genes are easily removed, allowing for observations of effects due to plasmid size. Also included in the vaccine design are a universal CD4+ T cell epitope (PADRE), a decapeptide derived from T. gondii gene GRA6 that has shown to produce an immunodominant and protective response (HF10), and CpG oligodeoxynucleotides that serve as a toll-like receptor agonist adjuvant. This design provides the optimal sequence for testing a DNA vaccine with a novel delivery system against T. gondii.

ANALYZING SUGAR COMPOSITION OF CORN ROOT EXUDATE TO IDENTIFY BIOMARKERS OF COLD TOLERANCE USING NMR SPECTROMETRY
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Lengthening the growing season in Zea mays (corn) increases the percent yield of the crop, but also can cause problems with the plants’ survival. Growing corn earlier can lead to seedlings being exposed to cold stress, potentially causing dramatic changes in adult phenotypes. Improving cold tolerance genetically at the beginning stages of corn growth could prevent death and increase percent yield by adulthood. Identifying an early biological indicator for cold tolerance would help to more quickly discriminate specific genotypes that are cold tolerant from the ones that are not. Corn’s exudates
vary with its genetic makeup. Exudates are found near the root of the plant and contain sugars, amino acids, and other organic molecules that assist in overall health of the plant to withstand environmental stress via their ability to attract beneficial microbes. In a previous study, 12 different genotypes were investigated. Half of the seedlings in every genotype were cold stressed for 24 hours at 10°C. At two weeks of age they were transplanted to a field. Height, and plant biomass data were collected. Two genotypes were identified that responded differently to cold stress. Genotype CML103 was unresponsive (canalized) to cold stress and genotype B73 had a tolerant response. This research aims to analyze the chemical makeup of the exudates of genotypes CML103 and B73. NMR spectrometry will be used to discriminate differences in specific components of CML103 and B73 that could serve as a biological marker for cold tolerance. Root exudates were extracted and the two genotypes and were prepared for NMR spectrometry. Spectra of each genotype were overlaid to compare similarities and differences. Within each set of spectra for both genotypes, the sugar region (3-4ppm) was found to differ between cold and control conditions. Identifying specific sugars in genotypes B73 and CML103 that could serve as an indicator of cold stress is being further examined.

EXAMINATION OF VARIOUS MEDIA'S IMPACT ON CANDIDA ALBICANS FILAMENTATION
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The fungus Candida albicans exists harmlessly as a member of the human microbiome in approximately 40% of the population; however, this microorganism’s pathogenicity makes it the leading cause of candidiasis, also known as yeast infections, thrush, or invasive candidiasis depending on the area of infection. C. albicans’ ability to cause disease relies on filamentation of yeast cells, and the characteristic of filamentation is a major qualification when clinically assessing the severity of a C. albicans infection. The media type and state in which C. albicans is grown impacts the filamentation of the fungus. To examine the effect various media traits have on filamentation I have performed a time course analysis of C. albicans grown at intervals 30, 60, 90, and 120 minutes either on solid or in liquid YPD, Lee’s, Spyder, FBS, and RPMI media.

TOWARDS THE VISUALIZATION OF PERSISTER CELLS IN BIOFILMS
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Persister cells are dormant, non-dividing variants of regular bacterial cells that form randomly in microbial populations and are highly tolerant to antibiotics. Persisters are different from bacterial colonies that have developed a resistance to antibiotics; they are simply cells that ensure the survival of a colony. They are relevant in biofilms because in a biofilm, persisters have the ability to stay dormant in the presence of antibiotics. After the stressor is removed from their environment, persisters awaken and have the ability to regrow biofilm populations. For this project, an assay is currently being developed to visualize persister cells of Pseudomonas aeruginosa biofilms. The assay will include the treatment with ciprofloxacin, a fluoroquinolone antibiotic. A high throughput microfluidic device called Bioflux serves as the platform to grow biofilms in small channels while media flows at constant shear. Results will be presented in order to determine whether the treatment of the biofilm with the antibiotic will allow the visualization of persister cells.
PSEUDOMONAS AERUGINOSA ATTACHMENT TO DIFFERENT SUBSTRATES
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Biofilms are groups of microorganisms that grow together on a surface and function as one community. In these biofilms, bacteria cells communicate chemically with each other to ensure the survival of the community, becoming more resistant to antibiotics in the process. Due to the complexity of biofilms, we decided to focus on bacterial attachment. Specifically, we are trying to determine what surfaces Pseudomonas aeruginosa strain PA01 bacteria can or cannot develop biofilm on to gain insight of what chemical bonds are being used to attach biofilms to surfaces. We will be considering how biofilm attachment is affected when trying to grow on glass slides, glass slides coated in gold, and glass slides coated in gold with a silica-like layer on top of it. We will quantify our biofilm growth using a crystal violet staining assay via UV/Vis spectroscopy. The data collected from this experiment will help in identifying what surfaces and components encourage biofilm growth. These results indicate that the surface chemistry is critical in the attachment and growth of PA01 biofilms.

BIOCHEMICAL COUNTER-REGULATION OF B CELL FUNCTION BY IL-10 AND IFN-γ
Madison Stock*, Nirmal Dutta, Angela Pack, Rahul Vijay and Noah S. Butler, Department of Biology, Nebraska Wesleyan University, Lincoln, NE

Malaria is caused by infection with parasites of the genus Plasmodium that are transmitted via the bite of infected mosquitoes. One species of the parasite, P. falciparum, causes approximately 200,000,000 cases of malaria and nearly 450,000 deaths each year. Malarial disease is characterized by severe fever and anemia, and it presents when parasites invade, replicate, and rupture from red blood cells (RBCs). Many challenges remain in the fight to eliminate Plasmodium infections as a public health concern. For example, resistance to severe malarial disease develops only after years of repeated parasite exposure in malaria endemic areas. Moreover, while antibodies are crucial for host survival, anti-Plasmodium B cell responses and humoral immunity are short-lived. The reasons for B cell dysregulation and inefficient acquisition of humoral immunity during malaria are not well understood. Our lab recently showed that two cytokines, IL-10 and IFN-γ, which are both highly expressed during Plasmodium infection, can exert counter-regulatory effects on B cell fate and function. IFN-γ signaling induces expression of the transcription factor T-bet, which is associated with short-lived B cell responses. IL-10 enhances humoral immunity by limiting expression IFN-γ and T-bet, allowing for the transcription factor Bcl-6 to promote long-lived B cell responses. However, the mechanisms by which these cytokines modulate B cell function remains unknown. Here, we tested the hypothesis that IL-10 and IFN-γ biochemically counter-regulate B cell function via direct modulation of pSTAT1/pSTAT3 dynamics and T-bet expression. To test this, immortalized B cells (A20) and primary B cells from naive mice were stimulated with either IL-10, IFN-γ, or both and changes in STAT protein phosphorylation were assessed using Western Blot and flow cytometric analysis. We also used reverse transcription PCR (RT-PCR) to measure changes in the expression of T-bet. Based on our data, we conclude that IL-10 can biochemically counter-regulate IFN-γ stimulated T-bet expression, likely via induction of STAT3 phosphorylation. Using this new knowledge, we can begin to explore opportunities to modulate cytokine activity and enhance long-lived anti-Plasmodium B cell responses.
DEVELOPMENT OF A FLUORESCENT BIOSENSOR FOR GAMMA HYDROXYBUTYRIC ACID (GHB), A DATE RAPE DRUG
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Drug-Facilitated Sexual Assault (DFSA) is a criminal act in which a victim is administered incapacitating, mind-altering substances, thereby compromising his or her ability to consent to sexual acts. The substances used to carry out such attacks are typically referred to as “date rape” or “predatory” drugs, and while well over 60 drugs have been associated with these crimes, among the most common are benzodiazepines (such as rohypnol), gamma-hydroxybutyric acid (GHB), ketamine, and alcohol. Each drug has a distinct structure and therefore the effects on the body vary slightly. For example, GHB can cause amnesia, drowsiness, muscle relaxation, unconsciousness, and nausea, which are exacerbated when interacting with alcohol. These symptoms can last up to 8 hours after ingestion of the drug. While several technologies have been applied to the development of cost-effective, portable detection devices, they suffer from either low sensitivity and specificity, or the cost of commercialization is prohibitive due to the regulatory requirements for testing the toxicity of a drink additive. The primary goal of the project is to overcome many of the shortcomings of the current approaches and develop a sensitive, easy-to-use, portable, fluorescence-based assay model for detection of GHB with high accuracy and reliability and which avoids regulatory entanglements. Once established, the assay format should be applicable to many other date rape drugs.

THE EFFECT OF SHEAR STRESS ON THE MORPHOLOGY OF PSEUDOMONAS AERUGINOSA BIOFILMS
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Biofilms are complex microbial communities that grow attached to a surface or at an interface and are embedded in an extracellular polymeric substance secreted by the microbes, which provides a stable environment microbial growth. The complexity of these communities is evident in the spatial structures that can develop over time in response to environmental conditions. In this study we investigated the effect of shear stress provided by the liquid medium flowing over a developing Pseudomonas aeruginosa biofilm on morphological features that can be measured from microscopic images. The bacteria was grown in a glucose-based minimal mineral media. Using a BioFlux 1000z integrated microscope and controlled shear flow microfluidic device, we obtained microscopic images over a 24 hour period and used image analysis software to calculate morphological properties including surface roughness and textural entropy.

DETERMINING THE EFFECTS OF SEED SIZE ON THE PRODUCTION OF AMINO ACIDS IN ROOT EXUDATES OF CORN
Michael Tross*, and Dr. Tessa Durham Brooks, Department of Biological Sciences, Doane University, Crete, NE 68333

Increasing corn yield and production is one method of combating the problem of world hunger and has thus been a focus for many plant physiologists. Currently, there is an understanding that the interaction of plant roots and microbes is an important aspect in figuring out how to improve the general health of corn and ultimately increase its production. Root exudate is a secretion that influences the root environment, nutrient availability and interactions of the root with microorganism as well as adaptations to environmental stresses. It is largely composed of amino acids, sugars, phenolic acids
and plant hormones. Scientists are now trying to comprehend what genetic factors are responsible for the composition and production of root exudates. However, maternal environment may also contribute to exudate production and composition. Seed size is a major indicator of plant maternal environment. Therefore, if seed size affects exudate production then the maternal environment of a plant needs to be considered in studies of the genetics of exudate production. This paper aims to investigate whether the amount of amino acids that is released in the exudate of a seedling root is dependent on the relative size of the seed it came from. In this experiment, seeds were separated and grouped into small, medium and large seeds depending on their relative masses. Each seed is then imbibed and sterilized together with their size group and then planted vertically on blotter paper. Three days after each radicle breaks the seed coat, the root is blotted with a paper containing the colorimetric indicator ninhydrin and the paper is allowed to develop overnight. The RGB values of the colour changes on ninhydrin paper due to amino acids in exudate is then measured. The results are composed into a scatter plot graph to compare the results of the output of amino acids for the small, medium and large seeds. Preliminary results have shown a general trend of bigger seeds producing relatively more exudate.

**COLLEGIATE ACADEMY**  
CHEMISTRY AND PHYSICS  

SESSION A  

**WORK TOWARDS AN ELECTROGENERATED CHEMILUMINESCENCE-DNA BIOSENSOR LABELED WITH A RUTHENIUM COMPLEX.**  
Hannah E. Durant*, Austin Jantrakul, Kenneth N. Hipp, Rebecca Y. Lai and Erin M. Gross, Department of Chemistry, Creighton University, Omaha.

Detection of DNA hybridization can measure the degree of similarity between two DNA sequences. Current methods for detecting DNA hybridization, while effective, tend to be slow and labor intensive. Electrochemical, folding-based DNA biosensors offer fast, sensitive and selective DNA detection. The technique electrogenerated chemiluminescence (ECL) can be used with these biosensors. These ECL-DNA biosensors combine the high sensitivity of a luminescence biosensor with the low cost and miniaturization capabilities of an electrochemical biosensor. The aim of this project is to fabricate an ECL-DNA biosensor utilizing a ruthenium complex emitter. In this project, a hairpin ECL-DNA biosensor is fabricated by electrochemically cleaning an electrode, drop casting a target ss-DNA over an electrode, and allowing the electrode to sit an alkanethiol diluent overnight, forming a mono layer. This newly fabricated ECL-DNA biosensor is then used to measure the ECL emission of the ruthenium complex in the presence of co-reactant. Next, target ss-DNA is added and the change in ECL intensity determined. A regeneration experiment is then preformed to see how well the electrodes are able to maintain the same ECL signal from the above results. Depending upon the change in signal from the ECL detection method, the ECL-DNA biosensor can be classified as either a “Signal-On” or Signal-Off” biosensor. This study investigated the performance and mechanism of the sensors as a function of diluent chain length and ECL coreactant identity and the stability of the sensors as a function of potential. This study also investigates non-complimentary and single-base mismatch targets to demonstrate specificity with the biosensors.
INVESTIGATION OF THE EFFECT OF ALANINE ON THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AEROSOLS
Mohammed Alfarr, Dillon Woods, Salvatore Gottuso, and Joshua Darr, University of Nebraska at Omaha, Omaha, NE, 68116.

Our atmosphere is full of different types of aerosols that have important effects on the environment and climate change. These aerosols are different in their size, structure, and chemical composition. The sea spray from the ocean is a common source of natural aerosols such as sodium chloride (NaCl). The main goal of this research is to investigate how amino acids such as alanine affect the hygroscopic properties of NaCl aerosols. For the experiment, we made many aqueous solutions of NaCl-alanine with different mole ratios and we performed two different types of experiments on them: efflorescence and deliquescence. For each of these experiments the relative humidity (RH) was systematically varied. The main goal behind doing the deliquescence mode is to examine the water content of aerosols that were originally dry. In contrast, for the efflorescence mode we examined the water content of aerosols that were originally wet. Once the aerosols were made from a specific aqueous solution, they were passed through two or three 4-L bottles for the low humidity value and three or four for high humidity values such as 85-90%. Then, they were flowed through an infrared (IR) spectrometer using a flow-cell apparatus. The IR spectrometer was used to measure their water content via the liquid water O-H stretching feature at approximately 3300 cm⁻¹. For NaCl-alanine experiments in deliquescence mode, the absorption of water occurs mostly between 69-77% RH, in accord with literature values for pure NaCl. For the efflorescence mode, however, the water is released at a lower percentage RH compared to the deliquescence mode, and the range varies with the mole ratio. This hygroscopic behavior is different than that observed for NaCl mixed with more hydrophilic amino acids such as glycine, lysine, and serine. From these results, we conclude that the relatively hydrophobic amino acid alanine has less effect on the hygroscopic properties of NaCl than hydrophilic amino acids such as glycine, lysine, and serine.

STEREOSELECTIVE SYNTHESES AND REDUCTION OF 3-ALKENYL-2-CYCLOALKENONES
Brianna Callahan and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178.

Through a Lindlar semihydrogenation, 2-methyl-[(Z)-2-phenylethenyl]-2-cyclohexenone can be synthesized from 2-methyl-3-(phenylethynyl)-2-cyclohexenone by selective reduction of the exocyclic alkyne. The (E)-isomer, 2-methyl-[(E)-2-phenylethenyl]-2-cyclohexenone, can be synthesized through a substitution reaction using (E)-2-phenylethynyllithium and 3-isobutoxy-2-methyl-2-cyclohexen-1-one. Through a reduction reaction with sodium bis(2-methoxyethoxy)aluminum hydride (Red-Al), we hypothesize that both the (Z)- and (E)-isomers will yield the stereoselective product (1S*,2S*,Z)-2-methyl-3-(2-phenylethylidenyl)cyclohexanol based on previous similar mechanistic studies that yielded primarily the (Z)-isomer.

UPGRADES TO TTL SPLITTER AND DISPLAY AT THE STAR EXPERIMENT SLOW CONTROLS AT BROOKHAVEN NATIONAL LABORATORY
Joseph D'Alesio, Department of Physics, Creighton University, Omaha NE, 68178.

The STAR collaboration uses a detector, the Solenoidal Tracker at RHIC (the Relativistic Heavy Ion Collider) at Brookhaven National Laboratory. RHIC contains two identical, concentric acceleration rings that operate in opposite directions, allowing for the collision of gold nuclei traveling at approximately the speed of light. To study the collisions, the high energy research group at Creighton
University analyzes the data collected from STAR involving the ultraperipheral collisions of gold nuclei. This project will focus on upgrades to the STAR detector control software for which Creighton has primary responsibility. Currently, the TTL (Transistor–transistor logic) signals are going to a VME interface that stores the states into EPICS (The Experimental Physics and Industrial Control System). The goal of this project is to build and implement a new EPICS interface using a PLC (Programmable Logic Controller). The TTL signal will be split to both systems, which will run in parallel for a year, to confirm that the PLC system runs without problems.

SOFTWARE UPDATES FOR THE TPC AND TOF GAS SYSTEM CONTROLS AT STAR EXPERIMENT SLOW CONTROLS AT BROOKHAVEN NATIONAL LABORATORY
Emma Dufresne, Department of Physics Creighton University.

STAR (Solenoidal Tracker at RHIC), the high-energy physics experiment at Brookhaven National Laboratory analyzes the collisions of heavy ions traveling at relativistic speeds. Much of the STAR detector controls system was designed and built in the 1990s. Although several aspects of this system have been updated since then, the gas monitoring for two important sub-detectors of STAR, the Time Projection Chamber (TPC) and TOF (Time-Of-Flight), still operate on a 20-year-old processor. Both the TPC and TOF require a proper gas mixture for operation. The composition of the gas determines the tracking ability and response times of these detectors. In addition, the composition of the different gases needs to be consistent over time to receive consistent data. The gas control application is currently running on two different Windows computers. Each system puts the pressures, flows, and temperatures into an ASCII file. One weakness this existing program has is that the gas values only get updated every couple of minutes by the gas system computers. The aim for the new program is that it will automatically update upon the change in the values. This will allow instant information transfer from the gas systems to the detector operators. The ASCII files are read by a remote computer with software that is no longer supported. While there is nothing wrong with this existing system, as long as no changes need to be made, it has been proposed to rewrite the program in Python programming language, as it provides much more flexibility. The other advantage is this allows us to move towards current software that is being supported. This talk will give an introduction to the current gas system control programs and discuss the proposed changes for improvement.

IDENTIFYING THE BINDING LOCATION OF ATRAZINE AND TWO OF ITS METABOLITES ON HSA USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY
Kati Frankenberg and Annette C. Moser, University of Nebraska at Kearney, Kearney, NE 68849.

Human Serum Albumin (HSA), the most abundant transport protein in blood, is able to bind a broad range of solutes including herbicides. In this study high performance affinity chromatography (HPAC) was used to measure the binding locations of atrazine and two of its main metabolites on HSA using competitive zonal elution and the probe compounds R-warfarin and L-tryptophan. The binding location of atrazine and its metabolites, hydroxyatrazine and deisopropylatrazine, was found to be Sudlow Site I due to the observed direct competition with R-warfarin. A separate competitive binding study with L-tryptophan showed no competition at Sudlow Site II.

ANALYSIS OF THE EFFECT OF SERINE ON THE HYGROSCOPIC PROPERTIES OF SODIUM CHLORIDE AEROSOLS
Megan Grove, University of Nebraska-Omaha, Omaha, NE 68130.

Aerosols exist nearly everywhere in the world due to their natural sources such as sea water. When ocean waves crash, aerosols are released into the atmosphere containing components of
inorganic salts and organic matter. However, ample amino acids are present at the sea’s surface as an environmental byproduct of microorganism decay. Therefore, we tested to see the effects of amino acids on NaCl aerosols. In this study, we incorporated NaCl-serine aerosols within a nitrogen carrier gas and passed it through relative humidity (RH) controlled chambers to an infrared (IR) spectrometer to determine the amount of water absorption or retention. In order to observe the water content of the aerosols, we analyzed the water O-H stretch in the IR spectrum. When pure NaCl aerosols are used, deliquescence and efflorescence are readily detected with water content abruptly increasing or decreasing, respectively, at discrete RH values. Conversely, when an equal ratio of NaCl-serine solution is used to make aerosols, water retention clearly increases gradually as RH increases. We attribute this difference to varying structures of the two aerosols with the structure of the NaCl-serine aerosol enhancing its hygroscopicity.

INTRODUCTION TO A LARGE ION COLLIDER EXPERIMENT (ALICE) AT THE EUROPEAN COUNCIL FOR NUCLEAR RESEARCH (CERN)
Alexandra McMillen, Department of Physics, Creighton University, Omaha, NE 68178.

A Large Ion Collider Experiment (ALICE) at the European Council for Nuclear Research (CERN) is one of 4 detectors at the Large Hadron Collider (LHC) on the border of France and Switzerland. ALICE is an experiment involving over 1850 scientists from 36 countries. Using the LHC, the experiment is attempting to understand the fundamental nature of the universe by colliding lead ions at relativistic speeds. These collisions are used to model the universe moments after the Big Bang, as well as examine our modern models of the strong and electromagnetic interactions. The ALICE detector is composed of 18 subdetectors, and weighs 10,000 tons. The detectors track and identify tens of thousands of particles in each of the approximately 8000 collisions a second. These collisions fall along a continuum, from head on to ultra-peripheral, where the atoms only interact through the electromagnetic force. This talk will be an introduction to the ALICE detector, and the ultra-peripheral collisions that are studied there.

SYNTHESIS OF AN ALPHA-HYDROXY-KETONE SUGAR, TMEDA, AND ICARIDIN ADDUCT: BINDING INSECT REPELLENT TO SKIN FOR IMPROVED EFFICACY
Ralph Mendez and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE, 68178.

Through a series of nucleophilic substitution reactions 1-bromo-3-hydroxyacetone, tetramethylethylenediamine (TMEDA), and icaridin can be linked to produce an adduct postulated to be able bind to the skin via the Maillard reaction. A route for an alternative hydrolyzable diester linker to replace TMEDA for formation of the adduct was explored, however, a TMEDA-based linker was determined to be more desirable. Icaridin, isolated from a commercial insect repellant, was esterified with bromoacetic acid. Current effort aims to prepare 1-bromo-3-hydroxyacetone from pyruvic acid.
DEVELOPMENT OF A NOVEL FLUORESCENCE LIFETIME-BASED ASSAY TO DETERMINE THE RELATIVE CONCENTRATIONS OF NICOTINAMIDE COFACTORS IN CELLULAR EXTRACTS

Paul Khoury, Kevin Brittan, Patricia Nguyen, Brook Yang, Marifel Gabriel, Margaret Glick, Dan Pham, Katie Sotelo, Kelsey Jackson, and Michael G. Nichols, Department of Physics, Creighton University, 2500 California Plaza, Omaha, NE, 68178

Altered metabolism and dysregulated growth factor signaling are key hallmarks of cancer. The reduced form of nicotinamide adenine dinucleotide (NADH) has been shown to be a useful indicator of metabolism because of its roll in glycolysis, the TCA cycle, the electron transport chain, and as a cofactor of transcriptional corepressors which regulates gene expression. Fortuitously, the reduced form, NADH, is fluorescent, while the oxidized form, NAD, is not. This permits non-invasive fluorescence imaging of cellular metabolism through techniques such as NADH fluorescence lifetime imaging (FLIM). Methods that rely on fluorescence intensity alone are unable to distinguish the reduced form of nicotinamide adenine dinucleotide phosphate (NADPH) and NADH. Therefore, we have adapted an absorbance-based assay to quantify the relative concentrations of NADH and NADPH from the fluorescence emission of extracts from cells exposed to metabolic inhibitors and uncouplers. Cell extracts were added to solutions containing either glucose-6-phosphate dehydrogenase (G6PD) or glutathione reductase (GR) to determine the contribution of NADPH to the overall fluorescence emission. This two-photon fluorescence-based assay overcomes problems with scattering typical of absorbance-based assays. In addition to discussing the optical and biochemical design of this assay, we will present preliminary results obtained from two Squamous Cell Carcinoma cell lines. This study was made possible 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 DUAL-WAVELENGTH AND SINGLE-WAVELENGTH PHASOR FLIM WITH UNMIXING TO DETERMINE THE RELATIVE CONTRIBUTION OF NAD(P)H AND FLAVOPROTEINS IN METABOLIC IMAGING OF SQUAMOUS CELL CARCINOMA CELLS

Katie Sotelo, Michael Nichols, Department of Physics, Creighton University, NE 68178.

Our metabolic imaging technique takes advantage of the endogenous fluorescence of the reduced form of NAD(P)H and the oxidized forms of flavins, two key markers of metabolic processes within cells. NADH plays a key role in glycolysis, the tricarboxylic acid cycle, and the electron transport chain as an electron carrier, while flavins (primarily NAD-linked α-lipoamide dehydrogenase flavin and electron-transport flavoprotein) aid in electron transport within the mitochondria. Both types of molecules can be excited using two-photon microscopy at a wavelength of 740 nm, but their overlap of emission spectra makes determining the relative contribution of each difficult to determine. To overcome this, we have utilized a dual-wavelength approach by exciting squamous cell carcinoma cells at both 740 nm and 900 nm with phasor FLIM. NAD(P)H does not absorb at 900 nm, allowing us to detect only flavins in the cells. By comparing the data from both wavelengths, this technique allows us to unmix the signals from both molecules. Another approach we have utilized is a single-wavelength method to excite the molecules at only 740nm and perform unmixing through phasor analysis alone. Comparing these
techniques allows us to evaluate the efficacy of each method. This study was made possible 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.

**NOVEL SOL-GEL NANOPARTICLE FEEDSTOCKS FOR USE IN 3D PRINTABLE GLASS INKS**

Alexandra Vahle, Emilia Berni, Peter Palencia, Julia Jobanputra, and Joel F. Destino, Ph.D.
Creighton University, Omaha, NE 68178-0133.

Direct-ink-writing (DIW) has recently been demonstrated as a viable route to prepare transparent fused silica glass. In this method, 3D objects are prepared through filament-by-filament assembly of a shear-thinning ink, which is extruded through a nozzle in a programmed pattern. Upon exiting the nozzle, the ink solidifies through a structure-building process (i.e. evaporation). Afterwards, the printed green body can be dried and sintered to a full dense glass using conventional ceramics processing. Sol-gel materials are an attractive DIW feedstock for fabricating optical quality glass and have been demonstrated for printing of functional oxides. Sol-gel chemistry is easily tunable and provides complete control of feedstock purity, particle composition, morphology, size, and polydispersity. Furthermore, there is an existing wealth of knowledge of sol-gel materials in optical applications, from coatings to monolithic optics. In this presentation, we will discuss ongoing efforts to prepare novel sol-gel derived nanoparticle feedstocks in various compositions to be used as inks for fabricating 3D printed glass.

**TWO-PHOTON IMAGING OF NAD(P)H OF SQUAMOUS CELL CARCINOMA CELLS IN VITRO REVEALS METABOLIC CHANGES FOLLOWING EXPOSURE TO UV LIGHT**

Marifel Gabriel, Katie Sotelo, Brooke Yang, Alexis Mills, Dan Pham, Michael Nichols
Department of Physics, Creighton University, NE 68178

Fluorescence lifetime imaging microscopy (FLIM) of endogenous NAD(P)H can be used to non-invasively monitor the altered metabolic activity of cancer cells. In this study, we assess two human squamous cell carcinoma cell lines expressing low and high levels of Human Epidermal Growth Factor Receptor (HER2), a receptor that is known to drive tumor formation, proliferation, and metastasis in multiple types of cancer. HER2 is also activated by ultraviolet (UV) radiation. We compared the metabolic response of SCC cells following UV exposure in both cell lines with total UV fluences ranging from 300 - 2400 J/m². In a separate study we varied the relative proportion of UVA, UVB, and UVC. UV exposure generally led to the redistribution of enzyme-bound and free pools of NADH toward free NADH. The manipulated in vitro metabolic state produced significant changes in endogenous fluorescence intensity and phasor distribution, which varied with HER2 status. This study illustrates how metabolic imaging of NAD(P)H can be used to monitor changes in cellular metabolism non-invasively following UV exposure with potential for application in vivo. This study was made possible 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.
STUDY OF THE BINDING INTERACTIONS BETWEEN HUMAN SERUM ALBUMIN AND ALACHLOR AND ALACHLOR ESA USING HIGH PERFORMANCE AFFINITY CHROMATOGRAPHY

Sidney Trenhaile and Annette C. Moser, University of Nebraska at Kearney, Kearney, NE 68849.

Human serum albumin (HSA), the most abundant transport protein in the blood, has been studied extensively for its binding interactions with drugs. However, very little research has been done to quantify the interactions of common herbicides and their metabolites with the two major binding sites on HSA, Sudlow Site I and Sudlow Site II. Two methods from high performance affinity chromatography (HPAC), frontal analysis and competitive binding zonal elution, were used to study the interactions between HSA and alachlor and one of its metabolites, alachlor ESA. Frontal analysis was used to measure the binding constant between the herbicide and HSA, and competitive binding zonal elution was used with the probe compounds, R-warfarin and L-tryptophan, to determine the location and/or competitiveness of alachlor’s binding to Sudlow Site I and Sudlow Site II. From frontal analysis, the association constant (KA) for alachlor ESA was found to be 6.3 (±0.2) x 10^4 M⁻¹ which indicates low to moderate binding. Competitive binding zonal elution studies with alachlor indicated noncompetitive binding in both Sudlow Site I and Sudlow Site II.

AN INTRODUCTION TO THE STARLIGHT MONTE CARLO SIMULATION OF THE ULTRA-PERIPHERAL COLLISIONS OF RELATIVISTIC HEAVY IONS

Jacob Wente, Department of Physics, Creighton University.

In our research, we study ultra-peripheral collisions in high energy particle accelerators. We call the collisions that occur in particle accelerators events. Many events occur, however, our detector can only detect a fraction of these events. The more events that our detector detects, the more efficient the detector is. To determine the efficiency of our detector, we use a Monte Carlo computer simulation called Starlight to create a specified number of events based on parameters that we establish. Parameters we insert into the simulation include what type of nuclei we are colliding and the relativistic gamma factor of the nuclei. When we reconstruct the events and observe the actual number of events that the detector detects, we can determine the efficiency of our detector. In this presentation, I will discuss how Monte Carlo computer simulations work, and how we use Starlight in our research.

ON THE HYDROGENATION OF ALKYNES WITH ALUMINA SUPPORTED PALLADIUM

Tazah Weinmaster, Reba Mehaffey, Kenzie Enmeier, Samantha Jarman and Bruce Mattson, Department of Chemistry, Creighton University, Omaha, NE 68178

Alkynes are hydrogenated in the presence of an alumina supported nanoparticle palladium catalyst (0.5%). With our catalyst, designed for flow experiments, the number of surface palladium atoms is approximately the same as the number of each of the reactant molecules. Residence time with the catalyst affects products. Studies involving the hydrogenation of 1-butyne and 1-butene are presented in the context of the accepted mechanisms for these reactions.
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Special recognition goes to Nebraska Wesleyan University for hosting our Annual Meeting and all the time and effort that entails.

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Dr. Romjue graduated from William Jewell College in Liberty, MO with a Bachelors of Arts Degree in Biology. She returned to Nebraska to teach Middle School Sciences, General and Advanced Biology at Naponee Public Schools and Franklin Public Schools (1963-1987). She organized School wide Science Fairs in both schools and her students competed in the Nebraska Junior Academy of Sciences, Junior Science and Humanities Symposia, the Greater Nebraska Science and Engineering Fair (GNSEF), the Central Nebraska Science & Engineering Fair (CNSEF), and the International Science and Engineering Fairs (ISEF) throughout those 24 years.

A new committee, the Scientific Review Committee (SRC) was formed in 1974. Dr. Ritter, Dr. Rhodes and Mary wrote rules for student research involving Vertebrate Animals, Human Subjects, Pathogens, and Recombinant DNA etc. Any science fair affiliated with the ISEF worldwide is required to follow these rules. All research submitted to ISEF is reviewed for compliance. She served on the SRC until 2002. The top two students at ISEF go to the Nobel Award Ceremonies in Stockholm, Sweden. In 1988 she helped as their escort. Then in 1998 & 1989 she helped escort the American Students to the South American Science Fairs in Novo Hamburgo, Brazil.

Mary was awarded the Henzlik Award for Outstanding Teacher In Nebraska and the Presidential Award for Excellence in Science and Mathematics Teaching Certificate of Honor, State Award Winner in 1985.

She earned her Ph. D. at the University of Nebraska/Lincoln (UNL) in 1991 and then taught Elementary Science and Social Studies Methods at Fort Hays State University. During a leave of absence from FHSU she coordinated an EPA Grant to develop Environmental Science Curriculum for the Nebraska State Department of Education. In August 1993 she joined the Faculty at the University of Central Florida (UCF) where she taught Elementary Science Methods and Space Science for Educators on Orlando, Cocoa, Daytona Beach and Palm Bay Campuses until retirement in 2010.

Currently Dr. Romjue volunteers at the Brevard Zoo Dinosaur Exhibit and in a Fossil Lab (The Academy of Natural History Preparation). She also assists with SCSEA Projects like, the Florida Middle School Science Bowl and Energy Whiz Olympics.
Michael Sibbernsen is a Lecturer of Astronomy at the University of Nebraska- Lincoln, co-founder and CEO of Branched Oak Observatory, and a NASA Solar System Ambassador for the state of Nebraska. Working in an ad-hoc capacity, Michael and his wife Kendra facilitate the NASA Nebraska High Altitude Ballooning (N-NHAB) Program launching scientific payloads into near-space.

Before working at the university, Michael was the Science & Technology Coordinator for the Strategic Air Command & Aerospace Museum, and before that, the Outreach Coordinator for the NASA Nebraska Space Grant. Michael has traveled throughout the state delivering hundreds of hands-on science & astronomy demonstrations and workshops for teachers and students under the auspices of NASA, 21st Century Community Learning Centers, and the Nebraska Department of Education. Michael has appeared on national television, and was for some time, a regular fixture as “the science guy” on the local “Morning Blend” talk-show in Omaha.

In September of 2017, the Nebraska Association of Teachers of Science awarded Michael their “Catalyst Award,” the organization's highest honor in recognition of significant contributions to science and science education in the state of Nebraska. Michael lives with his wife, Dr. Kendra Sibbernsen and identical twin sons, Matthew and Lucas.
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